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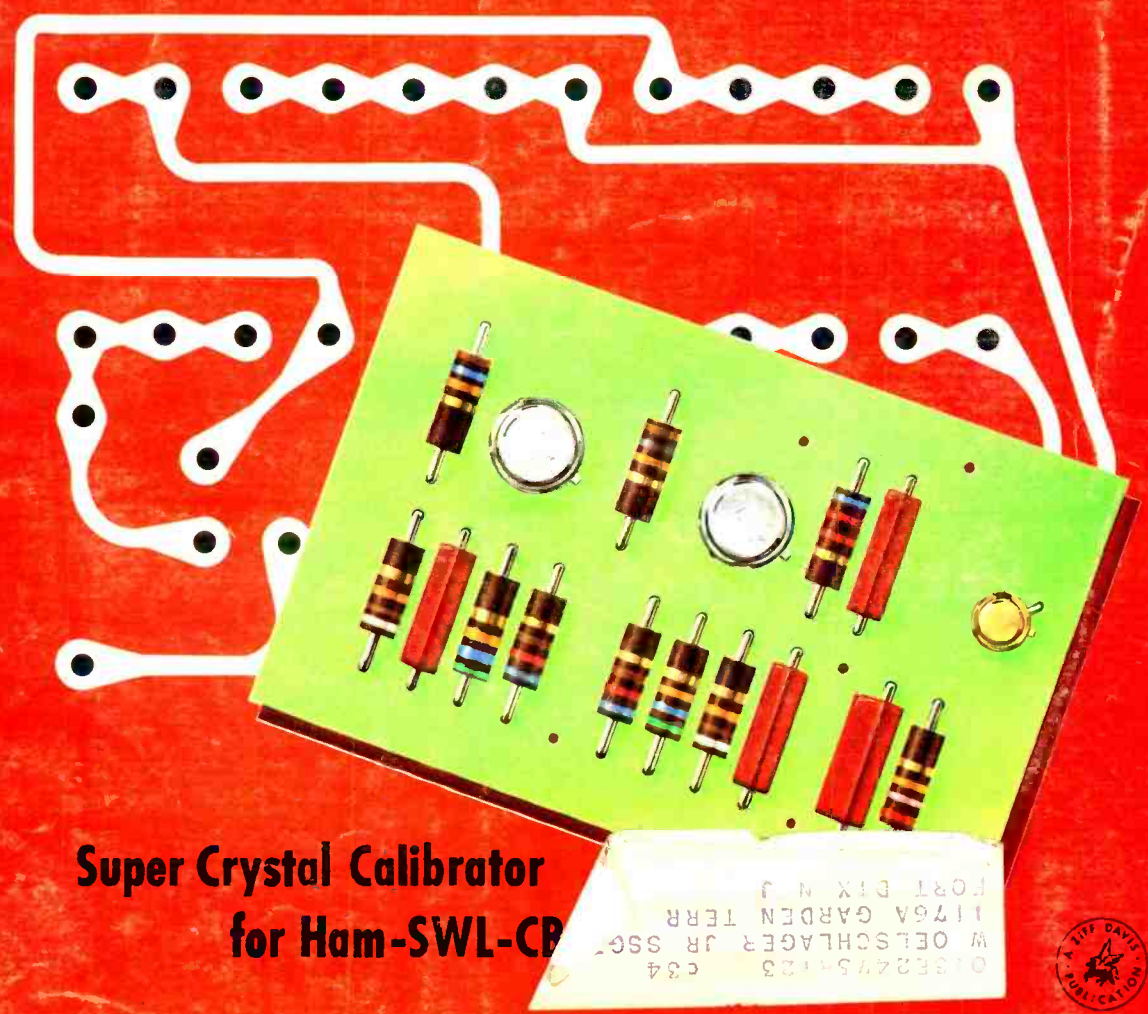

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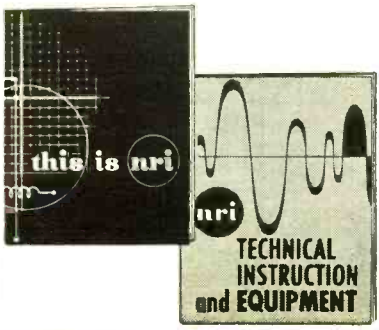

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VOLUME 19 NOVEMBER 1963 NUMBER 5

Special Construction Feature

Construction Projects

Amateur, CB, and SWL

Electronic Features and New Developments

Departments

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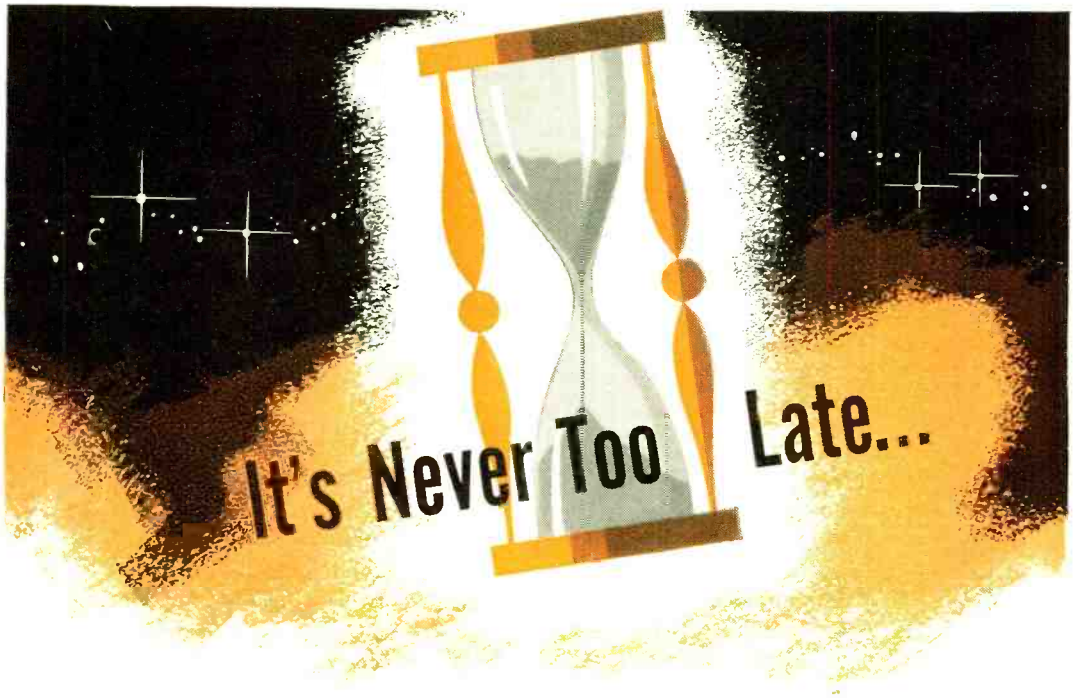

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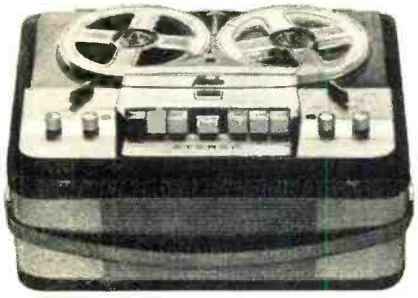

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Write for Brochure E-11 North American Philips Co., Inc., High Fidelity Products Division, 100 East 42nd Street, New York 17, New York.

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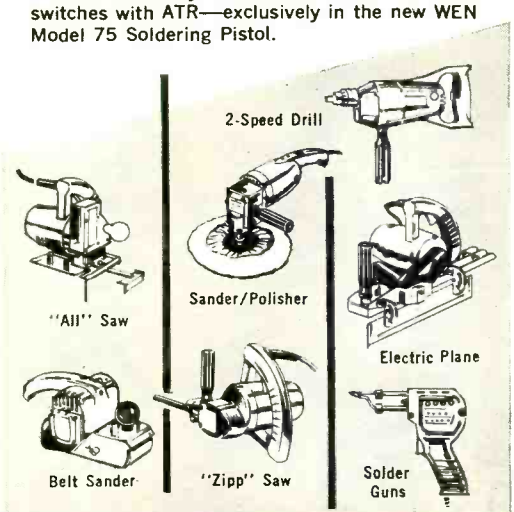

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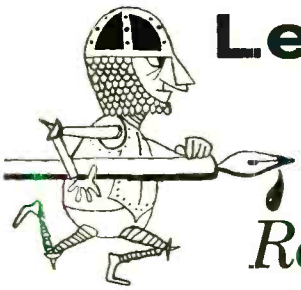


Letters from our Readers

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

Ham Equipment Directory?

■ The August issue of POPULAR ELECTRONICS featured a very complete directory of CB equipment, but I have never seen a listing of ham gear. How about a directory of amateur equipment?

GEORGE LINDSEY, WA4MVA
Memphis, Tenn.

Thanks for the letter, George. Although the idea of running such a directory has been considered, it has not been done due to the fact that there is a tremendous amount of ham equipment which falls into many different categories. There is a possibility, however, that we may run short directories from time to time covering, for example, low-power transmitters, medium-price receivers, etc.

"Electronics Widow" Wants Help

■ My husband knew little or nothing about electronics when we married five years ago. Two children later, he knows quite a lot—largely due to POPULAR ELECTRONICS, which he studies from cover to cover. I feel like a complete dunce when he talks about tubes and transformers, but I've come to

the conclusion that he's not joking when he refers to a bunch of plugs as "male" and "female." How can I find out what it's all about? Go ahead and laugh, but I didn't even know how to change a fuse until recently.

MRS. JANET RIZZI
Monterey Park, Calif.

P.S. I bet there are a lot of wives in my shoes—is there anyone at POPULAR ELECTRONICS brave enough to do a column for US?

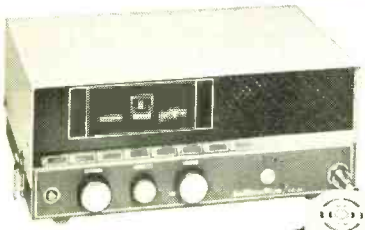
Thank you for the letter, Mrs. Rizzi. In answer to your last question, no, but perhaps the following

Terry
W9DIA
18W3516

CB'ers SAVE!

Buy this Hallicrafters CB-3A for $159.95 — pay cash, or as little as 10% and $7.20 per mo. (2 years)

and for just $1.00 extra you can have any one of these deluxe Hy-Gain antennas!



CB-3A
supplied on channel 11, extra channels $5.90 ea.

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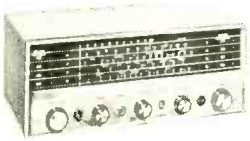
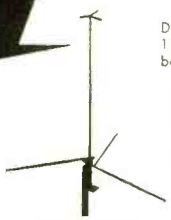
NEW! For the serious short-wave listener, Hallicrafters SX-122, now in stock for XMAS delivery. Yours for $5.00 down, $10.47 per mo. (3 yr.)

IDEAL XMAS GIFT:

Fomaus Hallicrafters S-120. Only $69.95. Just $5.00 down, $6.03 per month (1 yr.)

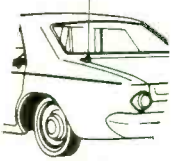


Xmas Special: For $1.00 extra, with purchase of any receiver listed at right, we'll send you a deluxe headset and appropriate outdoor antenna. What a deal!



Directional Model 113-B, 3 element beam

All new CLR II Colinear base-station antenna



Model TLMA, special marine antenna

Model T-WR car antenna, with noise suppression kit

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look at these *low payments* on new Hallicrafters receivers after just $5.00 down!

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*SX-62A, 14 tubes	430.00	15.34
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*These models do not have built-in speakers. Order R-48A speaker, $19.95.

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(describe trade-in fully on separate sheet)

NAME _____

ADDRESS _____

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A-1

Letters

(*Continued from page 6*)

suggestions will help. First, get a copy of an electronics dictionary (Allied Radio publishes a small one that costs just 50 cents; you might also secure copies of Basic Electronics *and* Electronics Data Handbook *from the same source). Next, read all of the literature you can find in your husband's interest area—*POPULAR ELECTRONICS, *hi-fi magazines, etc. When you come to a term you don't understand,* look it up; *and don't be satisfied until you know exactly what it means. Since you've indicated that your husband is mainly interested in hi-fi, you might also read* ABC's of Hi-Fi & Stereo *published by Howard W. Sams.*

Hams Out-Gunned, Says CB'er

■ This letter will probably never be printed in "Letters from Our Readers," but I think it expresses the feelings of many CB'ers. After being a CB'er for two years, I recently attended a ham club meeting. Unfortunately, I found that these fellows were wrapped up in themselves, and acted as if CB'ers were in a different social class. They don't encourage ham potentials, but rather ignore them. When it comes to civil defense, I think hams are against CB because they are afraid of being outclassed. While they're busy calling CQ, we can call any mobile or base unit immediately for 10-5 or 10-33 info—and there are probably ten times more mobile CB units in use than ham units. For every argument against CB, I can cite a good reason *for* it.

ROBERT W. HAMILTON, KHA1984
Decatur, Ill.

Heating Pad QRM

■ I have a problem which I'm sure bothers many other BCB and SW DX'ers. With sensitive communications equipment, I have enough heating pad interference to rip out the speaker cone when the volume is turned up. This r.f. interference is radiated through the air rather than the power

line—it disappears when I disconnect the antenna. How can I get rid of it, short of throwing the heating pad out?

THOMAS R. SUNDSTROM, WPE2AJ
Stockton, N.J.

Your problem is a common one, Tom, and the ultimate answer may be, especially if the heating

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Not only does the Grantham course cover all required subject matter completely; it grows and changes and expands in phase with change and expansion in the electronics field generally. With the Grantham course, you are assured of modern, up-to-the-minute instruction.

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The streamlined Grantham course is designed specifically to prepare you to pass FCC examinations and examinations given by electronics firms. What you need to know to achieve these goals, you are taught completely and in detail. The course is not "padded" with information you will not need.

Is It a "Coaching Service"?

The weakness of the "coaching service" or "Q & A" method employed by some schools and individuals is that it presumes the student already has a knowledge of basic electronics.

The Grantham course is presented from the viewpoint that you have no prior knowledge of the subject; nothing is taken for granted where your training is concerned. We "begin at the beginning" and progress in a logical, step-by-step manner from one point to another, with the necessary math taught as an integral part of the course. Every subject is covered simply and in detail; the emphasis is on making the subject easy to understand.

With each lesson you receive an FCC-type test so that you can discover after each lesson just which points you do not understand and clear them up as you go along. In addition to the lesson tests, ten comprehensive Review Exams are given throughout the course.

Is the School Accredited?

Grantham School of Electronics is accredited by the Accrediting Commission of the National Home Study Council.

Is It a "Memory Course"?

Grantham School has never endorsed the "memory" or "learn by rote" approach to preparing for FCC license exams. This approach may have worked in the early days of broadcasting, to the extent that a man could get his license that way; but, Heaven help the employer who expected this man to be able to demonstrate abilities implied by possession of the license!

Fortunately for all concerned, it is no longer possible for a man to pass FCC exams by spilling out memorized information which is essentially meaningless to him. Advances in the field of electronics—and the desire of the FCC to have the license really mean something — have caused upgrading of the exams to the point where only the man who is able to *understand* and *reason* electronics can acquire the 1st class FCC license.

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NEW CADRE C-75 CB TRANSCEIVER

The new Cadre C-75 1.5-watt, 2-channel transceiver is 15 times too powerful for youngsters (under 18 years of age) to operate, according to FCC regulations. Clearly, it's not a toy. It's designed for serious CBers who need 'big set' performance that can be used anywhere.

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

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

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

Cadre also offers a complete line of 5-watt all transistor transceivers and accessories.

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☐ AREA CODE 607, 748-3373. **Canada:** Tri-Tel Assoc., Ltd., 81 Sheppard Ave. W., Willowdale, Ont. **Export:** Morhan Exporting, 458 B'way, N. Y. 13, N. Y.

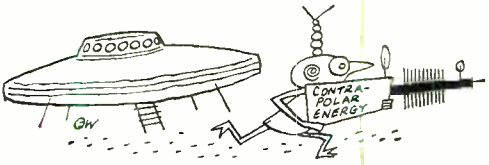
Letters

(*Continued from page* 8)

pad is an old one (they used tiny thermostats notorious for the r.f. noise they generated), to do as you suggest—throw it out. A less drastic remedy, successful in many cases, is to connect a .01- to .001-μf., 600-volt ceramic capacitor across each thermostat (small bimetallic switches that open and close as the pad gets warmer or cooler) in the heating pad. The capacitors should be connected as close to the thermostats as possible, and the leads kept short. You may have to open the pad up to connect the capacitors, and then stitch it back together.

Hoax Revealed: Contra-Polar Energy

■ With reference to the article on "Contra-Polar Energy" (April, 1955, page 27), I am deeply interested in this subject and would appreciate any assistance you can give me. After an extensive

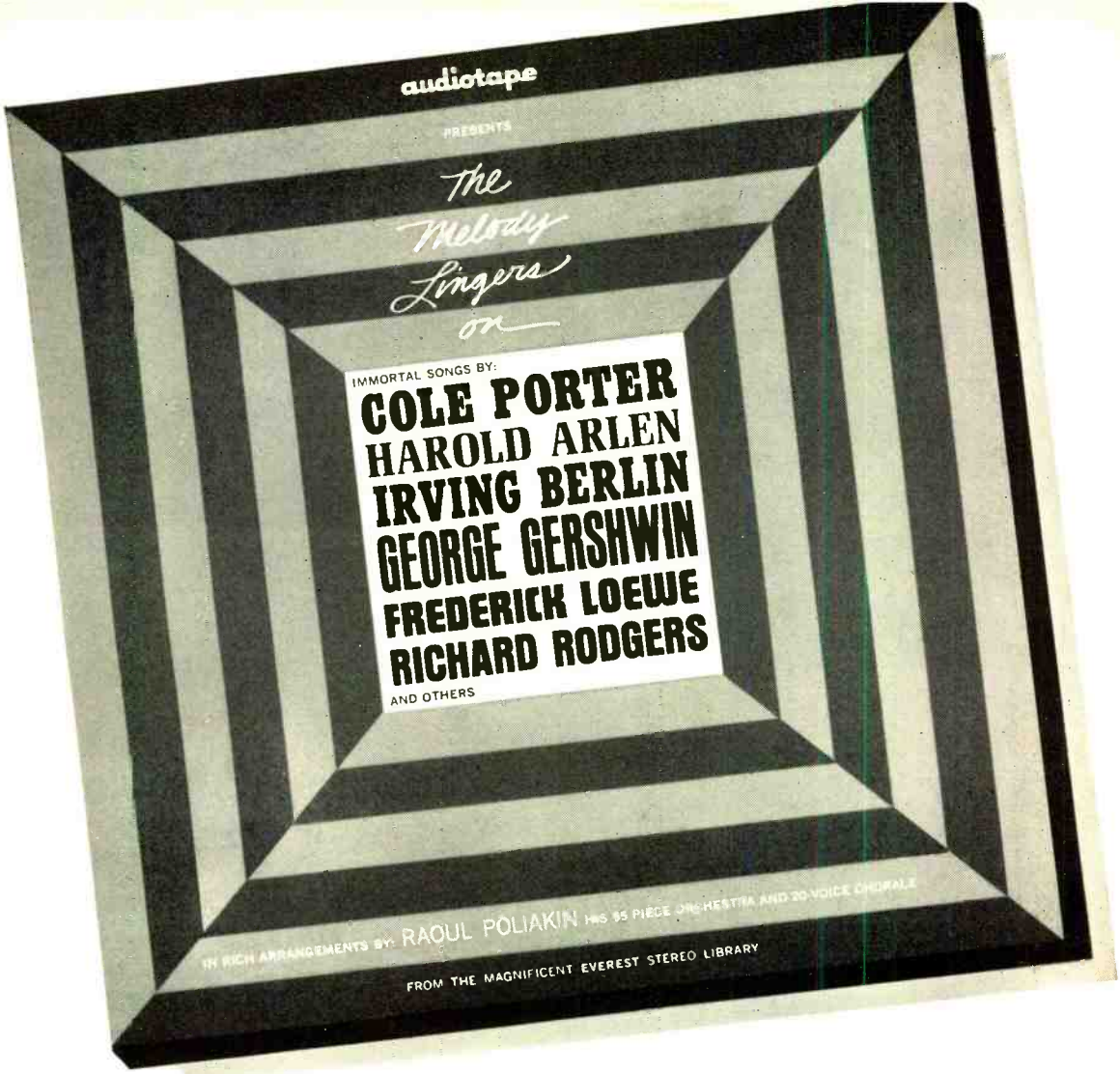


search through the Michigan and Arkansas library systems and a brief search in Washington, D.C., I was unable to locate the references mentioned in the text. Could you please advise me as to where I can obtain additional information and/or plans?
Name withheld

In answer to a number of inquiries on this article which have been received over the years, we would like to state once again that the subhead should be taken literally. It reads as follows: "In keeping with the first day of April." Careful readers will also observe that one of the footnotes refers to "a reprint of a document found in a flying saucer." Need more be said? —30—

Out of Tune

Sure Cure for Ham/CB Mobile Noise (*October, 1963, page* 65). Through no fault of the author, the price given for the "Eliminoise" kit is incorrect. The "about $12" figure refers to another new product being offered by the E.F. Johnson Company—a "Generator, Alternator-Regulator Suppression Kit." The Johnson/Hallett "Eliminoise" kit sells for $29.95 (6-cylinder cars) and $38.50 (8-cylinder cars). Our apologies to E. F. Johnson and to any readers who may have found our pricing information an inconvenience. —30—



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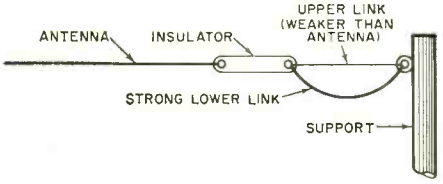
Tips and Techniques

SHIPBOARD ANTENNA SAVER FOR LANDLUBBERS

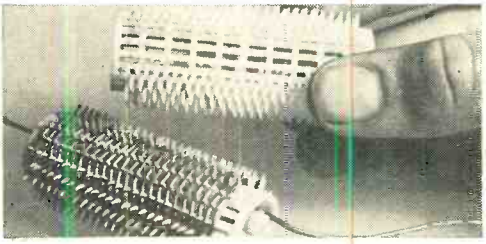
This antenna-saving idea is generally used at sea where a rugged installation is essential, but it is equally useful on land. As shown in the drawing, the antenna is supported by two wire links, one slightly weaker than the antenna, and the other one considerably heavier. When there is too much strain on the antenna, the top link breaks—rather than the antenna—and the strong lower link takes over, giving the sky wire more slack at the same time.



—Art Trauffer

CLEVER COILS FROM HAIR CURLERS

Take a look in the little lady's cosmetic case the next time you need a small coil form for winding a coil. Hair curlers, like

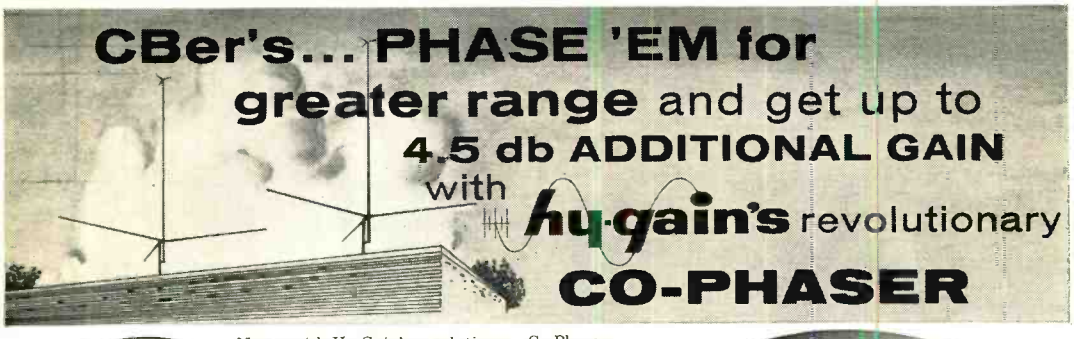


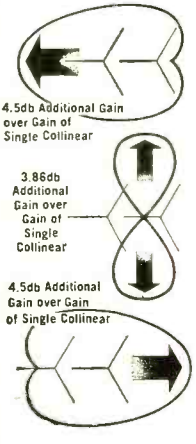
those shown or somewhat similar, are ideal low-loss, low-cost (unless she makes you buy her some more) coil forms.

—Jerome Cunningham

ERASER CLEANS CIRCUIT BOARDS

If you've ever faced the problem of having the foil separate from a printed-circuit board when you attempt to solder it, this





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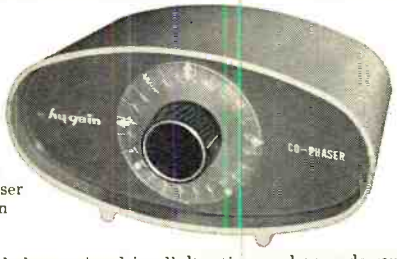

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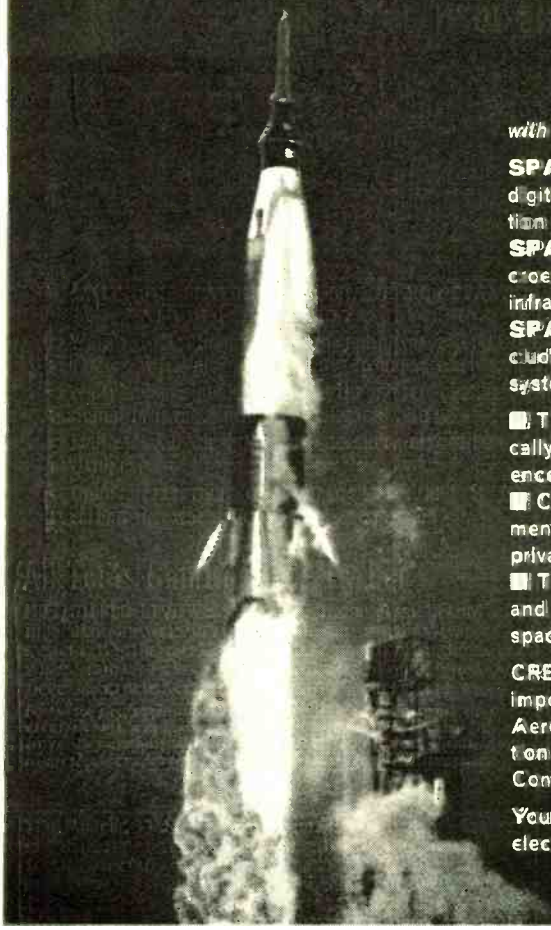

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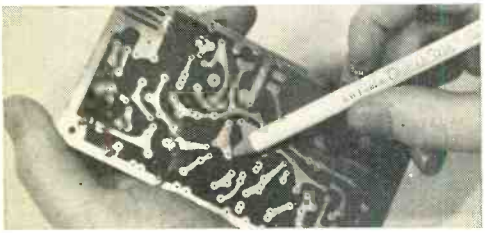
Tips

(*Continued from page* 12)

tip is for you. Before you start, carefully clean the copper foil by rubbing it with a typewriter eraser like that shown. The eraser has the correct amount of abrasive, and removes oxidation and dirt so that



joints can be rapidly tinned and soldered. Incidentally, this technique is recommended by NASA for high-reliability soldering of satellite components.

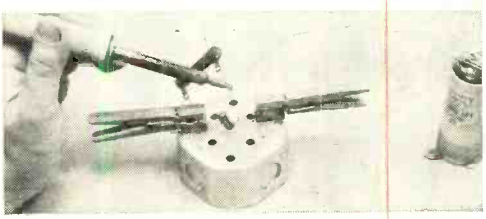
—*Kent A. Mitchell, W3WTO*

IDENTIFYING TRANSISTOR TYPES

Painted-on transistor type-numbers often wear off with repeated handling, and many transistors, especially those of the general-purpose variety sold to experimenters, are not marked at all. If you do a lot of breadboarding of circuits, you'll save yourself considerable time and trouble by scratching type numbers and/or other data such as "a.f." or "r.f.," and "*pnp*" or "*npn*," on the outside of each transistor case with a sharp instrument. —*Stanley E. Bammel*

MAGNETIC FINGERS FROM CLOTHESPINS

The use of wooden spring clothespins to hold small parts when soldering or gluing is an old idea, but if you cement a small, flat magnet to one jaw of each pin, the



clothespins will take on new usefulness. The magnets will hold them in place on steel surfaces, making it possible for you to work with a number of parts and hold a soldering iron at the same time. Plastic

(*Continued on page* 20)

Solve your Christmas shopping problems with the

TURNER COMBO

Yes, here's the perfect Christmas gift for any CBer — the Turner Combo Pack. Two fine Turner microphones in one package — the 350C mobile microphone and the 254C base station microphone. They're the perfect combination for insuring top performance at both ends of any CB rig. Do your Christmas shopping at your Turner dealer's — get the Turner Combo.

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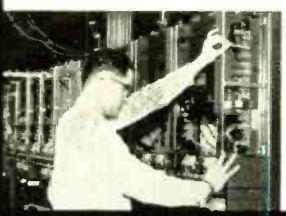

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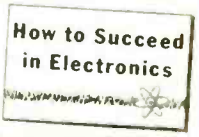

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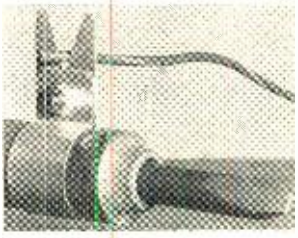
Tips

(*Continued from page* 14)

clothespins of the spring variety can also be used, but make certain that they are made of a material which does not soften excessively when heated. —*Philip Lawson*

WIRE STRIPPER FOR PLASTIC INSULATION

A handy wire stripper for plastic-insulated hookup wire can be made from a strip of sheet copper with a V-shaped slot in one end as shown in the photo. Bolt the copper in place and allow the iron to heat. The insulation to be removed is laid in the "V" and rotated. The heat will make a clean break in the insulation and permit it to be easily removed by simply sliding it off the wire. —*Milton F. Dickfoss*



COMING NEXT MONTH

Another sensational development in the field of automotive electronics is a transistorized substitute for the outdated noisy vibrator. Extraordinarily simple to build, the Vibrator Substitute is described in several different versions—it's suitable for inboard mounting as well as external rear panel mounting on a low-priced heat sink.

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SHURE MICROPHONES

for maximum voice punch!

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ALL-NEW... ADJUSTABLE HEIGHT

Model

444

for Ham and CB Use

Gets the message through where other mikes can't. "Shaped" frequency response cuts off below 300 cps, above 3000 cps—with specially developed "rising" characteristic from 1000 to 3000 . . . cuts through QRM, assures top intelligibility and maximum range. Touch-to-talk switch (with built-in switch provision for instant change to VOX or normal operation). Adjustable height stand minimizes operator fatigue. Dozens of other features. Only $25.50 net.

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FOR "SOLID" 10-4's

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for CB Use

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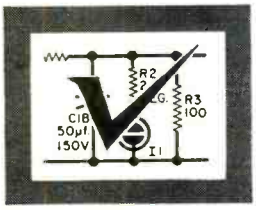
the CB improvement you can hear!

SEND FOR FREE SIGNAL CARD—Most popular "10" signals

Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Illinois

Manufactured under U.S. patents 2,454,425 and D194,749; other patents pending.

Operation Assist



THROUGH THIS COLUMN we try to make it possible for readers needing information on out-dated, obscure, and unusual radio-electronic 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 to OPERATION ASSIST, POPULAR ELECTRONICS, One Park Avenue, New York 16, N. Y. Give the maker's name, the model number, year of manufacture, bands covered, tubes used, etc. Be sure to print or type everything legibly, including your name and address, and be sure to state specifically what you want, i.e., schematic, source for parts, etc. Remember, *use a post card;* we can handle them much faster than letters. And don't send return envelopes; 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

Mobilet VHF crystal-controlled transceiver, no model number given. (R. Cook, 7 Montgomery St., Saugus, Mass.)

RME DB-20 preselector. USN No. 322-ME23. (Charles McGeorge, 16724 San Bernardino Ave., Fontana, Calif.)

Zenith Model 12V15S 12-tube, 4-band receiver, late 30's; **Crosley** Model 23, 3-band BC and s.w. receiver. (Joseph Werner, 2814 S. 13th St., Niles, Mich. 49120)

Truetone Series A-14 9-tube, 3-band receiver. No. A14-122, 1938. (W. Hnatyszyn, 39 Norfred Dr., Lackawanna 18, N.Y.)

BC 654-A transmitter and receiver. Army surplus. (Roger Van Divort, Rte 2, Chathaw Hill, Wenatchee, Wash.)

Zenith Model 6S223AM-SW.I, no other data. (James Cannon, Jr., 1108 S. Benbow, Greensboro, N.C. 27406)

Delco Model R1116, 6 tubes, BC and s.w., no other data. (Richard W. Black, Odessa, N.Y.)

G.E. Model F-86, no other data. (Russell G. Feran, 3817 Napoleon Ave., New Orleans 25, La.)

Travler TV Type No. 321-77, ser. 2587526. (Hans-Dietu Dudcu, 5167 King Edward, Montreal 29, IPQ, Canada)

RCA Model 96T4, No. RC399, RCA No. 616J. (John T. Sowers, Rte 5, Lebanon, Pa. 17042)

Guthman Model U-36 transmitter, no other data. (James DeVan, 214 Pioneer Trail, Marietta, Ga. 30062)

Crosley Model 21, 5-tube, 3-band BC and s.w. receiver. (Steve Mann, 1715 Greenfield St., Winston-Salem, N.C.)

Capehart Model 400-H complete hi-fi system, about 1940, 3-band tuner, separate bass and treble amplifiers

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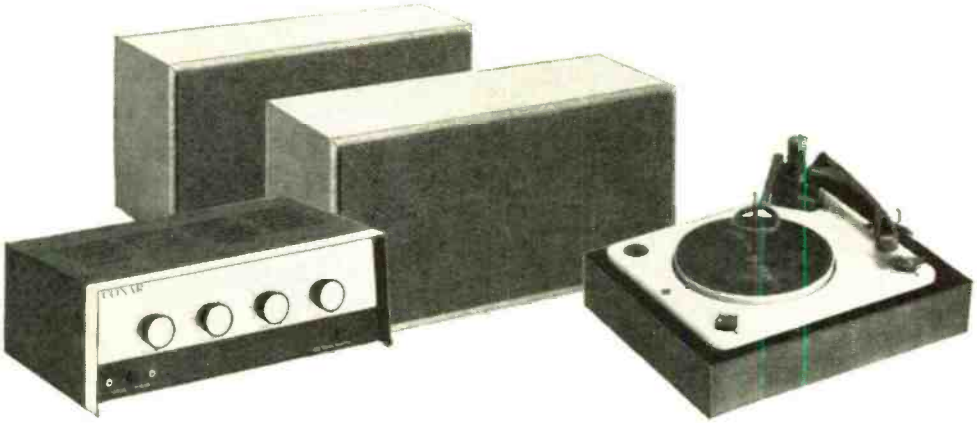

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Name.....

Address.....

City.....Zone....State.....

(Custom "300" is shipped exp. chgs. coll.)

Operation Assist

(*Continued from page 22*)

and speakers. (Robert D. Greene, 373 Newton St., Waltham, Mass. 02154)

Zenith chassis 6B01, 8S661, ser. A399583, 8-tube BC and s.w. receiver, about 1938. (Don Petty, 24 Berkeley Square, Los Angeles 18, Calif. 90018)

Sparton 4-6, BC and s.w. receiver, about 1938. (Leo A. Smith, 2142 N. 117th, Wauwatosa 13, Wis.)

Hickok VOM, Model 133B, ser. 51458, date unknown. (Carl A. Neste, 208 Tall Trees Dr., Vallejo, Calif. 94590)

RAX-1 4-band Command-type receiver, Navy surplus. (W. L. Cox, 3060 Cudahy St., Huntington Pk., Calif.)

Triplett Model 1632 signal generator, also operating data. (J. M. Knox, Rte. 6, Box 7, Henderson, Texas)

Grunow Model 1291, 12-tube BC and s.w. receiver. (Bradley Weekley, Wilbur, W. Va.)

DeWald Model D-508A BC and s.w. receiver. (Thomas Bertram, 2284 Fairfax St., Denver 7, Colo.)

Minivac 601 general-purpose computer, also other data. (Lance Lieberman, 50 Elm Drive, Roslyn, L.I., N.Y.)

Northern Electric Model 61 6-tube auto radio, ser. 178. (George R. Nunn, Box 357, Carstairs, Alberta, Canada)

Dayrad (Radio Products Co.) Type 320 tube tester, early 1930's. (M. L. Schultz, 30 Harriett Dr., Princeton, N.J.)

Pilot FM receiver, No. 104010, no other data. (Bo Yeargan, 120 Westmore Rd., Rome, Ga.)

Special Data or Parts

Admiral AM/FM tuner, Model 14D 53-2, any data at all; **GE** Model 18060 TV receiver, any data. (Steven McGinty, 2905 Lamona Ave., Fresno 3, Calif.)

Dumont Model 328 dual-trace oscilloscope, service manual. (T. Miller, 2639 W. Augusta Blvd., Chicago 22, Ill.)

Radio City Products Model N.S. 802 tube tester, tube testing charts. (Fred. Russo, 58 E. 32nd St., Brooklyn, 26, N.Y.)

Collaro Model RC-456 record changer, bottom layout showing parts placement. (Ed. Pacek, P.O. Box 142, Crabtree, Pa.)

Hickok Model 550X tube checker; **Ferret** Model 600A signal generator; **Stromberg-Carlson** Model AR-37A amplifier, and Model HFP-1 record player; **Webcor** Model BP2719-1 tape recorder, Model BP29-781 tape recorder; **Sonora** Model 402A radio/phono combination. Operating manuals for all, and tube chart for tube checker. (Mark Clark, 822 Coolidge Pl., Rockford, Ill.)

Radiosonde Model AN/AMT 2B Signal Corps surplus, operating manual and any other data. (B.D. Minielly, 784 Belmont Ave., W., Kitchener, Ontario, Canada)

Kolster BC receiver, ser. 126542, using six '01A tubes, about 1928, any technical data. (K & G Service Co., Box 7, Dexter, Maine)

Silvertone Wirecorder, recording wire. (Larry Thomas, 7259 Parkland, Detroit 39, Mich.)

Hallicrafters Model SX-62 communications receiver, r.f. coils, i.f. transformers, and maintenance manual. (J. Engelen, Niewstraat 13, Oranjestad, Aruba, Netherlands Antilles)

R-101A/ARN-6 receiver, surplus, any technical data, WL-468 vacuum tube, ratings and data for 6-meter use. (Clark Miller, Elkhart High School Amateur Radio Club, Elkhart, Ind.)

Tape Master Model PT-125 tape recorder, bias oscillator coil, suitable replacement unit, or inductance and Q. (Brother Henry Norman, St. Michael's College, La Salle Hall, Station 1, Santa Fe, N.M.)

Coronado AM/FM 7-tube radio, about 1938-1940, any technical data. (Quintin Davis, Rte. 1, Box 144, Olin, Ia.)

O. R. Co., of Detroit, "Monarch" BC and s.w. radio, 4 tubes, any technical data. (Ray Rayburn, 58-20 Lawrence St., Flushing 55, N.Y.)

Grigsby-Grunow Co., Majestic -7, Model 70, BC and l.w. radio; **RCA Victor** Model R-74, ser. AKL 1315; any technical data. (James Pouliot, 1174 Cowesett Rd., Warwick, R.I.)

—30—

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Measures AC Voltages .0002-Volt to 500 Volts
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Separate 1.5-volt rms and 4-volt peak-to-peak scales for accurate low AC measurements. Measures AC and DC voltages to 1500 volts, resistances from 0.2 ohm to 1,000 megohms. Ultra-slim probes, long flexible leads.

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For trouble-shooting B&W and color TV, radio, hi-fi, tape recorders. Exceptional gain and bandwidth (response to 5.5 Mc for toughest jobs. Scaled graph screen and internal calibrating voltage source for direct reading of peak-to-peak voltage. Supplied with direct/low-cap shielded cable.

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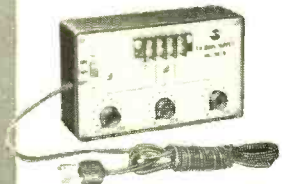
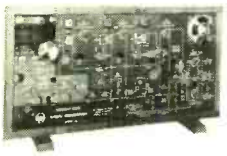


RCA WG-307B (K) TV BIAS SUPPLY KIT

Three separate DC output voltages each adjustable from 0 to 15 volts provide bias voltages for aligning RF, IF and other circuits of color and black-and-white TV receivers. Kit: $11.95*

See them all at your Authorized RCA Electronic Instrument Distributor

For specifications and technical data on individual kits, write Commercial Engineering, Section K-133-W, RCA Electronic Components and Devices, Harrison, N. J.



RCA WE-93A (K) TRANSISTOR-RADIO DYNAMIC DEMONSTRATOR KIT

Working six-transistor radio on color-coded panel board for instructional and demonstration purposes. Removable components. Includes 304-page RCA transistor manual containing detailed data on 373 semiconductor devices, representative transistor circuits, basic theory. Kit: $39.95*

RCA WE-95A (K) VOLT-OHM-MILLIAMMETER DYNAMIC DEMONSTRATOR KIT

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New Products

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which measures 17" x 10" x 7½", includes a built-in S-meter. Price, $149.50. (*Lafayette Radio Electronics Corp.*, 111 Jericho Turnpike, Syosset, L.I., N.Y.)

ALTERNATOR NOISE SUPPRESSION KIT

A special conversion kit for suppressing interference is now available for use with 40-, 60-, and 100-ampere Leece-Neville alternator systems. The kit, designed to aid users of mobile two-way radios, consists of a filter choke and four capacitors which are installed on existing regulators in 6- or 12-volt alternator systems. Simplified instructions are included, and the job can be done by the car owner. (*Leece-Neville Co.*, 1374 E. 51st St., Cleveland 3, Ohio)

TRANSISTOR IGNITION SYSTEM

Available in both negative and positive ground systems for either 6- or 12-volt operation, the new Sorensen "Transignition" system is designed for high reliability. All

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Featuring Tests Never Before Available To The Hobbyist

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- **Four specially designed tests to check distortion in stereo cartridges.**
- **Open-air recording of moving snare drums to minimize reverberation when checking stereo spread.**

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Although there are many stereo test records on the market today, most critical checks on existing test records have to be made with expensive test equipment.

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The result: the HiFi/STEREO REVIEW Model 211 Stereo Test Record!

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- ✓ **Flutter—a test to check whether your turntable's flutter is low, moderate, or high.**
- ✓ **Channel balance — two white-noise signals that allow you to match your system's stereo channels for level and tonal characteristics.**
- ✓ **Separation—an ingenious means of checking the stereo separation at seven different parts of the musical spectrum—from mid-bass to high treble.**

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

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HiFi/STEREO REVIEW's Model 211 Stereo Test Record will give you immediate answers to all of the questions you have about your stereo system. It's the **most complete test record** of its kind—contains the widest range of check-points ever included on one test disc! And you need no expensive test equipment. **All checks can be made by ear!**

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

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

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Please send me _____ test records at $4.98 each. My check (or money order) for $ _____ is enclosed. I understand that you will pay the postage and that each record is fully guaranteed. (Orders from outside the U.S.A. add 50c to partially defray postage and handling costs.)

Name _____
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SORRY—No charges or C.O.D. orders! **PE 113**

Mosley

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A REVOLUTIONARY CONCEPT IN AMATEUR ANTENNAS!

3 MODELS - NEW LOW PRICE!

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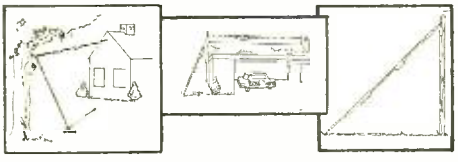

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Mosley Electronics Inc.

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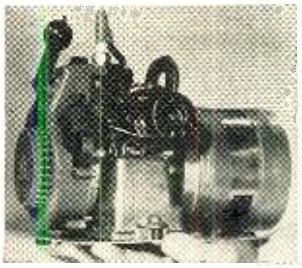
New Products

(*Continued from page* 26)

components are shock-mounted and sealed against moisture. The circuit uses one transistor and a Mallory coil, with ballast resistor mounted on it to simplify installation. (*Sorensen Industrial Electronic Co.*, Highway #10, Dover, N. J.)

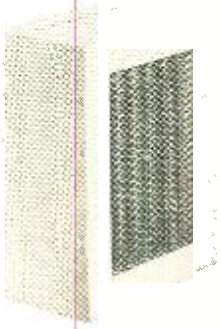
MINIATURE ENGINE-DRIVEN GENERATOR

This hand-size gasoline engine generator weighs just 12 pounds and is capable of operating a two-way radio, lights, a TV set, electric drill, or any other appliance drawing up to 300 watts. Produced by the Tiger Mfg. Co., and called the "Tiny Tiger," the unit is powered by an aluminum two-cycle ¾ H.P. engine that burns outboard motor fuel. The generator is a permanent magnet type, and is integrated with the engine. Ideal for outings or emergencies, the engine generator delivers both 115 volts a.c. and 12 volts d.c., and can be used to charge 6- and 12-volt storage batteries as well as as for powering 112-volt a.c. equipment. Price, $99.50 including shipping cost. (*Tiger Mfg. Co.*, 2312 W. Pacific Coast Hwy., Long Beach, Calif.)



WIRELESS MONITOR

Effective as an electronic "baby sitter," transmitting sounds made in the nursery or play area to a radio in another room, the 3½" x 5" transistorized "METRO-MIKE" is also intended for use as a calling or intercom system in office buildings and as a "night watchman" in factories. Voices and sounds can be picked up on conventional home or auto radios from a distance of 300 feet. The METRO-MIKE plugs into any wall outlet. Price, $39.95. (*Metropolis Industries, Inc.*, Shaker Building, Cleveland 22, Ohio) -30-



"One of the most sensitive FM tuners on the market."

—POPULAR ELECTRONICS

"We found that with only about three inches of wire connected to the antenna terminals we could get every one of the important stations in the New York area."

—AUDIO

"In addition to fine electrical performance, it has the smooth flywheel tuning and general 'feel' of factory-wired Fisher tuners."

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The StrataKit method of kit construction is a unique Fisher development. Assembly takes place by simple, error-proof stages (Strata). Each stage corresponds to a *separate* fold-out page in the instruction manual. Each stage is built from a *separate* transparent packet of parts (StrataPack). Major components are *pre-mounted* on the extra-heavy-gauge steel chassis. Wires are *pre-cut* for every stage—all work can be checked stage-by-stage, page-by-page.

Front-end and Multiplex stages come fully assembled and pre-aligned. The other stages are also aligned and require only a 'touch-up' adjustment by means of the tuner's laboratory-type d'Arsonval signal-strength meter.

The ultra-sophisticated wide-band Fisher circuitry of the KM-60 puts it in a spectacular class by itself. Its IHF Standard sensitivity of 1.8 microvolts makes it the world's most sensitive FM tuner kit. Capture ratio is 2.5 db; signal-to-noise ratio 70 db. Enough said.

Another outstanding feature of the Multiplex section is the exclusive STEREO BEAM,** the Fisher invention that shows if an FM station is broadcasting in stereo.

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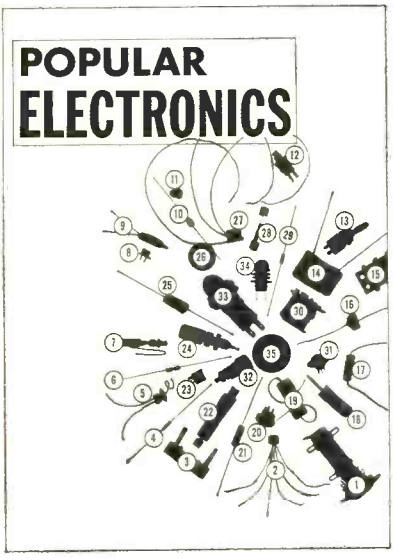
*FACTORY-WIRED (KM-60), $219.50. WALNUT OR MAHOGANY CABINET, $24.95; METAL CABINET, $16.95. PRICES SLIGHTLY HIGHER IN THE FAR WEST. EXPORT: FISHER RADIO INTERNATIONAL, INC., LONG ISLAND CITY 1, N. Y. CANADA: TRI-TEL ASSOCIATES, LTD., WILLOWDALE, ONT. **PAT. PENDING

COVER CONTEST WINNERS



YOUR fine response to our impromptu parts identification contest presented in the September issue swamped our editoral staff and resulted in a good deal of midnight-oil burning. Nonetheless, here are the five eagle-eyed winners, who may well take pride in having come out on top of so many hundreds of contestants. The first four names are listed in the order in which they were received, and each has all answers functionally correct. The fifth winner was judged most accurate among several who came to grief on a single item. Our tired-but-game editorial staff offers hearty congratulations to the winners, who will receive a free one-year subscription. Warm thanks and consolation go to all other entrants.

J. Collier, 4535 Orin Ave., La Crescenta, Calif.
P. Roberts, 1205 N. Santa Fe #47, Vista, Calif.
S. Levine, 216-69 68th Ave., Bayside, N.Y.
R. Carlson, 78 Lenox St., Rochester, N.Y.
R. Culter, 1317 Horseshoe Curve, Lake Oswego, Ore.

1. Turret tube socket. 2. Transistor transformer. 3. Resistor/fuse. 4. Resistor. ¼-watt carbon. 5. Silicon controlled rectifier. 6. Resistor, ½-watt carbon. 7. Piston trimmer capacitor. 8. Transistor socket. 9. Neon lamp. 10. Resistor, ¼-watt carbon. 11. Miniature incandescent pilot lamp. 12. Push-button switch. 13. Toggle switch. 14. Ceramic capacitor. 15. Barrier terminal strip. 16. Silicon rectifier. 17. Electrolytic capacitor. 18. Miniature phone plug. 19. Tubular paper capacitor. 20. Nuvistor socket. 21. Resistor, 1-watt carbon. 22. HV silicon rectifier. 23. Transistor socket. 24. Binding post. 25. Resistor, 2-watt carbon. 26. Potentiometer, Bourns Knobpot. 27. Potentiometer, Bourns Trimpot. 28. Fuse, Slo-blow. 29. Semiconductor diode, glass-cased. 30. Relay. 31. Transistor socket. 32. Banana jack. 33. Indicator lamp assembly. 34. Indicator lamp assembly. 35. Readout display tube, numerical.

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Published by Howard W. Sam & Co., 4300 West 62nd St., Indianapolis 6, Ind. Soft cover. 128 pages. $2.95.

ELECTRONIC CIRCUITS HANDBOOK

by Tom Kneitel

Compilations of selected circuits are becoming increasingly popular. There are books of transistor circuits, ham transmitter circuits, electronic game circuits, and many others. This book, with its 150 circuits, *should* have out-classed them all in reader interest. Unfortunately, since *Electronic Circuits Handbook* lacks an index and is organized in a disjointed fashion, it is almost impossible to find exactly what you're looking for. This may be just as well since the book is replete with misspellings, typographical errors, and other mistakes. For example, schematic 8-13 seems to be missing altogether and in its place is schematic 8-23. As another example, drawing 4-3 does not contain the designer's well-advertised corrections in resistance values (see *1963 Electronic Exper-*

(Continued on page 38)

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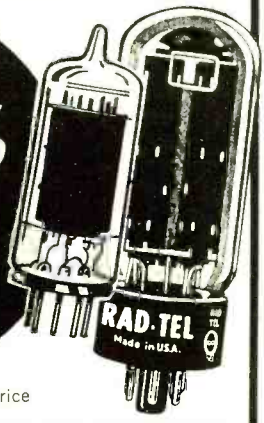

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	1DN5	.55		6AX4	.66		6SH7	1.02		12D4	.69
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	1R5	.77		6BC8	1.04		6SN7	.65		12DS7	.84
	1S5	.75		6BE6	.55		6SQ7GT	.94		12DT5	.76
	1T4	.72		6BF5	.90		6T4	.99		12DT7	.79
	1U5	.65		6BF6	.44		6T8	.85		12DT8	.78
	1X2B	.82		6BG6	1.70		6U8	.83		12DW8	.89
	2AF4	.96		6BH8	.98		6V6GT	.54		12DZ6	.62
	3AL5	.46		6BJ6	.65		6W4	.61		12ED5	.62
	3AU6	.54		6BJ7	.79		6W6	.71		12EG6	.62
	3AV6	.42		6BK7	.85		6X4	.41		12EK6	.62
	3BC5	.63		6BL7	1.09		6X8	.80		12EL6	.50
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	3DG4	.85		6BZ7	1.03		8BQ5	.60		12GC6	1.06
	3DK6	.60		6C4	.45		8CG7	.63		12J8	.84
	3DT6	.54		6CB6	.55		8CM7	.70		12K5	.75
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	3S4	.75		6CG8	.80		8EB8	.94		125K7GT	.95
	3V4	.63		6CL8	.79		8FQ7	.56		12SL7	.80
	4BQ7	1.01		6CM7	.69		9CL8	.79		12SN7	.67
	4CS6	.61		6CN7	.70		11CY7	.75		12SQ7GT	.91
	4DT6	.55		6CQ8	.92		12A4	.60		12U7	.62
	4GM6	.60		6CR6	.60		12AB5	.60		12V6	.63
	5AM8	.79		6CS6	.57		12AC6	.55		12W6	.71
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	5BK7	.86		6CY5	.70		12AF3	.73		18FW6	.49
	5BQ7	1.01		6CY7	.71		12AF6	.67		18FX6	.53
	5BR8	.83		6DA4	.68		12AJ6	.62		18FY6	.50
	5CG8	.81		6DE6	.61		12AL5	.47		19AU4	.87
	5CL8	.76		6DG6	.62		12AL8	.95		19BG6	1.39
	5CQ8	.84		6DJ8	1.21		12AQ5	.60		19EA8	.79
	5EA8	.80		6DK6	.59		12AT6	.50		19T8	.85
	5EU8	.80		6DN6	1.55		12AT7	.76		21EX6	1.49
	5J6	.72		6DQ6	1.10		12AU6	.51		25AX4	.70
	5T8	.86		6DT5	.81		12AU7	.61		25C5	.53
	5U4	.60		6DT6	.53		12AV6	.41		25CA5	.59
	5U8	.84		6DT8	.94		12AV7	.82		25CD6	1.52
	5V6	.56		6EA8	.79		12AX4	.67		25CU6	1.11
	5X8	.82		6EB5	.73		12AX7	.63		25DN6	1.42
	5Y3	.46		6EB8	.94		12AY7	1.44		25EH5	.55
	6AB4	.46		6EM5	.77		12AZ7	.86		25L6	.57
	6AC7	.96		6EM7	.82		12B4	.68		25W4	.68
	6AF4	1.01		6EU8	.79		12BD6	.50		32ET5	.55
	6AG5	.70		6EV5	.75		12BE6	.53		35C5	.51
	6AH4	.81		6EW6	.57		12BF6	.60		35L6	.60
	6AH6	1.10		6EY6	.75		12BH7	.77		35W4	.42
	6AK5	.95		6FG7	.69		12BK5	1.00		35Z5	.60
	6AL5	.47		6FV8	.79		12BL6	.56		36AM3	.36
	6AM8	.78		6GH8	.80		12BQ6	1.16		50B5	.69
	6AQ5	.53		6GK5	.61		12BR7	.74		50C5	.53
	6AS5	.60		6GK6	.79		12BV7	.76		50EH5	.55
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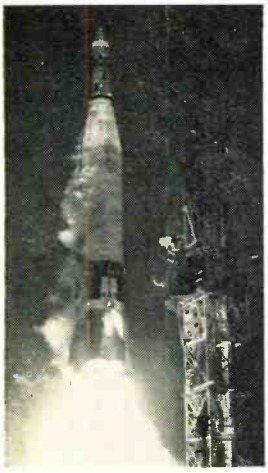

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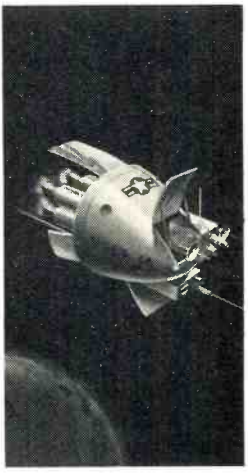

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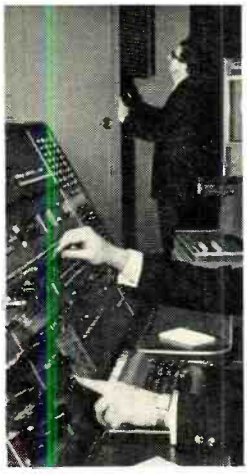

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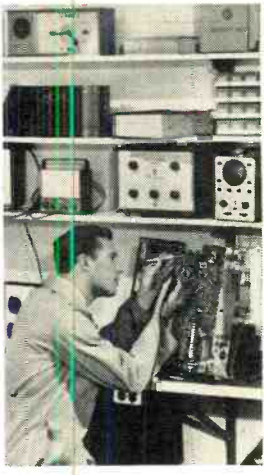

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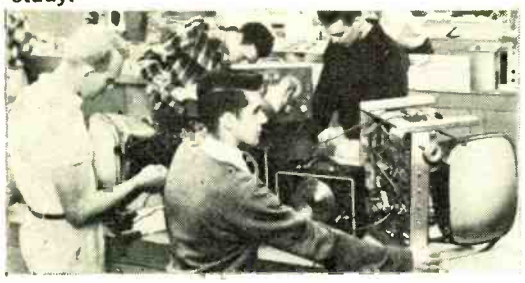

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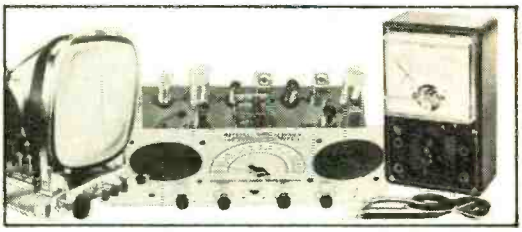

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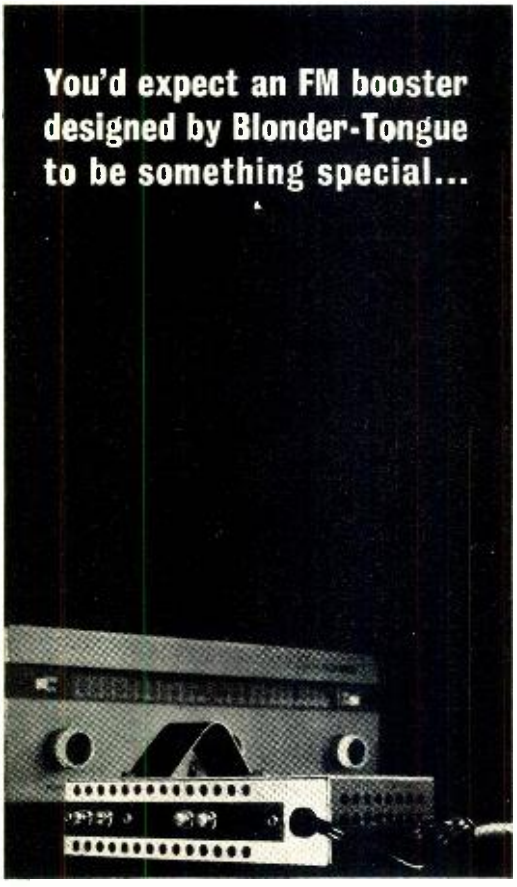

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Bookshelf

(*Continued from page 32*)

imenter's Handbook). There are numerous other errors that detract from what could have been a handy item on every workbench.

Published by Cowan Publishing Corp., 300 West 43 St., New York 36, N.Y. 128 pages. Soft cover. $3.00.

MICROELECTRONICS: THEORY, DESIGN AND FABRICATION

Edited by Edward Keonjian

Microelectronics, for the purpose of this book, refers to the art of fabricating electronic circuits from extremely small parts. Although it is intended principally for engineers and scientists, anyone with a more than casual interest in electronics will find in it a wealth of fascinating material. "Microelectronics" is, in several ways, a pioneering effort—a book that brings together diverse approaches to miniaturization. The oldest approach, that of using discrete (separate) component parts is considered first. The following chapters deal with thin film circuits (circuits in which the "components" are deposited in films a few microns thick), and with semiconductor integrated circuits in which a number of electrical elements are inseparably associated on or within a semiconductor. A final chapter gives the reader a glimpse of the future—a future in which a single device, perhaps a precisely tailored crystalline structure of some sort, will perform a complex function.

Published by McGraw-Hill Book Company, Inc., 330 W. 42 St., New York 36, N.Y. 375 pages; index. Hard cover. $12.50.

Free Literature

An indispensable item on anyone's electronics workbench, Allied Radio's new 444-page, 1964 catalog features hi-fi, CB, ham, p.a., and test equipment in addition to components and over 100 do-it-yourself Knight-Kits. All major manufacturers are represented in the 1964 catalog, No. 230, which marks Allied's 43rd year. For your copy, write to Allied Radio Corp., 100 N. Western Ave., Chicago, Ill., 60680. . . . The physical and electrical characteristics of Sonotone's line of rechargeable nickel-cadmium batteries are described in a reprint of an article entitled "Cordless Battery Power." It's available from Sonotone Corp., Elmsford, N.Y. —30—

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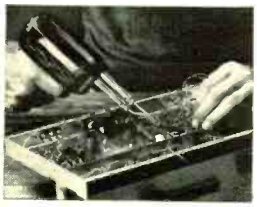

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MPX METER

Here's one that outdoes them all—simple, inexpensive and reliable, it's both a stereo and tuning indicator

By **FRED BLECHMAN,** K6UGT

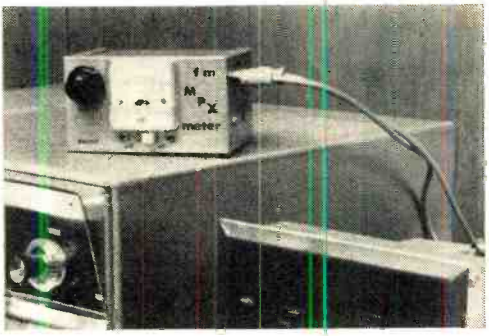
WANT A QUICK, INEXPENSIVE way to tell when you're receiving FM stereo multiplex broadcasts? The "MPX Meter," a new kind of stereo indicator which can be added to most existing equipment without wiring changes, will do the job perfectly. In addition, it doubles as a *tuning* indicator, letting you know when you are tuned exactly to the center of a multiplex station. Finally, you can custom-build the MPX Meter in any of three different versions to accommodate the output level of your particular tuner!

The principle behind the MPX Meter is simple. When an FM stereo signal is broadcast, a 19-kc. "pilot carrier" is sent along with it to permit the receiver to recreate the stereo subcarrier which is suppressed at the transmitter. The MPX Meter selects this 19-kc. signal

from the multiplex output of your tuner, rectifies it, and displays it as a meter reading. Since the pilot carrier appears only on multiplex signals, the meter reads only when you tune in a stereo program.

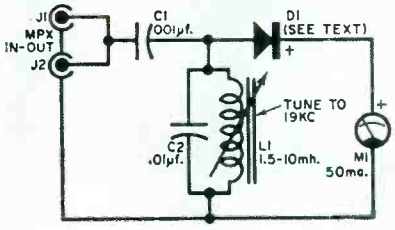
Practical Circuits. As shown in the schematic diagram and photos below, the simplest MPX Meter circuit uses no batteries, transistors, or switches. The 19-kc. signal from the tuner MPX output jack is coupled through isolation capacitor *C1* to the tuned circuit consisting of *C2-L1*. This tuned circuit, in combination with *C1*, forms a voltage divider for the 19-kc. signal, which is then rectified by *D1* (any general-purpose diode such as the 1N34) and passed on to a sensitive 50-μa. meter, *M1*.

If your tuner output is insufficient to operate the simple no-transistor MPX Meter, one or two transistors can be added to greatly increase the instrument's sensitivity. The second unit, illustrated in the schematic and photos on page 43, features an *npn* transistor rectifier-amplifier, *Q1*. During the positive half of the cycle, the 19-kc. signal applied to *Q1*'s base causes it to conduct. Since *Q1* provides additional gain, a less sensitive 1-ma. meter, *M2*, can be used. (If you use a 50-μa. movement, insert *R1* in series with the meter to limit the current flow.) Transistor *Q1* is essentially cut off when no signal is applied, and the battery drain is so small that an on/off switch is not even necessary.

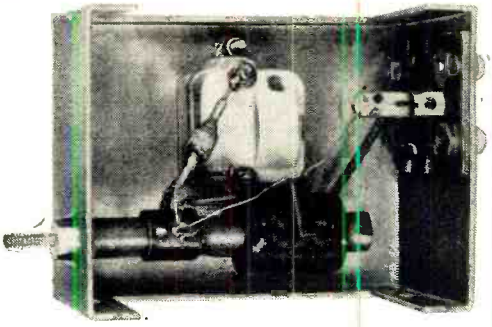


Simple to install, the MPX Meter (this is the two-transistor version) plugs into the tuner MPX jack.

The most complicated—though still simple—version of the MPX Meter provides even more gain by using a complementary *pnp* transistor amplifier, *Q2*, following *Q1* (see the schematic on page 44). Transistor *Q2* can be any general-purpose small-signal type such as the 2N107; the four-for-a-dollar variety should prove perfectly satisfactory. A switch *(S1)* is used in this circuit, since the leakage current is slightly higher; a slight meter reading when the switch



Simple diode MPX Meter—no transistors, batteries, switches—will work with many tuners having high-output ratio detectors.



Basic Parts, All Versions

C1—0.001-μf. ceramic disc capacitor
C2—0.01-μf. ceramic disc capacitor
L1—1.5-10mh. TV linearity control coil (Miller Type 6322)
J1-J2—Double RCA phono jack
1—Minibox or other housing
1—Shielded cable, RCA phono plugs at both ends
1—Decal or "Instant Lettering" set (optional)

Diode Version

D1—General-purpose crystal diode, 1N34, etc.
M1—50-μa. d.c. meter

One-Transistor Version

B1—1.5-volt penlight cell
M2—1-ma. d.c. meter
Q1—Npn transistor, 2N229, 2N170, etc.
R1—33,000-ohm, ½-watt resistor—see text
1—Battery holder for penlight cell
1—Transistor socket (optional)

Two-Transistor Version

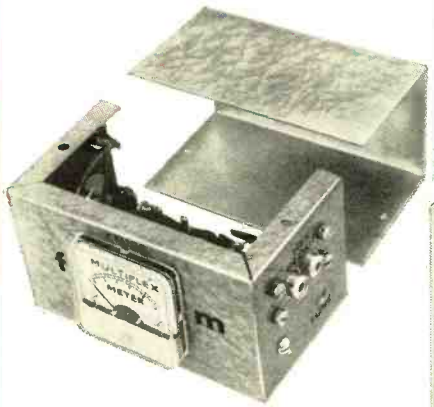
B1, M2, Q1—As above
Q2—Pnp transistor, 2N107 or equivalent
R1—1000-ohm potentiometer
R2—2000-ohm, ½-watt resistor
2—Transistor sockets (optional)

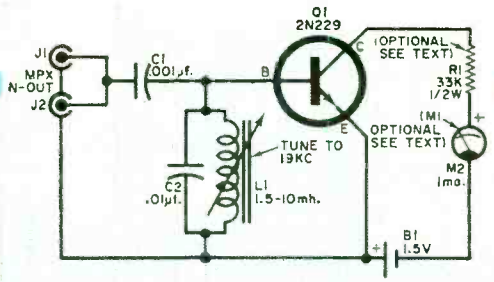
is turned on is normal in this version.

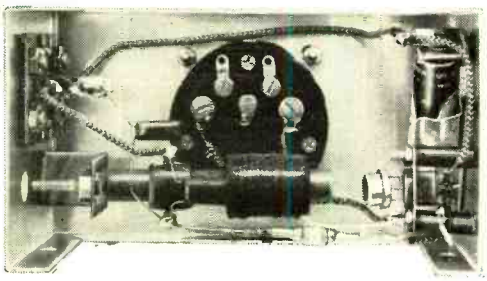
A 1000-ohm potentiometer, *R1,* is used to keep the high-gain circuit from pinning the meter needle. As shown in the Parts List, a 1-ma. meter is used just as in the one-transistor version. All of the meters employed in the prototypes of the MPX Meter are of the inexpensive, imported variety; they range in price from $2 to $4 depending upon sensitivity and the supplier.

Choosing Your Circuit. Whether or not you need *Q1,* or *Q1* and *Q2,* depends on the output level of the tuner. First check the instruction manual or schematic of your FM tuner or receiver, and determine whether it uses a ratio detector or a discriminator to demodulate the FM signal. A discriminator is usually preceded by a *limiter* stage (although it may not be labeled as such); a ratio detector is fed by the last i.f. stage of the tuner or receiver.

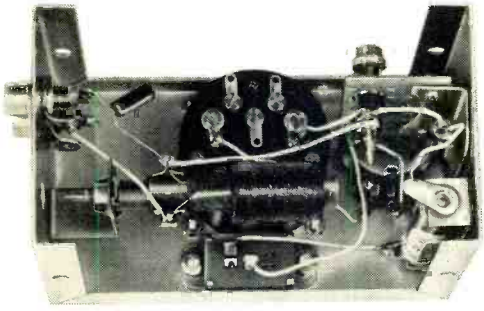
If your tuner has a ratio detector, chances are the simple no-transistor MPX Meter will do the job for you, but you may have to add *Q1.* If your equipment uses a discriminator, you should build *Q1* into your MPX Meter, and you may also have to add *Q2.* If you're not sure what kind of detector your tuner has, build the two-transistor MPX Meter



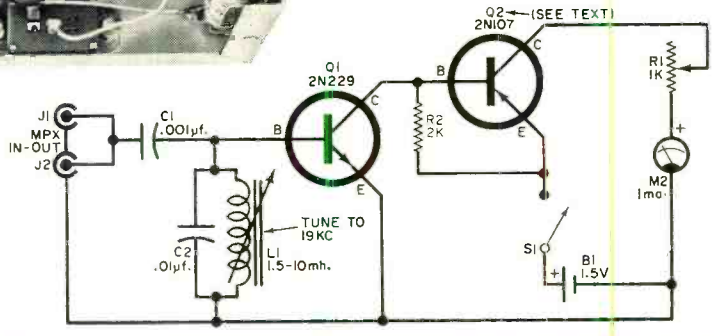




A single transistor is used as a rectifier-amplifier in this version. Either M2 may be used, or M1 along with R1.



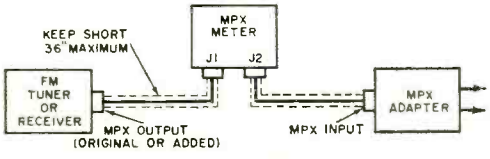
Two transistors are used in the high-gain version of the MPX Meter. Control R1 is added to prevent the needle from pinning on strong signals. This circuit will work with any tuner, regardless of output level.



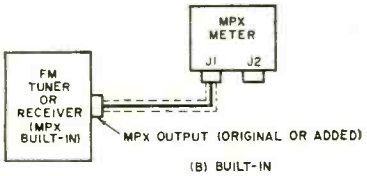
—you can always reduce the gain by adjusting control *R1*.

Construction and Hookup. Layout and construction are noncritical (the photos will serve as guides), and the unit may be housed in any metal or plastic box. If there is room on the front panel of your tuner, you can even mount the meter on it and tuck the simple circuitry away inside the chassis or behind the panel on a small perforated circuit board. Coil *L1* (and control *R1* in the two-transistor meter) requires only initial adjustment, so it does not have to be immediately accessible. The life of battery *B1* should be about a year or so, making replacement problems minimal.

Jacks J1 and J2 are simply paralleled so that the MPX Meter can be installed between a tuner and outboard adapter.



(A) EXTERNAL MPX ADAPTER



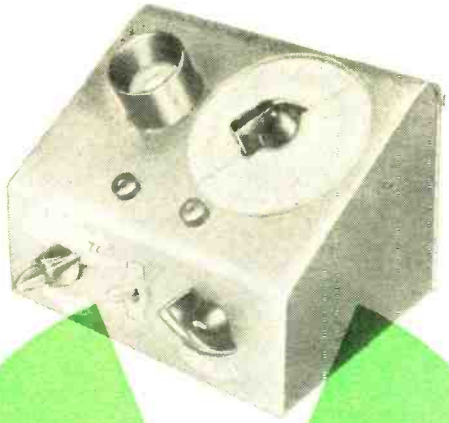
(B) BUILT-IN

Mount *L1* with a bracket bent from a strip of aluminum. Also mount the input and output jacks, the meter, and *R1, S1,* and the holder for *B1* if needed. The transistor(s) can be soldered in place or mounted in socket(s) attached to a small piece of perforated circuit board. Solder the connections carefully, using a heat sink to protect *D1, Q1,* and *Q2* as required. Be sure to observe proper polarities when connecting these components and the battery and meter into the circuit you select.

Most tuners sold in recent years are equipped with a multiplex output jack. If the MPX adapter is built in or if no jack is evident on your tuner, one can be easily added. Information on how to do this can often be obtained from the manufacturer, or by following the data provided with "universal" outboard multiplex adapters.

Plug the MPX Meter into the multiplex output jack, using shielded cable to make the connection. If you have an add-on stereo adapter, the double input jack on the MPX Meter will save the use of a "Y" adapter. The block diagram on page

(*Continued on page* 113)



meterless vtvm

By WILLIAM J. MILLARD

When you need a high-impedance voltmeter, you usually need it bad—this one uses no meter, and twelve bucks buys the parts

THE trusty multimeter is generally the first measuring instrument bought for the average home workshop, and often it's the *only* one the experimenter's budget will permit. But what do you do when the voltage to be measured is in a very high impedance circuit? Even if the multimeter is one of the fairly expensive sort having a 20,000-ohm-per-volt movement, the input impedance on a low-voltage range, say 3 volts full scale, is only 60,000 ohms. If you're trying to measure the bias on the oscillator grid of a mixer, or in a low-level audio stage having a 5-megohm (or higher) grid resistor, the multimeter looks pretty much like a dead short circuit to the voltage being measured. In such cases you either give up (unthinkable!), buy a vacuum-tube voltmeter ("unfundable"), or rummage in your junk box and build the "Meterless VTVM."

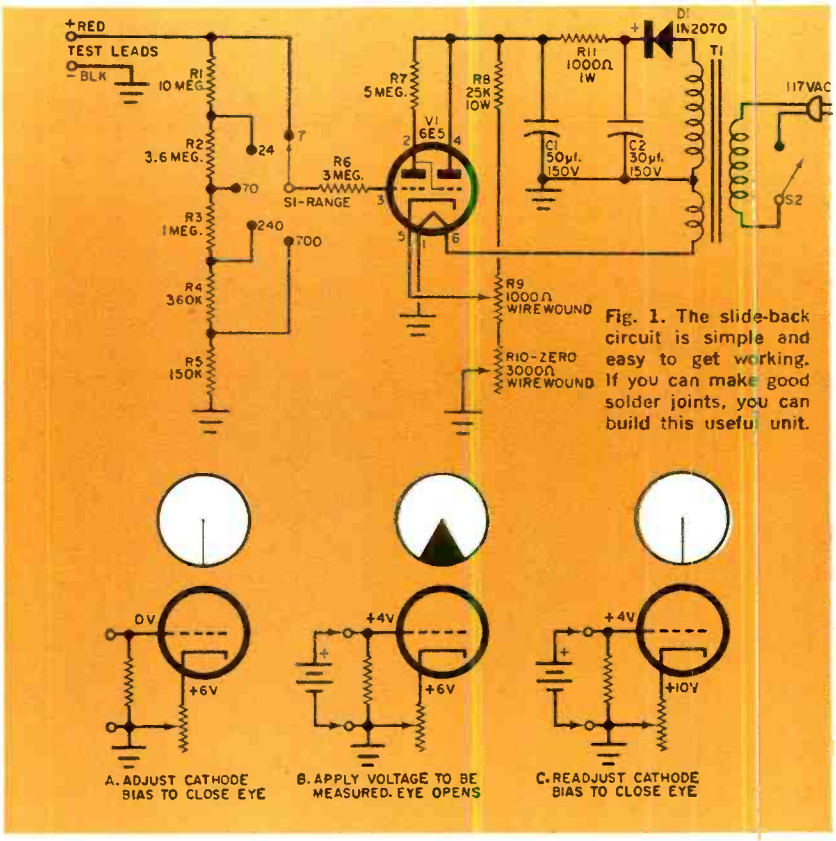


Fig. 1. The slide-back circuit is simple and easy to get working. If you can make good solder joints, you can build this useful unit.

PARTS LIST

C1—50-μf., 150-volt electrolytic capacitor
C2—30-μf., 150-volt electrolytic capacitor
D1—1N2070, 400-PIV silicon diode
R1—10 megohms
R2—3.6 megohms } *½-watt carbon*
R3—1.0 megohm *resistor, 5%*
R4—360,000 ohms } *tolerance*
R5—150,000 ohms
R6—3.0 megohms } *½-watt carbon,*
R7—5.0 megohms } *10% tolerance*
R8—25,000-ohm, 10-watt, wire-wound resistor
R9—1000-ohm, linear taper, wire-wound potentiometer
R10—3000-ohm, wire-wound potentiometer
R11—1000-ohm, 1-watt carbon resistor
S1—Single-pole, 5-position rotary switch
S2—S.p.s.t. toggle switch
T1—Power transformer; 125 volts @ 15 ma., 6.3 volts @ 0.6 ampere (Stancor PS-8415 or equivalent)
V1—6E5 electron-ray indicator tube
1—Aluminum box, sloping front (Bud AC-1612 or equivalent), or constructor's choice
Misc.—6-prong tube socket, line cord and plug, red and black pin jacks (one each), test prods, solder, hookup wire, hardware, etc.

It's true that the Meterless VTVM won't measure resistance or current, except by indirect methods, but the multimeter can still take care of those chores as before. And the Meterless VTVM will provide a bonus "instrument." You can use it when you're measuring a voltage that may suddenly take a drastic jump as you make adjustments, thereby avoiding the risk of wrapping the pointer of your multimeter around the stop pin! The repair of this all-too-common laboratory ailment (known as Technician Goofitis) will deflate your piggy bank by at least $10, and it *can* cost more. Such transient voltage jumps are taken in stride by the Meterless VTVM.

How do you measure voltage without a meter? By reviving a voltmeter circuit so old and out of use that it has probably been forgotten by many old-timers . . . and maybe never learned by newcomers to the electronics field. It's called the slide-back voltmeter circuit, and it originated back in the 1930's. It doesn't require a meter (although one *can* be

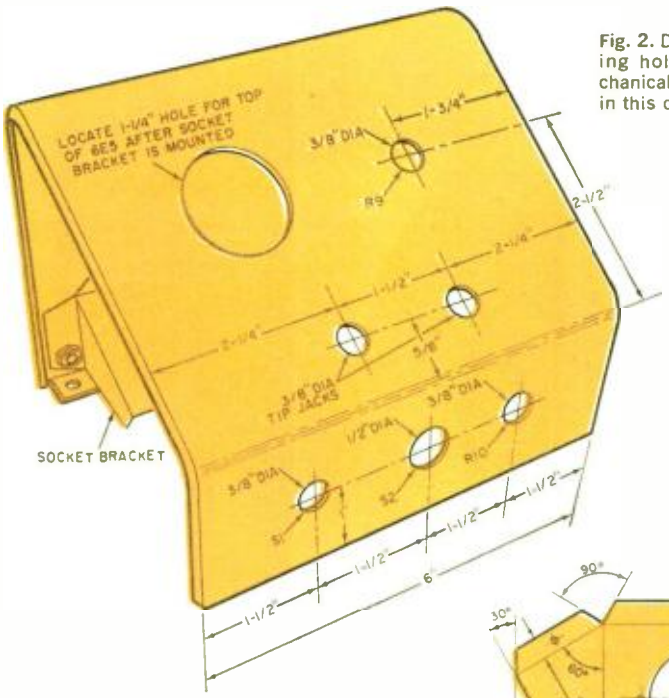


Fig. 2. Details of the mounting holes and other mechanical work are shown in this dimensioned sketch.

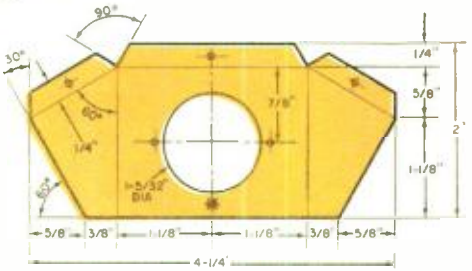


Fig. 3. Cut the sheet metal for the bracket as shown before bending to final shape.

•MOUNT TUBE SOCKET SO THAT PIN 5 IS AT THIS POINT. SHADOW WILL THEN BE AT 6 O'CLOCK WHEN TUBE IS INSERTED.

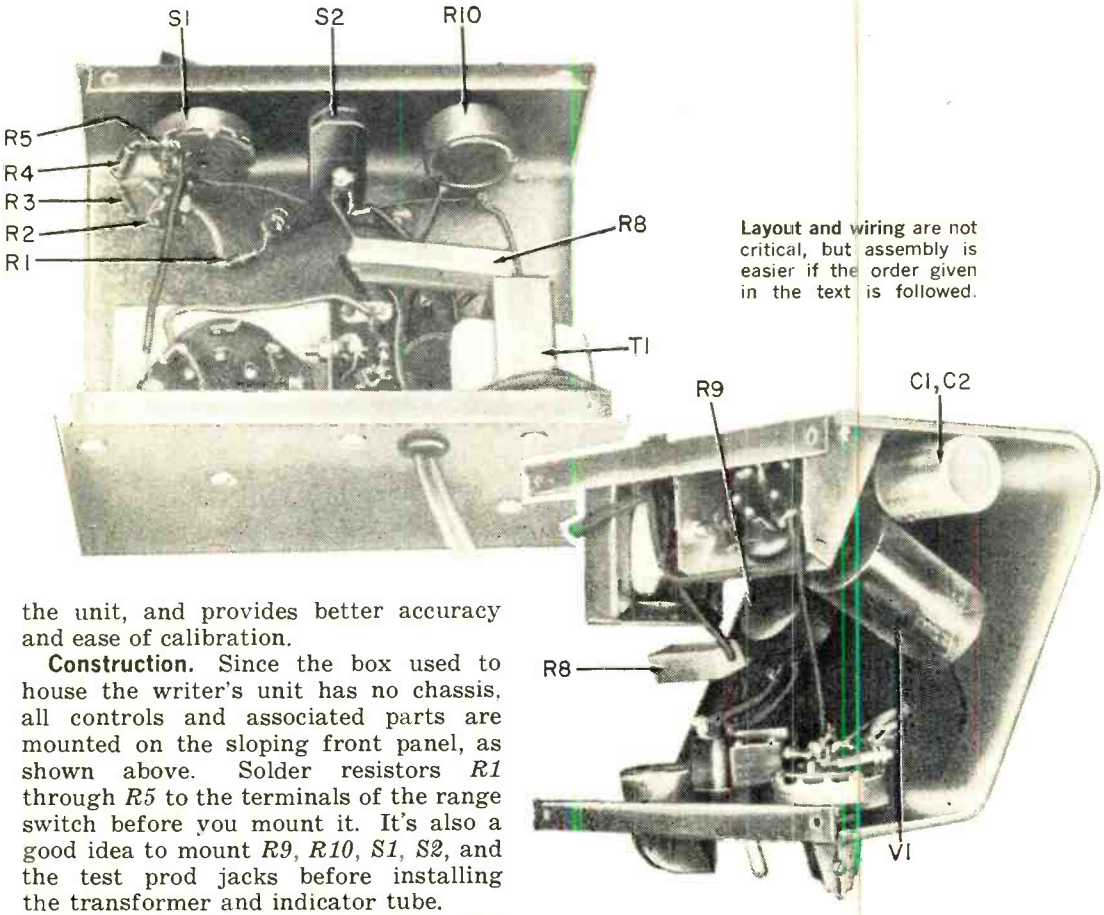
used, of course), because all that is needed is a means of indicating when two voltages have been adjusted to be equal, and a tuning indicator ("magic eye") tube can do that very nicely.

Years ago these miniature cathode-ray tubes were used by the thousands as tuning indicators in broadcast and other receivers. Today, they're still used widely in the less costly tape recorders. Naturally a lot of them are lurking in the junk box waiting to be put into service again, and if you don't have one on hand, the cost of a new one is far below that of a respectable meter.

How It Works. Take a look at the schematic diagram in Fig. 1. If you set the arm of potentiometer *R9* to the low-voltage end of the resistance element, and adjust potentiometer *R10* to bias *V1* so that the "eye" just closes, as in Fig. 1(A), application of a d.c. voltage to the input leads will cause the eye to open again—see Fig. 1(B). Now, by readjusting the bias by means of potentiometer *R9*, you can cause the eye to just close again, as in Fig. 1(C). And if you calibrate the position of the arm of *R9* on a suitable dial scale, you can read off the unknown voltage as quickly as the eye-closing adjustment can be made.

How do you calibrate the scale of *R9*? By applying known voltages, such as from combinations of batteries, or by measuring voltages in low-impedance circuits simultaneously with your multimeter and the Meterless VTVM.

Since the range of measurement potentiometer *R9* is limited, the switchable voltage divider network has been included to extend the usefulness of the circuit to higher voltages. For stable operation and ease of calibration, *R9* must be a linear taper wire-wound potentiometer, if you want the voltage scale to be uniform. The 1000-ohm value used by the writer provides a good spread of the dial markings without requiring too many steps of the range switch, but other values can be used to suit the individual constructor's needs. Use of 5% tolerance resistors adds little to the cost of



Layout and wiring are not critical, but assembly is easier if the order given in the text is followed.

the unit, and provides better accuracy and ease of calibration.

Construction. Since the box used to house the writer's unit has no chassis, all controls and associated parts are mounted on the sloping front panel, as shown above. Solder resistors *R1* through *R5* to the terminals of the range switch before you mount it. It's also a good idea to mount *R9*, *R10*, *S1*, *S2*, and the test prod jacks before installing the transformer and indicator tube.

For details of the angle bracket used to support the socket of *V1*, see Fig. 3. When the socket is in place, you can determine the exact location of the 1¼" hole in the front panel for the eye end of the tube. Cut this hole and cement a piece of blackened cardboard mailing tube around it as a light shield.

Fasten the filter capacitor to the rear surface of the box by means of the machine screw in the center hole of the tube socket bracket. A three-lug terminal strip on the side of the tube bracket supports diode *D1* and resistor *R11*. Resistors *R6* and *R7* (not indicated in the photos) are supported by the tube base lugs to which they are soldered.

Calibration. When you have completed and checked the wiring, switch the unit on and let it warm up until the eye pattern stabilizes. Set range switch *S1* to the lowest range and turn *R9* counterclockwise so that the arm is at the end nearest to *R10*. This is zero volts on all ranges. Then short the test leads together and adjust the zero setting control (*R10*) so that the eye of tube *V1* just closes.

Now fasten a piece of paper under the knob of *R9* with Scotch tape, for use as a temporary scale. Apply a known voltage such as from a single flashlight cell, and adjust *R9* until the eye is just closed again. Mark the temporary scale accordingly. Continue with other voltages until the low range is calibrated.

This scale will hold for ranges three and five if you multiply the scale markings by 10 and 100, respectively. Ranges two and four are calibrated in the same way, after which you have only to transfer the temporary markings to a permanent scale for mounting under the knob.

Want to use your unit for a.c. also? Just add a 0.02- to 0.05-μf., 200-volt capacitor from pin 2 of *V1* to ground, and you're in business. -30-

POPULAR ELECTRONICS news

LIGHTED COPS—Traffic officers of N.Y.C. Bridge and Tunnel Authority are now equipped with light-generating safety belts. The 12 lamps in belt, powered by nickel-cadmium battery, flash 60 times a minute.

R/C DUCK—Though it would make a perfect lure for hunters, Dr. Eckhard H. Hess, in charge of the animal behavior lab at the University of Chicago, uses an R/C duck in experiments on the behavior of ducklings.

World's Fair to Feature Ham Radio

A three-position amateur radio station to be operated by ARRL members will be a part of the Coca-Cola Co. pavilion at the 1964-1965 New York World's Fair. Visitors to the fair will have a chance to watch and listen, and licensed hams will be permitted to operate the equipment.

Good $5 Radios Wanted

With an inexpensive yet reliable battery radio in every native village, developing countries could jump the barriers of illiteracy and power lines, according to Dr. Wilbur Schramm, director of Stanford University's Institute for Communication Research. Transistor radios that operate for many hours from dry cells could be used, he pointed out in a recent article, and other power sources might be wind-driven or charcoal-burning generators.

Pioneer Company Changes Name

"The Marconi Company Limited" is the new name recently adapted by the former Marconi's Wireless Telegraph Co., Ltd., a designation the organization has used since 1900, three years after it was founded by Marconi. The change reflects the firm's greatly expanded activities.

HIGH-SPEED TRAIN SCANNER—An electronic scanner developed by Sylvania identifies moving passenger cars by sending out a white light, and then analyzing colored light reflected from a special label on the car. The information is relayed to a track-side recorder-transmitter.

BREAKTHROUGHS

Brief news flashes on important developments in the field of electronics

HIGH RESOLUTION RADAR capable of discriminating between objects separated by inches. Developed by General Dynamics, it involves the use of extremely short microwave pulses in the sub-nanosecond range to make possible the detection and separate display of signals reflected from many points on an object, rather than just a summation of all reflected energy as in conventional pulsed radar.

COLOR COMPUTER that can distinguish 100,000,000 different colors including 8,000,000 shades of red. Demonstrated by Toshiba Electric Co., the unit automatically draws a spectral curve of an object's color in two minutes, and then calculates and prints the results within seconds.

ELECTRONIC PEN that writes 100 feet a second, by Richard G. Sweet, Stanford electronics engineer. Designed for recording signals up to 10 kc., the pen operates somewhat like an electron gun, but it fires fine drops of ink instead of electrons. The drops pass between charged plates which attract or repel them to produce a wave pattern on paper.

TELESCOPIC TV CAMERA that can spot a basketball at 100 miles, by Bendix. The BX-7 image orthicon TV camera and a 2500-lb. telescope were mated to produce a system used to follow astronaut Gordon Cooper into space. It is expected to be the forerunner of more sensitive pickups for visual tracking.

A ROCKET POWER SYSTEM utilizing the rocket exterior and parts of the bulkhead structures as capacitor plates to be charged by solar cells. Invented by Robert J. Schwinghamer of the NASA Marshall Space Flight Center, the system could be used to store power to energize such equipment as lasers, radar, and electric engines.

UNDERWATER ATOMIC BEACONS emitting high-frequency sound as an aid to ship navigators. Currently being developed by the Martin Co. under A.E.C. contract, the device will use heat from radioisotopes to make steam which will, in turn, drive a sound-producing transducer.

VIDEO PLAYBACK UNIT said to produce both pictures and sound on a standard TV set from 33⅓ rpm long-playing records. Known as the "Videogram," the device utilizes a special pickup head and extended frequency range. It's under development by Wolverhampton Radio and Supply Co., Ltd., Wolverhampton, England, and is expected to sell for about $100 in final form.

PATTERN RECOGNITION SYSTEM that can learn to recognize photos of aircraft, people, or other objects, by Scope, Inc. Described as a conditioned reflex machine, "Conflex I" is capable of recognizing 4800 different patterns, including pictorial displays, numbers and geometric designs, with 99.6 per cent accuracy. Digital solid-state circuitry and magnetic-disk memory storage are used.

THIN-FILM R.F. AMPLIFIER (above) about the size of half a stick of gum will replace the conventional electron tube version at the left. Developed by ITT, it includes four transistors, 12 capacitors, 16 resistors, and associated wiring. It's made by depositing successive thin-film layers, comprising the circuit elements, on top of each other.

BODY-PRODUCED ELECTRICITY can be used to power electronic devices implanted in an organism to regulate its functions or report on physiological reactions, say GE scientists conducting experiments in bioelectrogenesis. During research, power to operate a 500-kc. transmitter was drawn from electrodes implanted in the body of a rat (photo below) without disturbing vital biological functions.

CRYSTAL SUPER CALIBRATOR

By R. A. SCHEIDEL

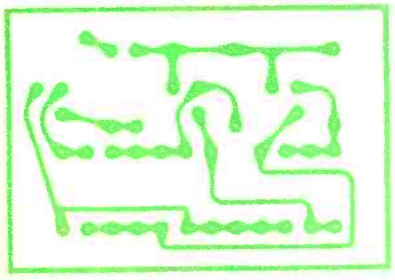
Like port and starboard channel buoys for the navigator, crystal calibrator harmonics mark the band edges for hams and others

NEXT TO MONEY, hardly anything serves certain needs of the ham, the SWL, and the set builder better than a good crystal calibrator. For the ham, those stable signals precisely 100 kc. apart mark the band edges of most of the amateur bands with an accuracy that removes the gnawing fear of an unwanted FCC QSL for out-of-band operation. For the SWL, the rather sketchy calibration of many short-wave receiver dials no longer causes such exasperating difficulties when trying to identify an unknown station. And the set builder and experimenter can calibrate the dial of the new receiver, oscillator, or other tunable device with some assurance that the figures they put down on the scale mean something definite.

Crystal calibrator kits are available from several companies, and many receivers feature a plug-in socket for a calibrator, or have a calibrator built in at the factory. Even so, the unit described here has several solid advantages that more than justify its moderate cost and the time required to build it.

First of all, the "super" calibrator is small, rugged, and can be constructed as a completely self-contained unit if you wish. This makes it a natural choice for field day, portable, or mobile use. It also means you don't need to cut into other equipment to steal power, although of course you *can* power the unit

COVER STORY

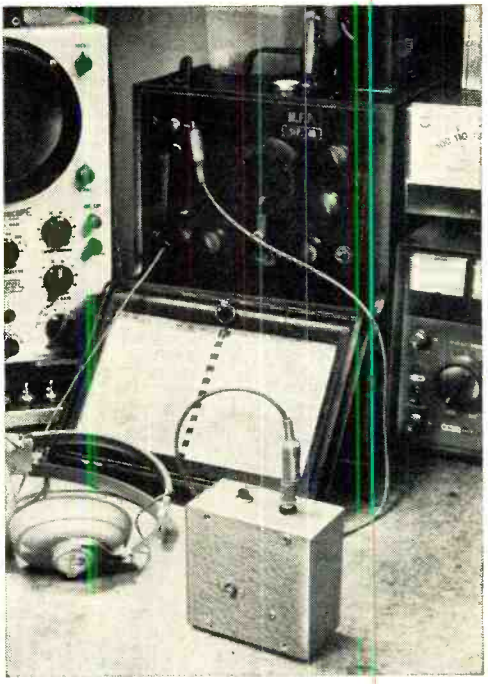


this way if you choose, and a circuit for this construction scheme is provided. Next, crystal current is very low, even if you elect to use the highest battery voltage the design permits, and all other sources of thermal frequency drift are weak. For these reasons, stability is significantly better than is usual for units not operating in a temperature-controlled oven.

Third, the super calibrator is so easy to build, thanks to a high-quality printed-circuit board, that you can choose just about any final assembly form that suits your own needs. This can range from building the unit into an existing receiver to making it the basis for an elaborate home lab signal source, with additional multivibrators to provide outputs at multiples and submultiples of the basic 100-kc. frequency. Because of the "foolproofness" of the design, constructors are encouraged to adapt the unit to their own requirements, although the version described here can be duplicated exactly if desired. And even for this completely self-contained model, certain optional choices are given in the Parts List.

And as the final clincher, the super calibrator provides usable harmonic output to well beyond 100 mc., thanks to an output amplifier stage of optimum design. This last feature alone should perk up the interest of 6-meter hams, and DX'ers who comb the mobile bands above 30 mc., for this is where many calibrators get feeble, and receiver gain also begins to droop.

How It Works. The oscillating circuit of the super calibrator is essentially a multivibrator, with the crystal connected in the feedback path from the collector of transistor *Q2* to the base of transistor *Q1*. The crystal operates in this circuit at its series-resonant frequency; that is,

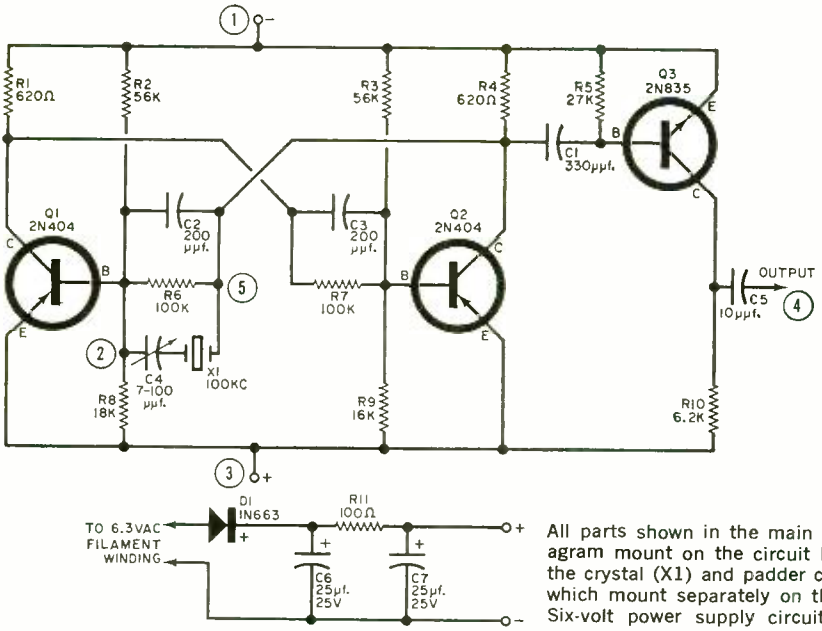


Where accurate frequency check points are a must, as when checking a BC-221 at 100-kc. points, the super calibrator speeds and eases the operation.

it presents a relatively low series impedance at 100 kc., and a relatively high impedance at all other frequencies near 100 kc. As a result, the circuit made up of *Q1*, *Q2*, and associated resistors and capacitors oscillates at 100 kc., since this is the only frequency at which there can be enough positive feedback to sustain oscillation. The exact frequency of oscillation can be adjusted over a small range by means of padder capacitor *C4*, making it possible to adjust the calibrator to zero beat (of a harmonic) with WWV, or another standard frequency signal source.

The base of output transistor *Q3* is coupled to the collector of *Q2* by capacitor *C1*. Transistor *Q3* is an *npn* type (2N835), and is capable of being switched from cutoff to fully conducting condition in about 10 nanoseconds. This high switching speed is just another way of saying that it can handle very high frequencies.

Since the input waveform from the oscillator circuit is substantially a 100-kc. square wave, *Q3* amplifies this wave and all harmonics to at least 100 mc.,

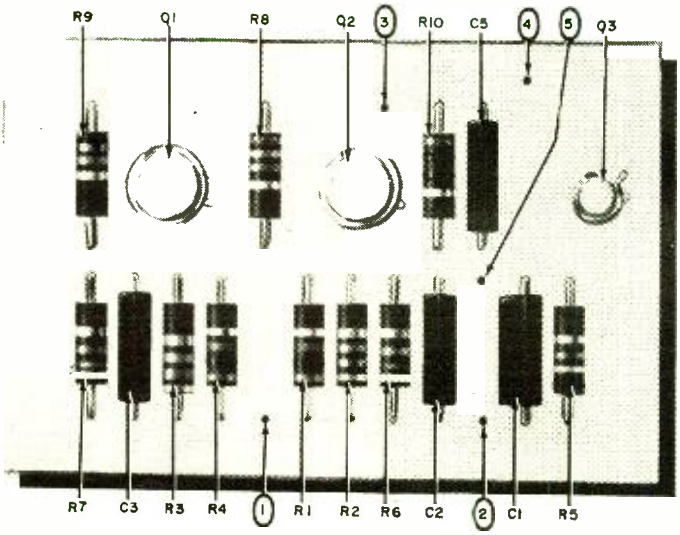


All parts shown in the main schematic diagram mount on the circuit board, except the crystal (X1) and padder capacitor (C4) which mount separately on the box cover. Six-volt power supply circuit is optional.

PARTS LIST

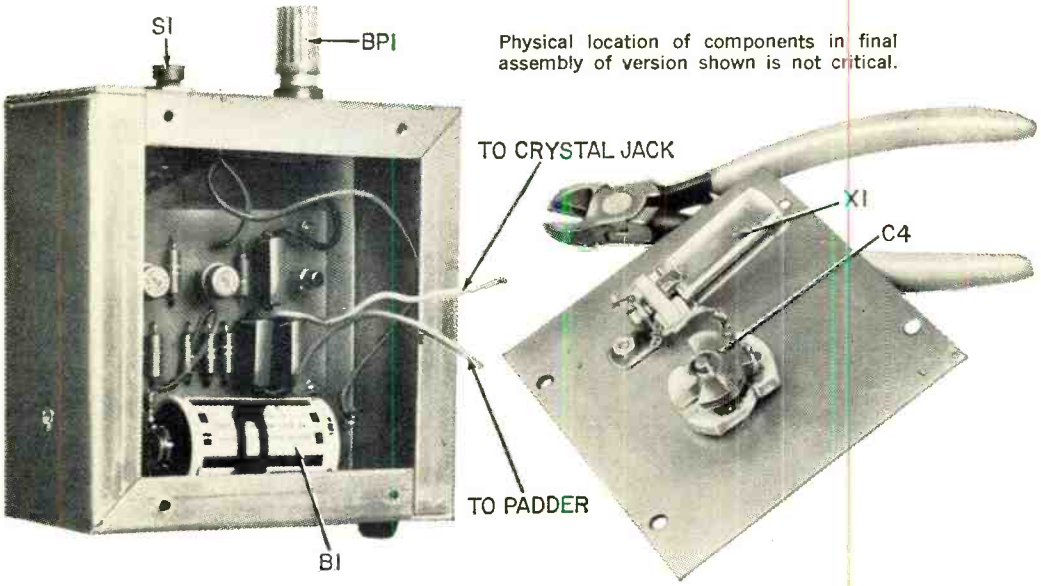
B1—1.5-volt to 10-volt battery to supply 4- to 12-ma. drain—see text*
C1—330-μμf. silver mica capacitor, voltage rating not important
C2, C3—200-μμf. silver mica capacitor, voltage rating not important
C4—7-to-100 μμf. air dielectric variable capacitor, ceramic insulation (alternate for easier fine adjustment; 7-to-24 μμf. size)
C5—10-μμf. silver mica capacitor, voltage rating not important
J1—Crystal jack, to suit 100-kc. crystal used—see text*
Q1, Q2—2N404 pnp transistor
Q3—2N835 npn transistor
R1, R4—620 ohms
R2, R3—56,000 ohms
R5—27,000 ohms
R6, R7—100,000 ohms
R8—18,000 ohms
R9—16,000 ohms
R10—6200 ohms
(R5, R6, R7 — all resistors carbon, ½ watt)
S1—Any small on-off switch—see text*
X1—100-kc. standard type crystal (Petersen Z-6A or equivalent)
1—Printed circuit board (available from R. A. Scheidel, 2272 Placentia, Costa Mesa, Calif., $3.00, three-week delivery)
1—Small aluminum box (4" x 4" x 2" used here)
Misc.—Binding post or pin jack for outputs, screws and spacers for mounting board, hookup wire, solder, rubber feet for box, etc.

**Not shown in schematic, constructor's option*



(1) POWER CONNECTION (−)
(2) PADDER CONNECTION
(3) POWER CONNECTION (+)
(4) OUTPUT CONNECTION
(5) CRYSTAL CONNECTION

Parts placement is set by circuit board layout. Note orientation of the transistor locating lugs when inserting leads in circuit board openings.



Physical location of components in final assembly of version shown is not critical.

and delivers the amplified version to the output terminal through *C5*. The output stage is of relatively low impedance, so that moderate loading such as by the input circuit of a receiver under test will not seriously reduce the output or alter the unit's frequency stability.

Construction. The type of box chosen to enclose the unit does not affect the construction greatly, since almost all of the parts are mounted on the printed-circuit board. However, the type of switch chosen, and the type and size of the battery used to power the unit do affect the choice of the box, so it is well to select these components before you buy the box.

If you choose to duplicate the construction illustrated, begin by drilling holes for 4 x 32 machine screws in the three corners of the printed-circuit board that are clear of printed conductors. By drilling before the parts are mounted on the board, the chance of damaging anything is greatly reduced. With the holes in the board drilled, use the board as a template to locate the mounting holes to be drilled in one of the box covers. In doing this, be sure to spot the holes so the board will clear the lip of the box when it is mounted on the cover, noting that the board will be supported far enough from the cover to allow ample clearance for the solder side.

With this done, mount the padder capacitor, *C4*, and the crystal jack (if one is used) on the other box cover, as shown in the illustration. The crystal can be soldered into the circuit if desired, but most constructors may prefer to mount a ceramic crystal jack as shown, and insure the crystal against accidental removal due to jarring by securing a rubber band around the holder and crystal can.

Mount the output binding post and the on-off switch on one side of the box frame, and the battery holder on the opposite side.

Wire the circuit parts on the printed-circuit board in the positions shown. Use normal care in soldering, and be sure to use a heat sink (such as a copper alligator clip or pair of long-nose pliers) when soldering the transistor leads.

When all parts have been soldered in place and the ends of the leads have been trimmed close to the solder surface, connect five pieces of insulated hookup wire to the points on the board numbered *1* through *5* in the photograph showing the mounted parts. If you use a different color for each wire, it will help prevent errors when you make the final hookup. Leave these wires long enough to permit completion of the wiring when the board and other components are mounted in their final positions.

At this point you can either "go for

(*Continued on page* 112)

Assemble a PHONE-BOOST

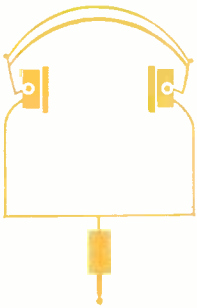
By LOU GARNER

Low headphone volume? Here's a unit that makes inexpensive magnetic types better than the best

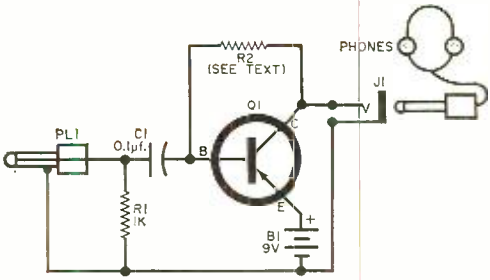
ALMOST EVERYONE owns a pair of inexpensive, rugged, reliable, standard magnetic headphones. With impedances ranging from 500 to 2000 ohms, they have just one major shortcoming—lack of sensitivity. This defect can be easily overcome, however, by building the "Phone-Boost," a simple, compact, one-transistor amplifier that fits into any housing about 1″ x 2″ x 3″, and plugs into a headphone jack. The Phone-Boost is extremely versatile, and can be used with communications receivers, signal tracers, monitors, CPO's, and any other piece of equipment that has a phone jack. The unit will accept a wide range of input signals without overloading, and is "automatic" in that no power switch or gain control is needed, since no power is consumed until the phones are plugged into the output jack. Finally, the circuit is temperature-compensated, permitting operation of the Phone-Boost in the field as well as on the bench.

As shown in the schematic on the next page, the circuit is that of a common-emitter amplifier. Almost any small-signal transistor will work for *Q1*. A *pnp* type was used in the original model, but an *npn* unit can be substituted if battery (*B1*) polarity is reversed. Capacitor *C1* is used as a combination coupling-d.c. blocking capacitor, and the magnetic headphones serve as *Q1*'s collector load.

The Phone-Boost differs from more familiar common-emitter stages in that the base bias resistor, *R2*, is returned to *Q1*'s collector rather than to *B1*. This puts part of the amplified output signal into the base circuit as negative feedback, the result of which is to reduce circuit distortion and make the stage less sensitive to overloading by strong signals. Resistor *R2* also provides tempera-



PHONE-BOOST



Circuit is that of a common-emitter amplifier with negative feedback and temperature compensation.

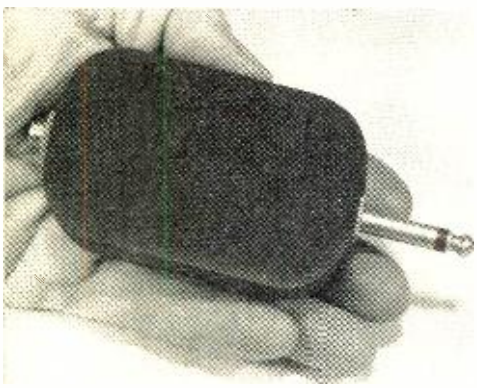
ture compensation. Base bias is dependent on collector voltage which, in turn, depends on collector current. An increase in temperature, which results in an increase in collector current and corresponding decrease in voltage, also causes a decrease in base bias voltage, and therefore tends to restore collector current to its optimum value. Since base bias and collector voltage are not applied until the collector circuit is completed by the headphones, no power switch is needed.

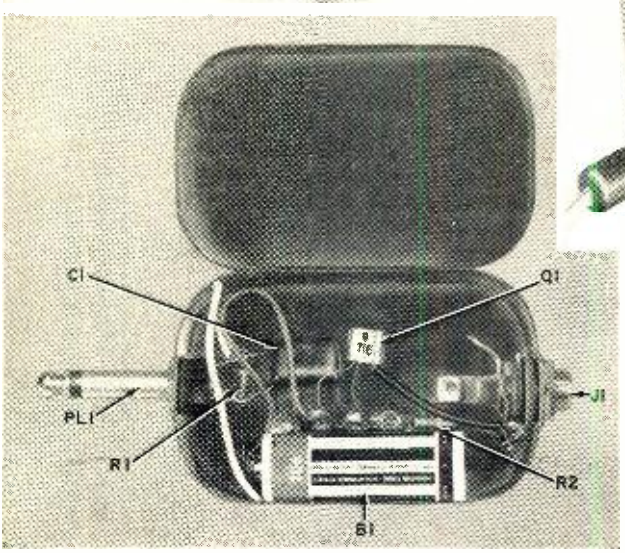
PARTS LIST

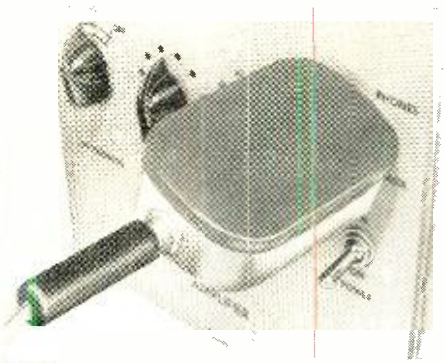
B1—9-volt battery (Burgess 2U6)
C1—0.1-μf., 50-w.v.d.c. ceramic capacitor
J1—Open-circuit phone jack
PL1—Standard phone plug
Q1—Pnp transistor (CK722, 2N107, 2N109, etc.)
R1—1000-ohm, ½-watt resistor—see text
R2—20,000- to 100,000-ohm, ½-watt resistor (noncritical—see text)
Misc.—Small plastic or metal case, terminal strip, battery connector, wire, solder, etc.

Although *R2*'s value is not critical, it can be determined experimentally for best performance with the particular transistor and phones used. Simply clip

(*Continued on page 114*)







A metal cough-drop box provided the case for the original Phone-Boost. Small, convenient to use, and inexpensive to build, it plugs into a receiver or other headphone jack, providing an audio "boost" and greater sensitivity for low-impedance magnetic headphones. Layout and design is noncritical. Almost any small-signal transistor can be used in the circuit.

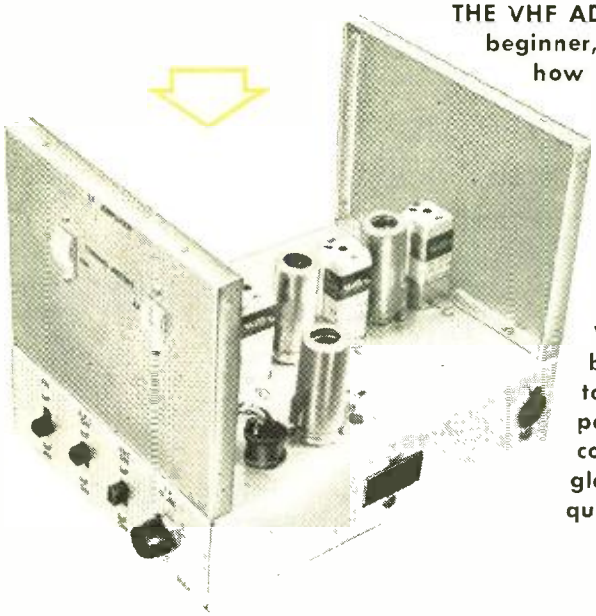
VHF adventurer

PART 2

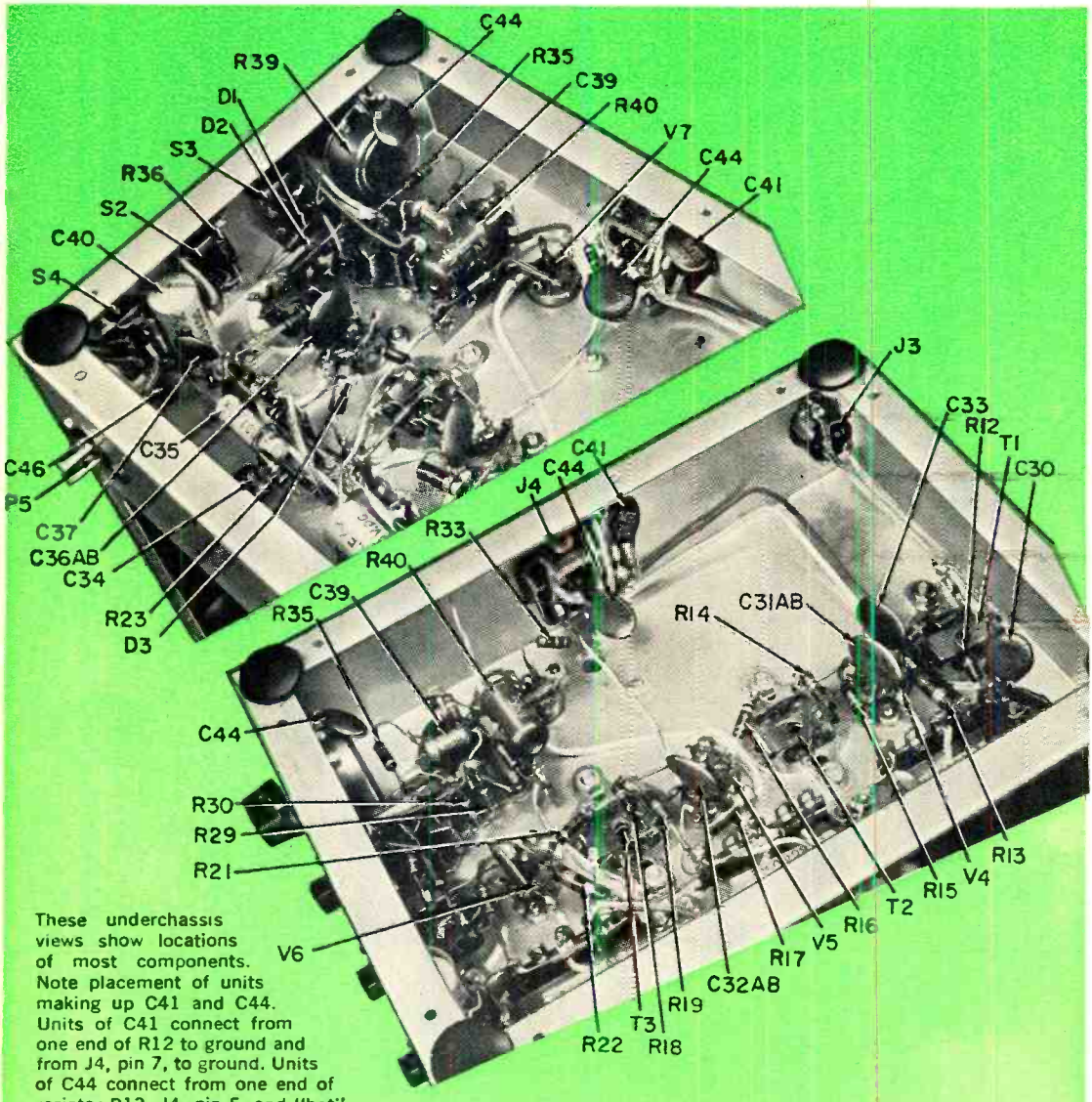
By **JAMES G. LEE,** W6VAT

A quality AM/FM superhet in three parts: Here we present the i.f. strip—second of two modules needed to operate the converters

IF YOU'RE READY to advance beyond the limitations of simple "rush box" superregenerative VHF receivers, this modular design will be right down your alley. Built in three separate sections—audio/power supply (described in the October issue, page 41), i.f. strip and detectors (this issue), and 30-50 mc. converter (coming next month)—the VHF ADVENTURER does everything a good superhet receiver is expected to do. The converter modules for the various VHF bands are also designed as individual units, and each offers high sensitivity and good bandspread tuning. The i.f. strip is sufficiently broad to provide good reception of both FM and AM transmissions. In addition, noise limiter, a.g.c., a.f.c., S-meter, FM carrier deviation and BFO circuits are included.



THE VHF ADVENTURER is not a project for a beginner, although exhaustive details on how each module is constructed are presented. Several items of test equipment will be required to properly align the i.f. strip and the converters, and wiring techniques in the converter stages must be exceptionally good. Care and patience are prerequisites in making your VHF ADVENTURER work properly. Some builders may find it advantageous to await publication of all three parts of this article before starting construction. The Editors will be glad to answer any specific inquiries about this project.



These underchassis views show locations of most components. Note placement of units making up C41 and C44. Units of C41 connect from one end of R12 to ground and from J4, pin 7, to ground. Units of C44 connect from one end of resistor R13, J4, pin 5, and "hot" end of potentiometer R39 to ground.

Construction. Assembling the i.f. module will be somewhat more difficult and exacting than the audio/power supply module described last month. Chassis layout dimensions of the major components are shown on page 62. While it is not absolutely necessary to follow this arrangement, the author's experience indicates that it will cut down on the possibility of feedback and self-oscillation in the i.f. strip.

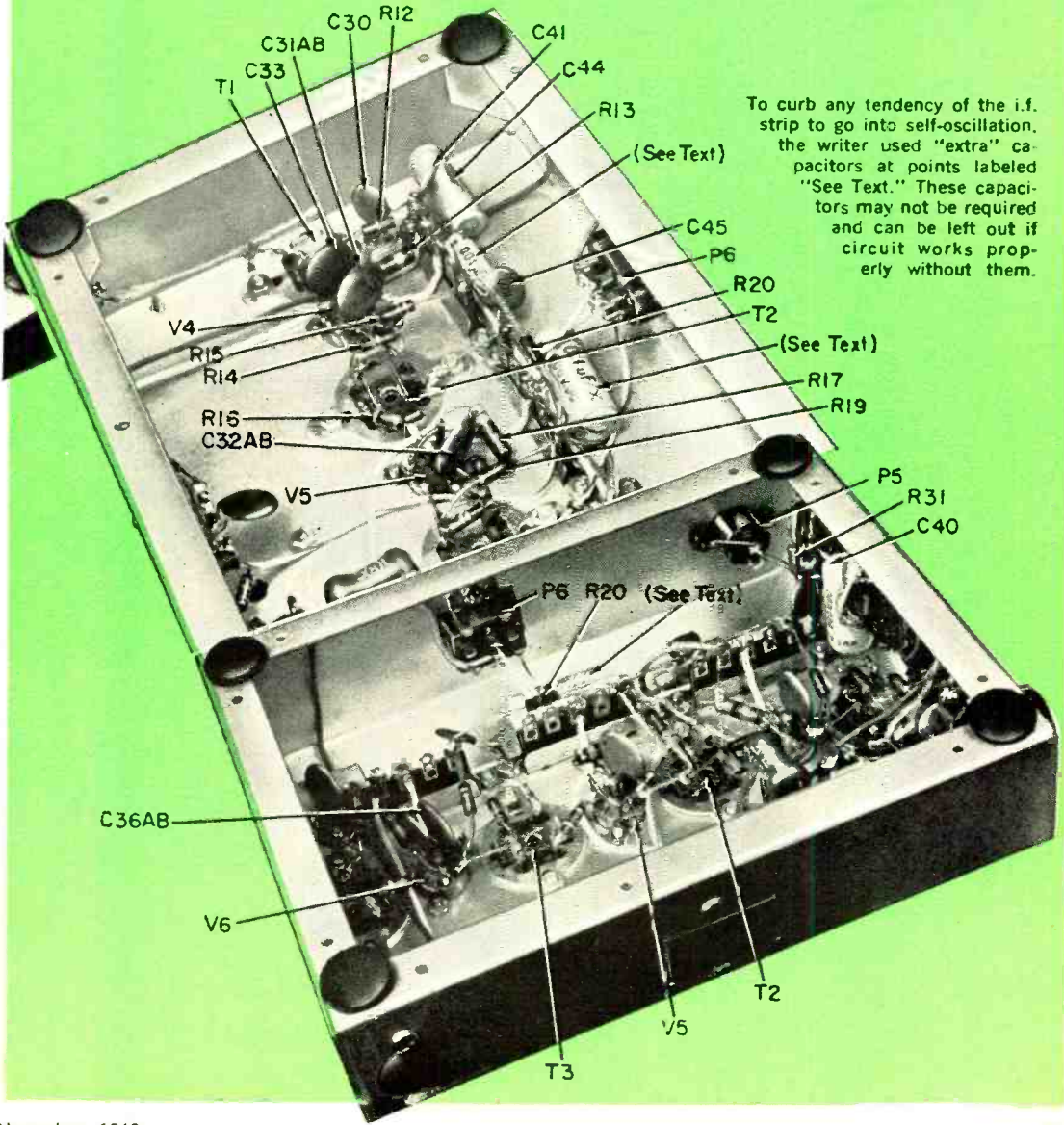
Begin mechanical assembly by mounting the socket for *V5*, followed by the i.f. transformers and other tube sockets on either side of *V5*. Three 5-terminal Cinch-Jones strips (Type 2005) are also mounted under the chassis adjacent to the tube sockets; these strips are important and should be mounted in approximately the positions shown in the photos and drawings. Mount single solder lugs under each bolt holding the 5-terminal strips; they will be used as your grounding connections.

The i.f. input transformer, *T1*, is at the rear of the chassis, ratio transformer *T4* all the way to the front. Slight departures from the spacing and positioning of these

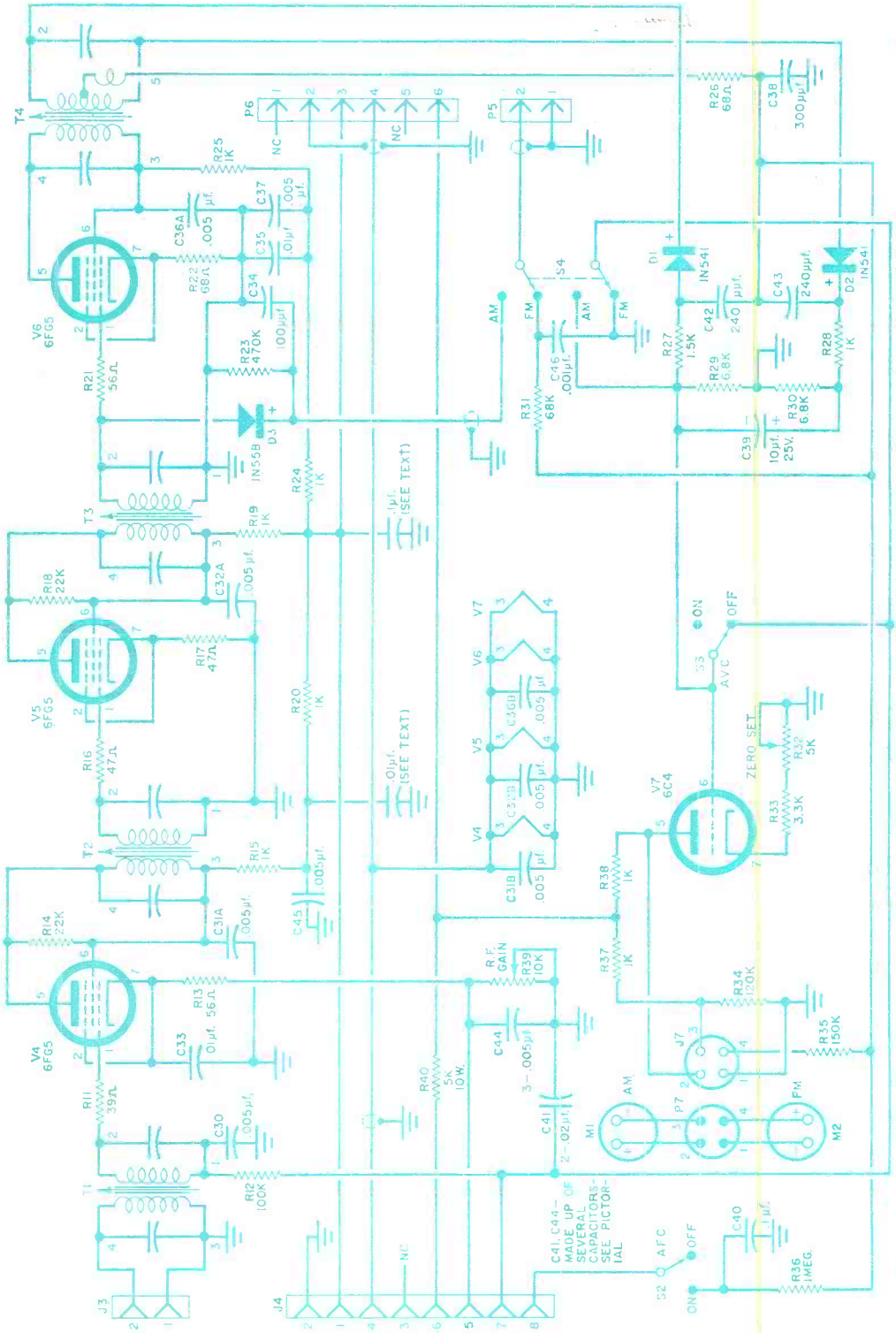
parts from that given in the layout drawing are relatively unimportant. Zero-set potentiometer *R32* should be placed as shown with a single hole passing through the deck of the chassis to permit connection to *R33*. Any 5000-ohm potentiometer can be used in place of the one specified, but be sure that it does not mechanically interfere with the positioning of *J4*.

A fourth 5-lug terminal strip and a 2-lug tie point are mounted near *J7*. The 2-lug strip is used to mount *R40* while the 5-lug strip holds *C38*, *C39*, *C42*, and *C43*. Drill the holes to mount these strips after you are sure of sufficient clearance away from *R39*. The three slide switches (*S2*, *S3*, and *S4*) are equally spaced along the front skirt of the chassis.

Considerable care must be exercised in cutting out holes for *P5* and *P6*. These two plugs must mate with jacks *J5* and *J6* on the audio/power supply module. The dimensions shown in the drawing on page 62 should be followed so that the panels of the two units are flush—when the plugs and jacks are mated. This may sound difficult



To curb any tendency of the i.f. strip to go into self-oscillation, the writer used "extra" capacitors at points labeled "See Text." These capacitors may not be required and can be left out if circuit works properly without them.


T4
P6
P5
R25 1K
R26 68Ω
C38 300μμf.
C36A .005 μf.
C37 .005 μf.
C35 .01μf.
R22 68Ω
C34
R23 470K
100μμf.
V6 6FG5
D1 IN541
C42 240 μμf.
C43 240μμf.
D2 IN541
S4
FM
AM
C46 .001μf.
R27 1.5K
R29 6.8K
R28 1K
R30 6.8K
C39 10μf. 25V.
R31 68K
R21 56Ω
D3 IN558
R24 1K
T3
R19 1K
.1μf. (SEE TEXT)
R18 22K
C32A .005 μf.
V5 6FG5
R17 47Ω
V7
V6
V5
V4
C32B .005 μf.
C32B .005 μf.
C31B .005 μf.
R20 1K
.01μf. (SEE TEXT)
R16 47Ω
T2
R15 1K
C45 .005μf.
C31A .005μf.
R14 22K
V4 6FG5
R13 56Ω
C33 .01μf.
R11 39Ω
C30 .005μf.
T1
R12 100K
R.F. GAIN
R39 10K
C44 .005μf.
3-.005μf.
C41 2-.02μf.
R40 5K 10K
M1
M2
J7
P7
R38 1K
R37 1K
R34 120K
R35 150K
V7 6C4
ON
OFF
S3
AVC
ZERO SET
R32 5K
R33 3.3K
C41, C44— MADE UP OF SEVERAL CAPACITORS— SEE PICTORIAL
AFC
S2
C40 .1μf.
R36 1MEG
J3
J4
NC

PARTS LIST

C30, C37, C45—0.005-µf., 600-volt ceramic capacitor
C33, C35—0.01-µf., 600-volt tubular capacitor (extra capacitor may be required—see text)
C31ab, C32ab, C36ab—Dual 0.005-µf., 600-volt ceramic capacitor (Centralab Duo-Kaps DD2-502 or equivalent)
C34—100-µµf. mica capacitor
C38—300-µµf. mica capacitor
C42, C43—240-µµf. mica capacitor
C39 — 10-µf., 25-volt Tantalex capacitor (Sprague 132D106C2025UO or equivalent)
C40—0.1-µf., 600-volt tubular capacitor (one extra capacitor may be required—see text)
C41—(2 required) 0.02-µf., 600-volt disc ceramic capacitor (see photographs for placement in circuit)
C44—(3 required) 0.005-µf., 600-volt disc ceramic capacitor (see photographs for placement in circuit)
C46—0.001-µf., 600-volt ceramic capacitor
D1, D2—1N541 germanium diode; buy matched pair known as 1N542 (Amperex or equivalent)
D3—1N55B germanium diode (Raytheon or equivalent)
J3—Chassis-mounted jack (Cinch-Jones S-302-AB or equivolent)
J4—Chassis-mounted jack (Cinch-Jones S-306-AB or equivalent)
J7—Chassis-mounted jack (Amphenol 78-S4S or equivalent)
M1—Tuning or S meter (Lafayette Radio TM-12 or equivalent)
M2—FM tuning meter (Lafayette Radio TM-13 or equivalent)
P5—Chassis-mounted plug (Cinch-Jones P-302-AB or equivalent)
P6—Chassis-mounted plug (Cinch-Jones P-306-AB or equivalent)
P7—4-prong miniature plug (Amphenol 71-4S or equivalent)
R11—39 ohms
R12—100,000 ohms
R13—56 ohms, 1 watt
R14, R18—22,000 ohms
(All resistors ½ watt unless otherwise stated)
R15, R19, R20, R24, R25, R28, R37, R38—1000 ohms
R16, R17—47 ohms
R21—56 ohms
R22, R26—68 ohms
R23—470,000 ohms
R27—1500 ohms
R29, R30—6800 ohms
R31—68,000 ohms
R32—5000-ohm potentiometer (Mallory FL-5k or equivalent)
R33—3300 ohms
R34—120,000 ohms
R35—150,000 ohms
R36—1.0 megohm
R39—10,000-ohm, 2-watt potentiometer (Ohmite CU1031 or equivalent)
R40—5000 ohms, 10 watts
S2—S.p.s.t. slide switch
S3—S.p.d.t. slide switch
S4—D.p.d.t. slide switch
T1, T2, T3—4.5-mc. i.f. transformer (J. W. Miller 6203 or equivalent)
T4—4.5-mc. FM ratio detector transformer (J. W. Miller 6205 or equivalent)
V4, V5, V6—6FG5 tube
V7—6C4 tube
1—California Chassis Co. Type A-120 chassis; if not available locally, write to 5445 E. Century Blvd., Lynwood, Calif. (or use Bud AC-406 or Premier ACH-404 which are 1" larger in depth and width, and adjust cutouts accordingly)
Misc.—Tube sockets and shields, wire, screws, bolts, nuts, decals, knobs, solder, etc.

but it is really a simple job requiring only a little extra care.

When mounting the tube sockets, place a small grounding solder lug under the mounting screw nearest to pin 4. This lug will serve as the ground point for each individual stage.

Wiring. Begin the wiring by soldering the grounding lug to pin 4 on all four tube sockets. Next, connect the tube heaters. This is done by running a short wire from pin 3 of *V4*, *V5*, and *V6* to the center terminal of the three adjacent 5-lug strips. Run a wire from pin 3 of *V7* over to pin 3 of *V5*. Now wire all of the center lugs on the strips together and connect to pin 4 of *P6*. Use a length of shielded lead to run a filament lead from *P6* to pin 4 of *P4*.

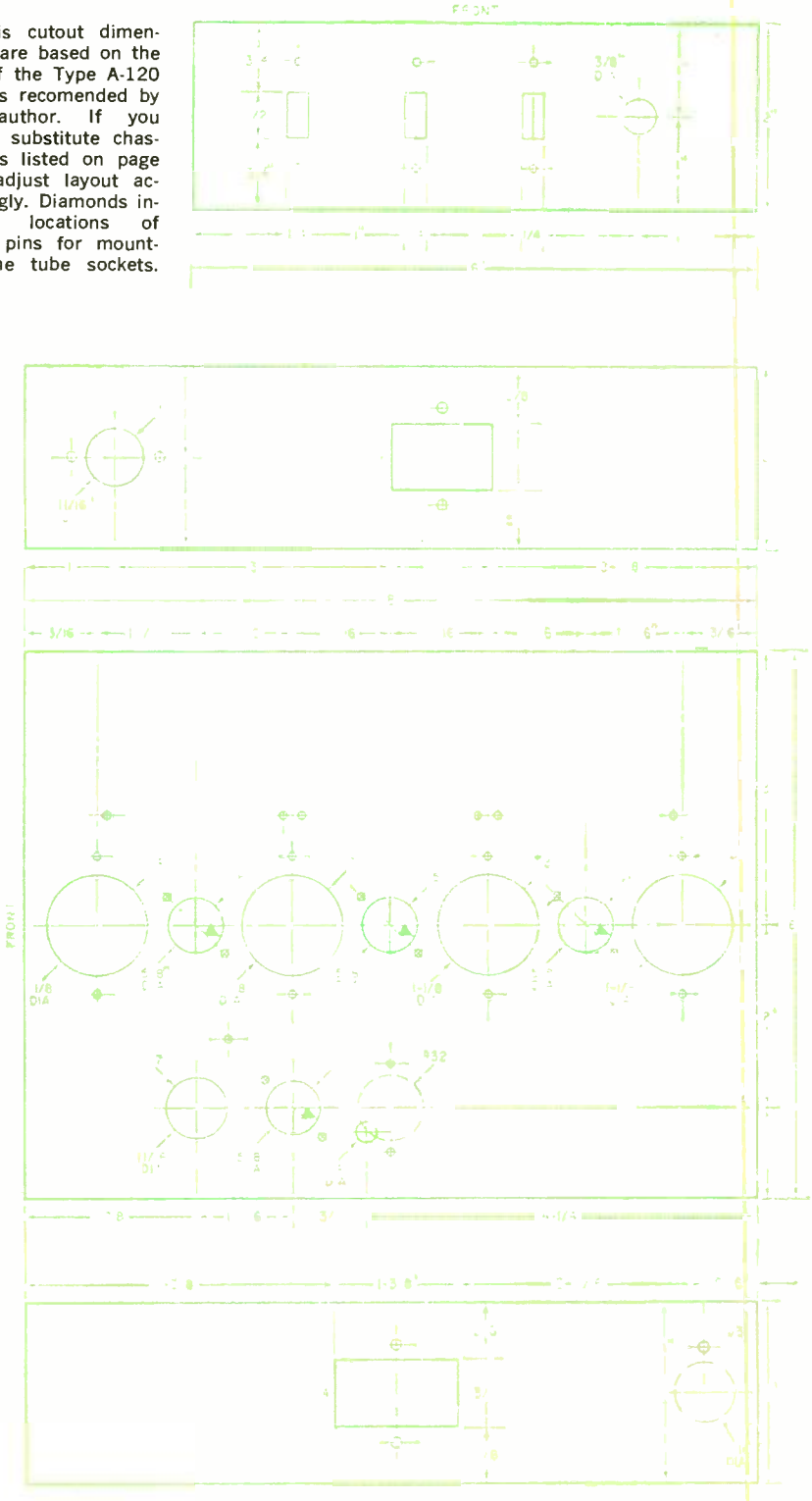
Wire in *R33* between pin 7 of *V7* and *R32*. Temporarily remove the 5-lug strip near *R39* and number the lugs 1 through 5 from front to rear. Wire in *C43* between lug 3 and lug 5 on the side nearest gain control *R39*. Slip two ½" pieces of spaghetti tubing over the *R27* leads and wire it between lugs 5 and 1 on the same side of the strip. Then wire *C43* from lug 4 to lug 2 on the opposite side. Resistor *R28* is between lug 4 and 2 while *C38* is wired with just one end connected to lug 3.

Remount the above terminal strip and solder the free lead of *C38* to ground. Between pin 4 of *T4* and lug 3 of the terminal strip, wire in *R26*. Pair *R29* and *R30*, and twist one set of their leads. Preform and cut their leads so that the two free leads of the combination may be soldered to lugs 1 and 2 of the five-lug strip. Wire the twisted leads of the pair to the solder grounding lug under the *T4* mounting plate. Solder in diodes *D1* and *D2* last, being careful of heat conduction along the leads.

The photographs show how the remaining part of this module is wired. The very last items to be soldered in place are the special Centralab Duo-Kaps *C31ab*, *C32ab* and *C36ab*. Their leads must be short and in each case the capacitor should straddle the tube socket with the center wire soldered to the center post of the socket.

Obviously a plug and jack (*J7* and *P7*) are not really necessary for connecting up the two meters. The author

Chassis cutout dimensions are based on the use of the Type A-120 chassis recomended by the author. If you use a substitute chassis (as listed on page 61), adjust layout accordingly. Diamonds indicate locations of blank pins for mounting the tube sockets.



found it a convenience, but other constructors may prefer to run leads from below the chassis through a grommeted hole to the meters.

After wiring, check to see that all connections are soldered and that no accidental short circuits have been created. Take the audio/power supply module and mate it with the i.f. module. Do not plug in any of the tubes in the new module, but turn on the a.c. power and see if the AM S-meter reads full-scale. If it does not, turn off the power and adjust *R34* until it does. Less than a full-scale meter reading means that the value of *R34* is too high.

Alignment. A signal generator and a VTVM are required to align the i.f. module of the VHF ADVENTURER properly. If you do not have these two pieces of test equipment, try to borrow them from a fellow experimenter or local ham. They will be required again to align the 30-50 mc. converter module which will be discussed next month.

Start the alignment procedure by plugging in *V6* (not *V4, V5* or *V7*); setting the r.f. gain, *R39,* to maximum (wiper closest to *R13*); a.f.c. switch *S2* to off; a.v.c. switch *S3* to on; and the AM-FM switch, *S4,* to AM. Connect the signal generator through a 0.001-μf. coupling capacitor to pin 4 of i.f. transformer *T3*. Set the generator to 4.5 mc. with about 50% audio tone modulation output.

Now connect your VTVM to the junction of *R27* and *R29;* this is the a.v.c. "take-off" point. Set the VTVM for —d.c. volts and adjust the generator r.f. output and VTVM scale for a discernible reading. Set the audio gain control, *R41,* to a comfortable aural setting. With a plastic hex alignment tool, adjust the top and bottom slugs of *T3* and the bottom slug of *T4* for maximum VTVM indication. You will find it necessary to readjust the generator, VTVM, and audio as the i.f. transformers come into alignment.

Turn off the power and plug in *V5*. Move the signal generator connection (with coupling capacitor) to pin 4 of i.f. transformer *T2*. Turn on the power and, after the tubes heat up, tune the top and bottom slugs of *T2* for a maximum VTVM reading. Now go back and retune *T3* and the bottom slug of *T4* for maximum output. Finally, shift back and forth among all five tuning adjustments until you're satisfied the second i.f. stage is aligned.

Repeat this process after plugging in *V4* and connecting the signal generator to pin 4 of *T1* or pin 2 of *J3*. Keep reducing the output from the signal generator to be sure that the i.f. stages are "on the nose" and not swamping the a.v.c. line.

Then insert tube *V7* and set *R32* to maximum resistance. Disconnect the signal generator and switch *S3* to off. You should now be able to zero the AM S-meter by carefully setting *R32*. Once the S-meter is set on zero, re-connect the signal generator to *J3,* switch *S3* to on, and observe whether the meter deflects upwards. If you wish, you can safely use the S-meter to align all i.f. transformers except the top slug adjustment of *T4*.

Rotate the BFO control on the audio module and set the knob pointer to approximately mid-scale. Keep the signal generator on and tune *C57* until a beat note is heard. Set *C57* so that zero-beat occurs at the mid-scale point.

Turn the BFO off and, with a fairly strong signal coming from the signal generator, slowly rock the generator above and below 4.5 mc. by about 100 kc. The needle of the FM tuning meter (*M2*) should vary from its center position to follow this rocking action. Now repeak the signal generator to 4.5 mc. by observing the S-meter and prepare to tune the top slug of *T4*.

Adjust the last slug (top of *T4*) until the VTVM and FM tuning meter are both set on zero. This point should occur simultaneously if all the i.f. stages are in alignment. Rock the signal generator back and forth to double-check this adjustment—the two meters should swing in the same rhythm.

Problems. It's possible that some self-oscillation or regeneration may appear in the i.f. strip as alignment is taking place. This trouble results from the use of high-gain tubes and the minor wiring differences that may exist between the author's prototype and your model. Regeneration is an indication of unwanted coupling between stages or between the input and output connections of the same stage. Generally, the problems in the VHF ADVENTURER i.f. strip can be solved by additional B-plus bypassing or changing the lead dress.

Wire your i.f. strip without the 0.01-μf. and 0.1-μf. capacitors shown as "See Text" in the schematic and photographs. You may not need them. However, if regeneration does occur, solder them into the circuit in the positions shown.

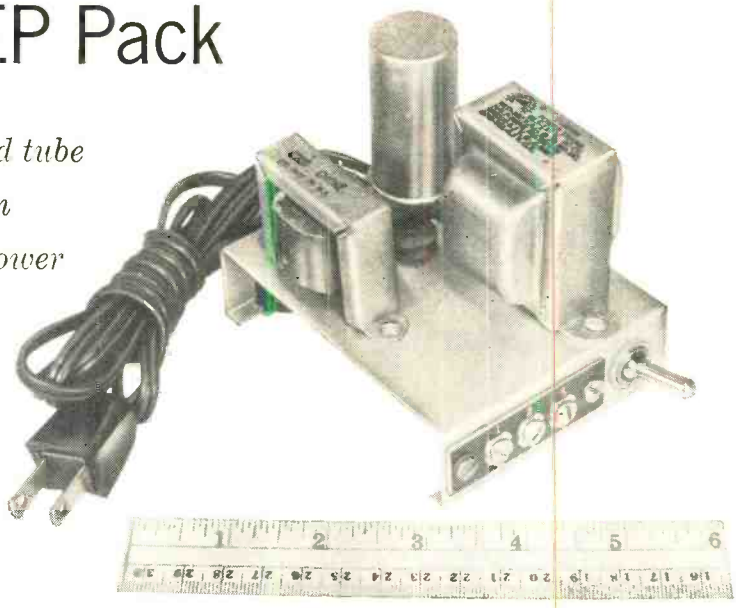
Finishing Up. Once again a perforated chassis cover dresses up the module. Cut it out of Reynolds aluminum stock sold in numerous hardware stores. Decals may be applied to the panel switches using any one of the various sets of dry transfers which are becoming so popular.

Set the two completed modules aside to wait for the 30-50 mc. converter which has bandswitching and tunes the 20-mc. frequency range in two bands.

(To be continued next month)

Handy EP Pack

Like to breadboard tube circuits? Here's an Experimenter's Power pack that makes it easy



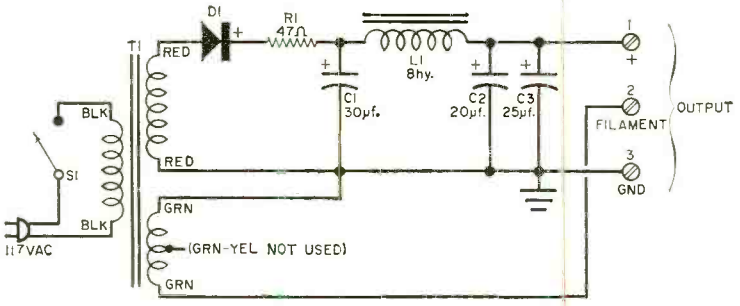
By E. G. LOUIS

ONE OF THE BIG REASONS transistor circuits are popular with experimenters is that the only power supply required is a small battery. Tubes can do a number of jobs better than transistors, however, and if you take an hour or two to assemble this simple supply, your power problems for one- and two-tube circuits will be ended.

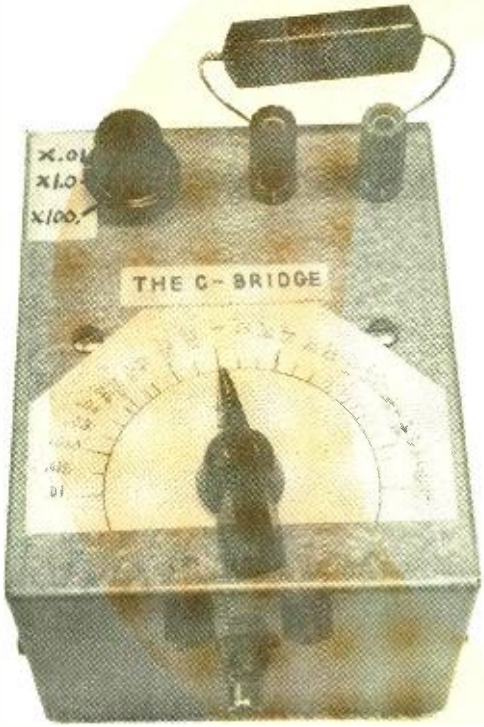
Since the EP Pack is a medium-voltage supply, a rather elegant filter section can be used without straining the budget; in any case, the junk box should provide numerous substitutions. Transformer *T1* (Merit P-3046 or equivalent) delivers 150 volts at 25 ma., and 6.3 volts at 0.5 ampere. A half-wave rectifier circuit is used with a 50-ma., 300-PIV (or better) silicon rectifier (*D1*). Resistor *R1*—1 watt will suffice—prevents surge damage to *D1* as *C1* charges. The filter capacitors (*C1, C2, C3*) are all in one multi-section can, and should be rated at 250 w.v.d.c. Use an 8-henry choke for *L1* (Stancor C1355). The only other parts required are a small chassis, tie points, a s.p.s.t. toggle switch, and a three-terminal, screw-type terminal strip.

Mount the major components, placing the capacitor can so that it is not in direct contact with the heat-producing transformer. Also, some degree of separation between the choke and transformer should be maintained to prevent hum coupling. The wiring under the chassis is connected to standard tie points. Be sure to observe capacitor and rectifier polarities; use a heat sink when wiring the rectifier.

If the supply will not be connected to a constant load, add a bleeder resistor (60,000 ohms, 2 watts) between terminals 1 and 3 (the B-plus and ground terminals). If isolated filament output is desired, a four-screw terminal strip can be used—five screws if the filament winding of the transformer employed has a center tap. A neon pilot lamp can be connected across *T1*'s primary, and another optional feature would be a ½- or 1-amp fuse connected in one leg of the primary. —30—



Simple power supply for experimenting with tube circuits is cinch to build, and can usually be put together with junk box materials. If you use a higher voltage transformer, you must rate other components accordingly.



BRIDGE

By FRANK A. PARKER

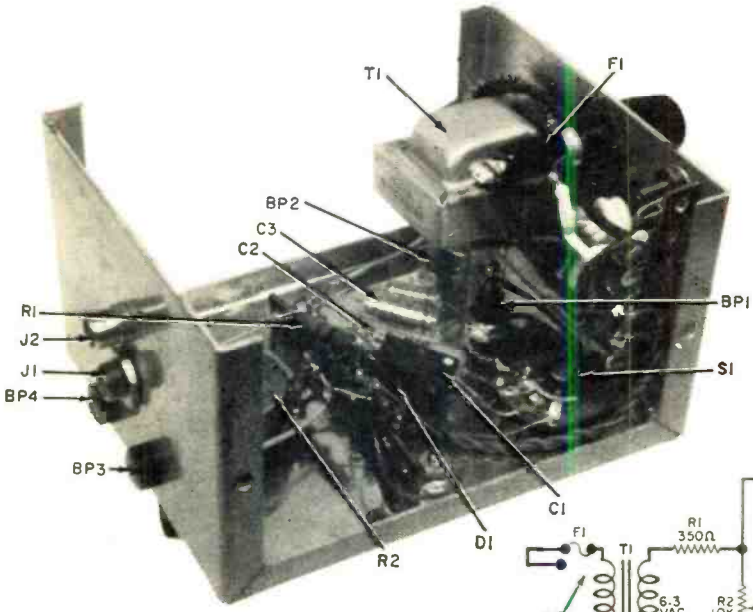
Having trouble reading the markings on your junk box capacitors? The C Bridge will enable you to measure them more accurately than the maker marked them.

MOST OF US have many capacitors gathering dust in the junk box because the markings can't be read. It's easy to measure the values of the unknowns if you have access to a capacitance bridge, but most such instruments come high, due to the wide range, sensitivity, and accuracy that must be provided in a laboratory instrument.

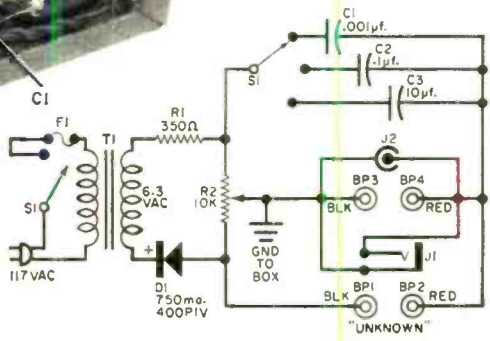
For those who can't afford so much frosting on their technical cake, the "C Bridge" will do the job very well. And you can make the accuracy high enough to yield far closer values than the maker puts on ordinary bypass and coupling capacitors. Best of all, since no sensitive null detector is built in, you can construct the C Bridge for about $12.00, even if you buy all new parts. If your junk box contains a few of the common parts needed, you can easily cut that cost in half.

How It Works. Any bridge works by comparing the signal voltage across the unknown part with the same signal across an adjustable known part that is accurately calibrated. The C Bridge is no exception, but by using a null indicator that you already have on hand, and making the a.c. line provide the bridge signal, a lot of the cost of the precision lab bridge is avoided.

The bridge circuit consists of potentiometer *R2*, the "known" capacitor selected by switch *S1*, and the unknown capacitor connected between binding posts *BP1* and *BP2*. Notice that *R2* actually forms two arms of the bridge



Label positions of range switch S1 "x .01," "x 1.0," and "x 10.0." Use capacitors of known value singly and in parallel combinations to calibrate your C Bridge. By borrowing or buying a few 5% capacitors, you can give your scales greater accuracy.



PARTS LIST

BP1, BP2—Universal binding post (one black, one red)
BP3, BP4—Insulated pin jack (one black, one red)
C1—100-μμf., 200-volt silver mica capacitor—see text
C2—0.1-μf., 200-volt Mylar or paper capacitor—see text
C3—10-μf., 25-volt electrolytic capacitor—see text
D1—750-ma., 400-PIV silicon diode
F1—⅜-ampere, 250-volt type 3AG fuse
J1—Open-circuit phone jack
J2—Phono jack, RCA type
R1—350-ohm, ½-watt carbon resistor
R2—10,000-ohm, linear taper, carbon element potentiometer (Ohmite CMU-1031 or equivalent)
S1—Single-pole, 3-position rotary switch
T1—6.3-volt, 0.6-ampere filament transformer
1—5" x 4" x 3" aluminum utility box
Misc.—Hardware, knobs, terminal strips, wire, solder, etc.
Note: *Four 0.0001-μf. and four 0.01-μf. capacitors for use in calibration may be required if capacitors of known value are not at hand*

circuit, since its moving contact is grounded, and the signal is connected across the whole resistance element of *R2*.

The signal? That's a harmonic of the 60-cycle a.c. line frequency generated by diode *D1*. It's mostly the 180-cycle third harmonic, since diode *D1* acts as a half-wave rectifier, but the exact frequency does not matter very much, as long as it can be heard in headphones or measured with a multimeter or VTVM. (The reason for not using the 60-cycle line frequency from the 6.3-volt secondary of transformer *T1* is that many inexpensive earphones don't reproduce a 60-cycle signal very well.)

The signal voltage across the known and unknown capacitors in series will be divided according to their relative capacities. By adjusting the arm of potentiometer *R2*, a point will be found where the voltage is the same as the voltage at *BP4*, the common point of the known and unknown capacities. In a pair of headphones plugged into *J1*, this will be heard as a "null" point, at which the signal disappears. Once the dial scale of the potentiometer is calibrated, the value of the unknown capacitor can be read from the scale as fast as you can find the null point.

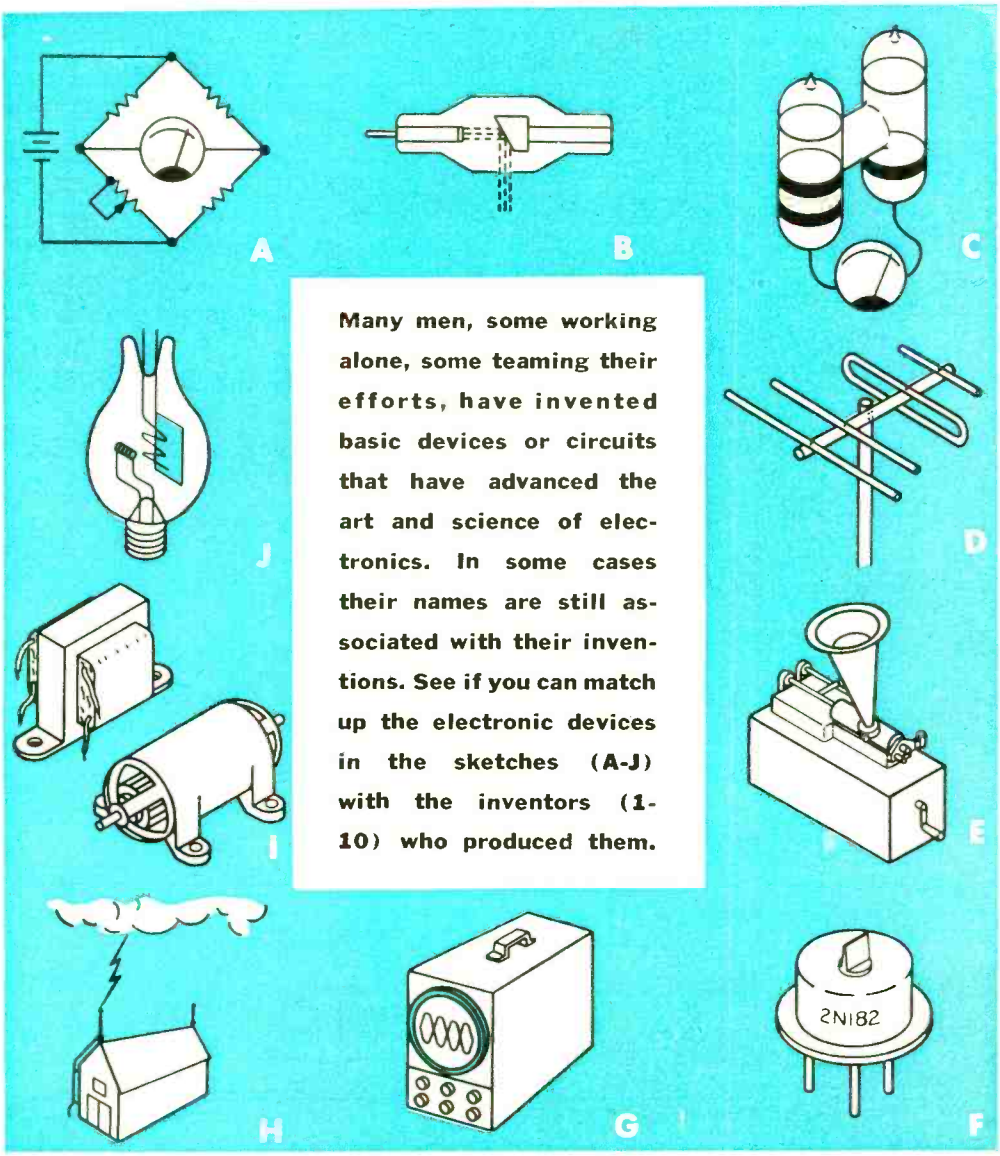
Construction. All parts of the circuit mount in the cover portion of the box. There is nothing electronically critical about the parts layout, but potentiometer *R2* should be located so that the calibrated scale can be made relatively large and easy to read. The writer's layout is convenient, but need not be followed exactly.

First drill and deburr all the holes

(*Continued on page* 109)

ELECTRONIC INVENTORS QUIZ

By ROBERT P. BALIN

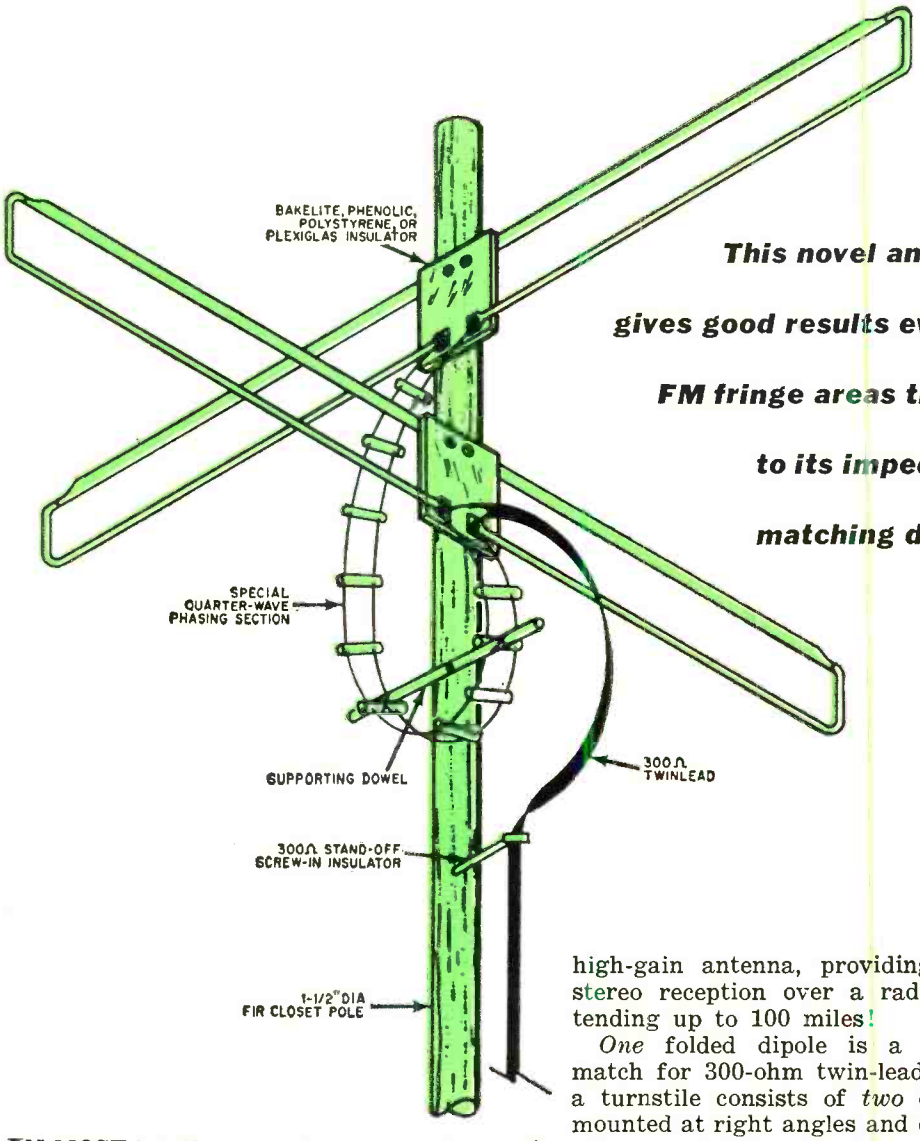


Many men, some working alone, some teaming their efforts, have invented basic devices or circuits that have advanced the art and science of electronics. In some cases their names are still associated with their inventions. See if you can match up the electronic devices in the sketches (A-J) with the inventors (1-10) who produced them.

(*Answers on page 92*)

1 Bardeen, Brattain, and Shockley ____
2 De Forest ____
3 Edison ____
4 Faraday ____
5 Franklin ____
6 Lissajous ____
7 Roentgen ____
8 Weston ____
9 Wheatstone ____
10 Yagi ____

Build a Turnstile



This novel antenna gives good results even in FM fringe areas thanks to its impedance matching design

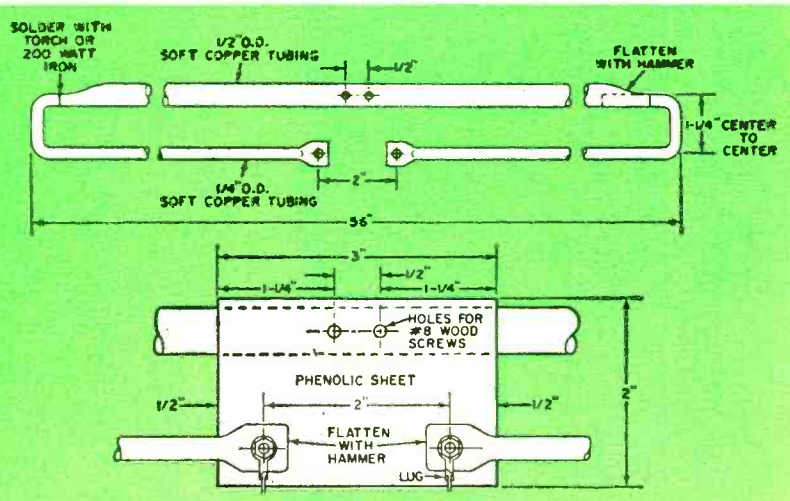
IN MOST locations, good stereo requires a good antenna. Widely separated FM stations pose another problem—an antenna with a rotator or an omnidirectional antenna is required. Turnstile antennas, available commercially, are omnidirectional; unfortunately, for reasons which will become apparent, they rarely give as much gain as they should. The version described here, thanks to its design, is both an omnidirectional *and* high-gain antenna, providing good stereo reception over a radius extending up to 100 miles!

One folded dipole is a perfect match for 300-ohm twin-lead. Since a turnstile consists of *two* dipoles, mounted at right angles and coupled through a special quarter-wave phasing section, the common feed-point is a match for 150-ohm line, and the use of twin-lead gives a 2:1 mismatch. Fortunately, there's a way out of the dilemma: Increase the impedance of each of the folded dipoles to 600 ohms by making them with conductors of unequal diameter, and couple them with 600-ohm line for a 300-ohm output.

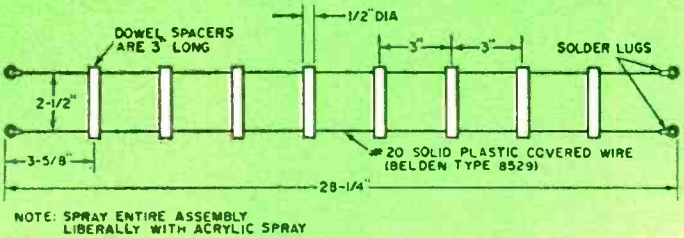
The folded dipoles are made of soft

for Stereo

By FREDERICK J. HAINES, W2RWJ



Unique construction of two folded dipoles using ¼" and ½" soft copper tubing gives them an impedance of 600 ohms each, 300 ohms when coupled together. Hammer the tubing together and solder. Mount ends to insulators (see text), and connect 300-ohm twin-lead and/or phasing section. Quarter-wave phasing section is 28¼" of open wire line spaced 2½" apart with dowels. Use #20 plastic-covered wire, and spray line with acrylic spray.



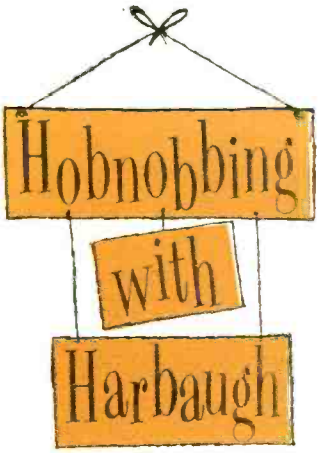
NOTE: SPRAY ENTIRE ASSEMBLY LIBERALLY WITH ACRYLIC SPRAY

copper tubing, available at hardware and plumbing supply stores, which is easy to work and solder. Materials required are 112 inches of ½"-o.d. copper tubing, 117 inches of ¼"-o.d. copper tubing, a 10' closet pole 1½ inches in diameter, a ⅛" sheet of polystyrene or other insulating material from which to cut two 3" x 3" antenna insulators, 3 feet of ½" wood doweling, 6 feet of #20 plastic-insulated wire, spar varnish, acrylic spray, TV standoff insulators, and hardware (brass screws and bolts should be used).

Cut antenna alignment notches at right angles and 3 inches apart in the closet pole for the top elements of the two dipoles; give the pole two coats of spar varnish. Cut the copper tubing to size for the folded dipoles—hammer the pieces of tubing together before soldering carefully with a small torch or heavy soldering iron. Then give the joints several coats of acrylic spray.

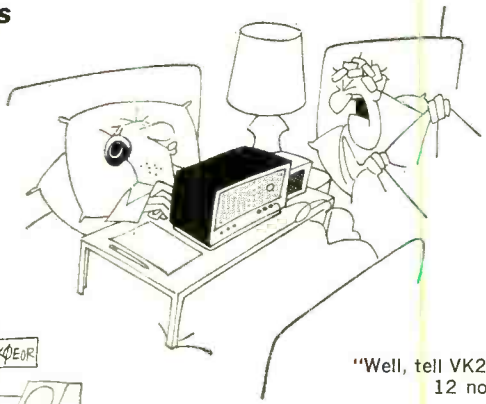
Make up the phasing section, cutting the doweling into 3" lengths, and notching the ends so the two wires will be spaced 2½ inches apart. Spray it with several coats of acrylic spray (but do not spray the connecting ends).

Finally, mount the two dipoles with four #8, 1⅝" brass screws through the insulators and copper tubing. Bolt the bottom sections to the insulators, using additional nuts to secure the phasing line and lead-in. —30—



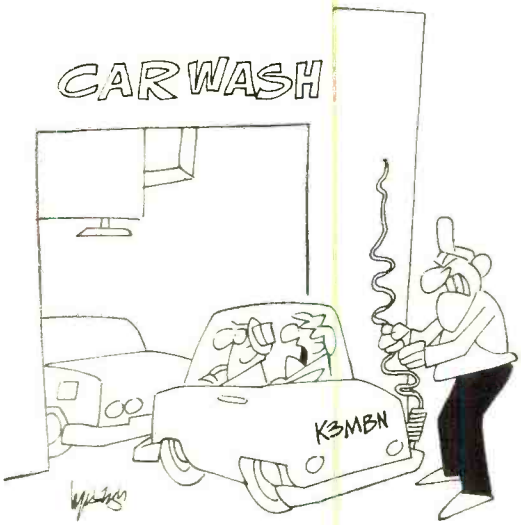
"Dah-dit-dit, dit-dah, dah-dit-dit, dah-dit-dit, dah-dit-dah-dah!"

Those Happy Happy Hams

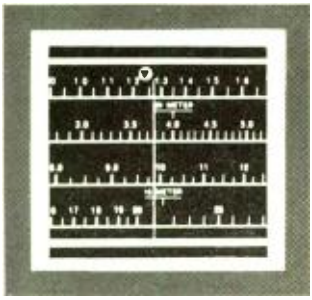


"Well, tell VK2AX it isn't 12 noon here!"

"The electric company would like you to QSL them $200.00."



"Wait a minute . . . he's lowering your antenna."



Across the Ham Bands

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

ARRL SWEEPSTAKES—1963

WANT to make a load of new contacts? Think you can pick off hundreds of fast QSO's in the 50 states of the U.S. and Canada's seven provinces in just two hectic week ends on the lower ham bands? Would you like to add a couple of states to your total for the 6-meter and higher bands? If all this sounds good to you, be on deck for the 30th annual ARRL Sweepstakes contest, scheduled for the November 9-11 and 16-18 week ends. Regardless of the license you hold—Novice, Technician, or Conditional/General—there's something in the Sweepstakes for you, even if you don't capture one of the high-scorer certificates that go to the winner in each of the 73 ARRL sections.

Contest Rules. The contest begins at 2300 GMT (6:00 p.m., EST) Saturday, and ends at 0801 GMT (3:01 a.m., EST) Monday, on both week ends. You may operate a maximum of 40 hours on all frequencies authorized by your license, using either c.w. or phone, or both (but in this case, you must file two separate logs), as you choose. To take part, you exchange contest "preambles" with as many other stations as possible in the 73 ARRL sections. (These are listed on page 6 of any issue of QST.) The contest preamble you transmit consists of these six parts: (1) sequential number of the contact; (2) station call; (3) your RST signal report of the station you work; (4) name of ARRL section you are in; (5) Greenwich Mean Time of the contact; and (6) the date.

The sequential number is merely the number you assign to each contact consecutively as you make it, beginning with 1, 2, etc. The sequential number

Novice Station of the Month

When this picture was taken, Brian Hayek, WN9FAB, La Crosse, Wis., had contacted 41 states with his well-equipped Novice station. Brian is shown here keying his Heathkit DX-60 transmitter via the Hammarlund HK-1B transistorized electronic keyer on top of the transmitter. His receiver is a Hallicrafters SX-110, and a 40-meter dipole antenna comoletes the installation. For submitting this photo in our Novice Station of the Month contest, Brian will receive a one-year subscription to POPULAR ELECTRONICS. If you want to enter the contest, send us a clear picture of your station—preferably showing you at the controls—along with some information about yourself, your equipment, and your operating achievements. Even if you don't win, we'll try to publish your picture as space permits. All entries should be sent to Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana.

It took Jim Landers, WN2DIA, Bronx, N. Y., nine months to work 34 states on 40 meters. Then he tried 15 and worked 5 countries in two weeks. His antenna is a 40-meter dipole.

Flora Strickhausen, WA5DPU (formerly WN5DPU), of Galveston, Texas, ran up a total of 41 states, the Canal Zone, Canada, Mexico, Puerto Rico, and Venezuela, with her Hallicrafters "twins"—the HT-40 and SX-140—and Gotham V-80 vertical antenna.

you transmit will not be the same as the one you receive, except by coincidence, for the first station you contact may have you for his fifth contact, or fiftieth, for that matter.

Scoring. You earn one point for each preamble sent and another point for each one received. Your total score is the number of points earned multiplied by the number of sections worked, and multiplied again by a power multiplier. If your transmitter power doesn't exceed 150 watts at any time during the contest, your power multiplier is 1.25 on c.w. and 1.5 on phone. If you run over 150 watts, the multiplier is 1.

The ARRL will award certificates to the highest scoring phone and c.w. stations in each ARRL section. In addition, separate Novice and Technician certificates will be awarded in each section in which there are three or more Novice or Technician entries. The ARRL will also award certificates to the highest scoring phone and c.w. stations in any club in which three or more club members submit scores and identify the club to which they belong.

You send your score to The American Radio Relay League, Inc., 225 Main St., Newington 11, Conn. A request to the same address will bring you a supply of Sweepstakes log sheets, which will simplify logging and reporting your score.

Making Contacts. To participate in the contest, you simply call "CQ SS" on c.w. or "CQ Sweepstakes" on phone and also answer such calls. When you make a contact, be brief; send your contest information, acknowledge the other station's information, sign off, and immediately try for another contact.

Don't waste time sending your name and address, station description, weather report, etc. The other operator couldn't care less about such details. If he wanted to rag-chew, he wouldn't be in the contest in the first place. If *you* want to rag-chew, don't call or answer "CQ SS."

Good hunting!

TECHNICAL TIP

If you are fortunate enough to own a surplus BC-221 (or Navy LM) frequency meter but are troubled by very low headphone output, check the audio-coupling choke between the crystal oscillator and the mixer and the output tube for an open winding. If the choke (#30, 450 henries in the BC-221M instruction manual) is open, indicated by an extremely high ohmmeter reading across its terminals, replace the choke.

Finding a replacement that will fit the available space may be something of a chore. One suitable replacement is the United Transformer Company #24, 500-henry, 3-ma. audio choke with a d.c. resistance of 6000 ohms. The UTC #23 choke will also work, but it has an inductance of only 300 henries.

The above tip was sent to us by Harold Reed, Hyattsville, Md.

ARMED FORCES DAY RESULTS

During the 12½-hour communications test on May 18, 1963, a total of 7366 in-

(*Continued on page* 110)

A Carl and Jerry Adventure in Electronics

The Lightning Bug

By
JOHN T. FRYE
W9EGV

CARL, Jodi, Jerry, and Thelma were parked in a secluded spot on a country road not far from the campus of Parvoo University. It was a beautiful, late-October, Indian summer evening, but their conversation was not of romance.

"You girls ready to be introduced to the Lightning Bug?" Jerry asked.

"It won't hurt us, will it?" Thelma inquired nervously.

"Of course not!" Jodi scoffed. "I told Carl and Jerry we needed something unusual that would sort of uncurl the Toni's of those pledges we're initiating tomorrow night, and they spent their whole week end at home building this—this thing. We're ready, Jerry."

Jerry turned off the headlights, and Carl took a bulky object from the trunk and carried it several yards down the road in front of the car and placed it on the black-topped surface. Then he returned to his place in the back seat with Jodi.

When Jerry flipped the headlights back on, the thing in the beam of light instantly came to life. It lumbered around in a little half-circle and headed for the car with an odd, hunting, zigzagging motion. Snapping sounds like the clicking of teeth came from it, and the rear part of its body glowed intermittently after the fashion of a lightning bug. The closer it came, the faster it moved, and Thelma, sitting beside Jerry, let out a little shriek.

Jerry turned the headlights off again, and immediately the strange object halted and sat there in front of the car, completely silent and motionless.

"Here, take this flashlight and walk around on the other side of the Lightning Bug and turn the light on it," Carl instructed Jodi.

A little hesitantly, Jodi got out of the car and walked in a very wide circle around the silent object in the road. Finally, from a distance of several yards, she turned the beam of the powerful flashlight on it. Immediately the body began to pulse with light, and the thing wheeled around and started for her. She started backing up, but it picked up speed and began to gain on her.

(*Continued on page* 94)

Transistor Topics

By **LOU GARNER,** Semiconductor Editor

OUR *Transitips* discussion on AM wireless microphones (July, 1963) brought forth a number of letters from readers asking for our "favorite" circuit. This is a difficult request to comply with, for we don't have a favorite design. Your Semiconductor Editor has personally tried a number of different circuits in the past and, in most cases, has been able to obtain satisfactory results by adjusting component values.

One circuit that has given good results is illustrated in Fig. 1. Inexpensive, readily available components are employed and the instrument can be assembled quite easily into a case no larger than a package of king-size cigarettes. The resulting "Home Broadcaster" can be used for fun at parties or in similar applications. Its range is limited, in keeping with FCC regulations, yet ample for use around the house.

Referring to the schematic diagram, transistor *Q1* serves as the r.f. source, while *Q2* acts both as an audio amplifier and modulator. Transistor *Q1*'s base bias is established by *R1*, bypassed by *C1*, with *Q2*'s base bias provided through *R2*, bypassed by *C6*. The common-emitter configuration is used in both stages. A single battery (*B1*) supplies power to both transistors, which are connected *in series* as far as the d.c. source is concerned.

Transistor *Q1* operates as a "tickler feedback" oscillator. The operating frequency is determined by the tuned circuit made up of *C3* and *T1*'s primary winding. The *T1* secondary winding provides the feedback necessary to start and sustain oscillation. Capacitor *C4*, in *Q1*'s emitter-collector circuit, serves to "swamp" the transistor's interelectrode capacities and thereby to minimize frequency modulation. The r.f. is coupled to the antenna through *C2*.

Sound waves striking the crystal microphone are converted into electrical signals which are applied to *Q2* through matching transformer *T2*. Since *Q1* and *Q2* are in series, *Q1*'s emitter current is the same as *Q2*'s collector current and varies in the same way. Thus, the r.f. signal developed by *Q1* is amplitude-modulated in accordance with the amplified audio signal delivered by *Q2*. Capacitor *C5* serves as an r.f. bypass in *Q1*'s emitter circuit to prevent interaction between r.f. and audio stages.

Although the instrument is small, it is easily assembled, for the miniature parts leave plenty of elbow room for wiring. If you have average skill, you can duplicate this unit in one or two evenings.

Resistors *R1* and *R2* are rated at one-half watt. Capacitors *C1* and *C5* are disc ceramics, while *C2*, *C3*, and *C4* are tubular ceramics. Capacitor *C6* is a 15-volt electrolytic, and any value from 10 to 20 μf. will give good results. Coil *T1* is a standard transistor oscillator coil; a Lafayette MS-165 was used in the model, but similar coils will work as well. The audio transformer, *T2*, is an Argonne AR-129 and has a 50,000-ohm primary and 1000-ohm secondary. The microphone may be any standard crystal microphone cartridge. Battery *B1* is a miniature 15-volt unit (Burgess Y10) and a s.p.s.t. slide-type power switch is used for switch *S1*.

Easy-to-assemble wireless microphone in miniature case gives good results when used around the home. All components are both inexpensive and readily available.

Almost any *pnp* r.f. transistor will do for *Q1* . . . typically, a CK760, 2N394, or 2N409. Transistor *Q2* is noncritical also, and a variety of *pnp* audio types may be used here—a CK722, 2N107 or 2N402, for example. Depending on the exact transistors used, results may be improved by experimenting with different values for bias resistors *R1* and *R2*.

The unit shown was assembled in a standard plastic box measuring 2⅝" x 3⅝" x 1¼" over-all, and a small piece of perforated phenolic sheet was used as a "chassis." The layout can be modified to meet individual needs. Major components are mounted with either general-purpose cement or small machine screws and nuts.

Use a small, clean soldering tool, pre-tin lead wires, and take the normal precautions against overheating the transistors. Do not install the transistors or battery until all wiring is completed. Identify the positive terminal of the battery box with a dab of red fingernail polish or enamel.

The antenna consists of an 18" to 30" length of #12 or #14 busbar soldered to a small lug and attached to the case with a small machine screw and nut. Its exact length is not critical but, in general, the longer the antenna, the better the radiation. A flexible lead may be substituted if preferred.

Once the wiring is completed and double-checked for errors, the antenna, battery and transistors can be installed. Afterwards, the instrument should be adjusted in accordance with the following standard procedure.

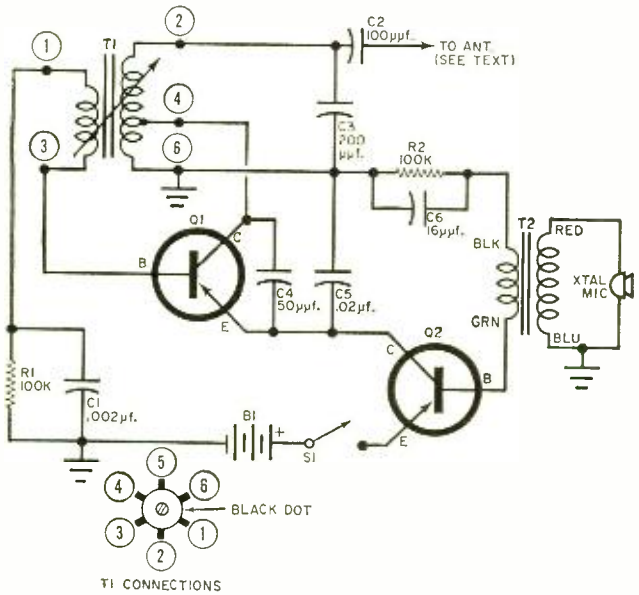
(1) Turn on a standard AM broadcast-band receiver and tune to near the middle of the band (around 800 kc.) where there is a "dead" spot (no stations received). Adjust the volume control to maximum.

(2) Holding the instrument in your hand about 3 to 6 inches from your mouth. flip the power switch *(S1)* "on."

(3) Whistle, sing or count while adjusting *T1*'s "slug." *Adjust the slug slowly,* listening for a signal from the receiver.

(4) When you hear your voice coming from the receiver, adjust the slug for clearest and loudest reception, then move farther away from the broadcast set, readjusting the slug for best results.

Coil *T1*'s slug provides a moderate range of frequency adjustment, but does not cover



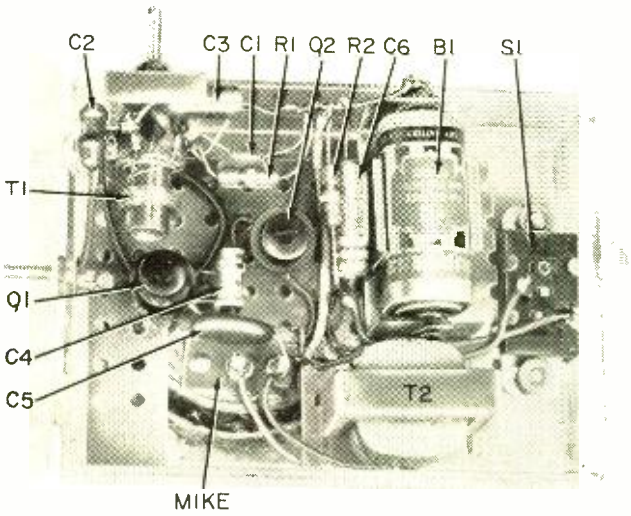


Fig. 1. Two pnp transistors are connected in series in wireless microphone circuit. Changing value of C3 shifts tuning range; a smaller capacitor raises operating frequency, a larger one lowers it. Note uncrowded layout in photo at left.

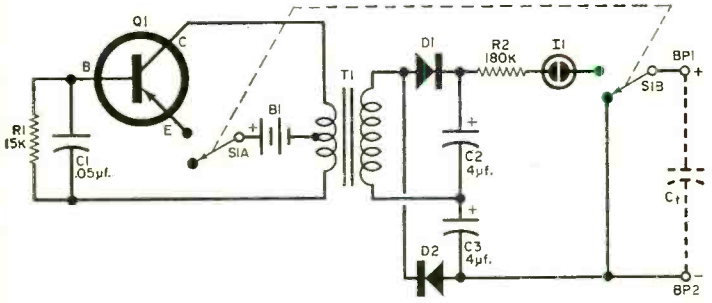


Fig. 2. "Condenser leakage tester" circuit sent in by reader Melvin Hyatt supplies over 100 volts d.c. for checking capacitors rated at 150 volts or more.

the entire band. To shift the tuning range, change the value of *C3*. A smaller capacitor raises the operating frequency; a larger one lowers it. Unless the lower end of the broadcast band is well-filled with stations in your locality, you'll find you can obtain better results by keeping to frequencies below 1000 kc. Typical values for *C3* range from 50 μf. to 350 μf.

Reader's Circuit. With their low voltage and power requirements, transistors are ideal components for battery-operated and portable test instruments. Many readers have recognized this fact and used transistors in signal generators, test amplifiers, signal tracers and similar instruments. One interesting instrument application is illustrated in the circuit of Fig. 2. Submitted by reader Melvin T. Hyatt (2810 W. 73 Terrace, Prairie Village, Kan.), the device is a *condenser leakage tester*. Although powered by a pair of penlight batteries, the instrument supplies in excess of 100 volts d.c. for checking paper, mica and ceramic capacitors with ratings of 150 volts or more.

Referring to the schematic diagram, a *pnp* power transistor, *Q1*, is used in the common-emitter configuration as a low-frequency oscillator. A standard filament transformer, *T1*, is connected "in reverse," with its center-tapped low voltage winding serving as *Q1*'s collector load and furnishing the feedback necessary to start and maintain oscillation. Transistor *Q1*'s operating power is supplied by *B1*, controlled by one section of d.p.d.t. switch *S1*. The transistor's base bias is established by series resistor *R1*, bypassed by *C1*.

In operation, the a.c. voltage developed by oscillator action when *S1a* is closed is stepped up by *T1*'s primary (used, in this case, as a secondary winding) and rectified by a conventional voltage-doubler, *D1-D2* and *C2-C3*. The resulting d.c. test voltage is applied to the tested capacitor (*Ct*) through current limiting resistor *R2*, a neon test indicator (*I1*) and the control switch (*S1b*). When *S1* is returned to the "off" position, *S1b* connects a jumper across the capacitor under test, discharging it.

Readily available components are used in the instrument. Transistor *Q1* is an experimenter's power transistor (such as a Motorola 2N554). Transformer *T1* is a 1- or 2-ampere, 6.3-volt filament transformer, *R1* and *R2* are half-watt resistors, *C1* a small paper or ceramic capacitor, and *C2* and *C3* are oil-filled 200-volt "bathtub" paper types. The diodes, *D1* and *D2*, are GE 1N538's. Test switch *S1* is a d.p.d.t., spring return, toggle, push-button or lever type. Almost any small neon bulb can be used as test indicator (*I1*) . . . typically, an NE-2 or NE-51. Insulated binding posts *BP1* and *BP2* serve as output terminals, while power is supplied by a pair of penlight or flashlight cells connected in series (*B1*).

With neither layout nor lead dress critical, the *condenser leakage tester* may be assembled in a wood, plastic, or metal case, depending on individual preferences. A small Minibox makes an ideal case. Good wiring practice should be followed, of course, with care taken not to overheat the diode or transistor leads when installing these components. While exact component values are not too critical, Melvin cautions against the use of electrolytic capacitors for *C2* and *C3;* electrolytics have relatively high leakage and may overload the oscillator circuit to the point where it fails to operate.

The completed instrument can be given a professional touch by labeling the control switch and output terminals with suitable decals or nameplates. If decals are used, they should be protected, after application, with a coat or two of clear lacquer.

To test a capacitor, connect it between *BP1* and *BP2*, then close *S1*. If the capacitor is leaky, *I1* will light and remain lit as long as the switch is held closed. If the capacitor is in good condition, the neon lamp will not remain lit, although it may flash momentarily in the case of large value capacitors (0.1 to 0.5 μf., for example).

(*Continued on page* 106)

Monthly Short-Wave Report

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

LIGHTNING STRIKES HCJB

SEVERAL MONTHS AGO we received sketchy information to the effect that HCJB, Quito, Ecuador, had been struck by lightning. We were unable to get any specific details although various reports and our own monitoring indicated that the station was still on the air, but with a considerably reduced signal on some channels. Now we have received the latest issue of *Call of the Andes* which contains the full story.

Some 278 feet of steel came tumbling to the ground on March 26 when HCJB's long-wave tower was struck by lightning during a violent thunderstorm at Pifo, the transmitter site. A critical supporting cable burned and shortly afterward the giant tower was crumpled on the ground—a mass of twisted steel. Also damaged were the 16- to 19-meter curtain antennas used for broadcasting to Europe.

The total damage was estimated in thousands, but fortunately no one on the mis-

DX Awards Presented

The following DX'ers have qualified for awards this month (100, 75, 50, and 25 countries verified). Congratulations, and welcome to the Awards List!

One Hundred Countries

Gerry L. Dexter (WPEØJJ), Minneapolis, Minn.
Mark Alan Weiss (WPE6ETS), Sherman Oaks, Calif.

Seventy-Five Countries

F. R. Cook (VE3PE1WX), Toronto, Ont., Canada
Steve Russell (WPE8CW), Kalamazoo, Mich.
Marlin A. Field (WPE8FRE), Benton Harbor, Mich.

Fifty Countries

Robert L. Rankin (WPE4CBX), Tifton, Ga.
Jack Lane (WPE9EVU), Lafayette, Ind.
Steven Shook (WPE4FFO), Lexington, Ky.
Owen Williamson (WPEØBSL), Minneapolis, Minn.
Mike Flomp (WPE2IXH), Valley Stream, N. Y.

Twenty-Five Countries

Warren Nordgren (WPE9DGI), Waukegan, Ill.
Larry Tompkins (WPE2INO), Long Island City, N. Y.
Tommy N. Thompson (WPE9FHP), Jeffersonville, Ind.
Jack J. Carr (WPE8CCF), Cincinnati, Ohio
Percy G. Miller (WPE3EWQ), Fullerton, Pa.
John J. Watermeier III (WPE5CCN), New Orleans, La.
George H. Seaman (WPE2BAG), Maple Shade, N. J.
Bruce J. Brown (WPE9CVN), Skokie, Ill.
Sheldon Daitch (WPE4EDU), Louisville, Ga.
Pat Montgomery (WPE8EEW), Cincinnati, Ohio
Denis O'Keefe III (WPEØCLL), Omaha, Nebr.
Louis Rappaport (WPE4EOH), Miami, Fla.
Dieter O. Kaetel (WPE7IA), Seattle, Wash.
Warren Hunter (WPE3DHY), Arlington, Va.
Kenneth Shafer (WPE9DCK), Whitestown, Ind.
Paul Rubinfeld (WPE2JBK), Millburn, N. J.
Claude Schwesig (VE2PE1CM), Verdun, Que., Canada
Robert Nardini (WPE2IVU), North Bergen, N. J.
Garry C. Hess (WPE3CXT), Washington, Pa.
Michael Wilson (VE6PE4N), Calgary, Alta., Canada
Victor Perla (WPE2IBQ), North Bergen, N. J.
Paul Herman (WPE6EKB), Montebello, Calif.
Emil Vandevelde (WPE2KHS), Oakland, N. J.
Roy Moore (WPE4FWH), Hazard, Ky.
George Oppegard (WPE3LI), New Castle, Del.
Alan Trainer (WPE4GCF), Memphis, Tenn.
Cecil Waugh Jr. (WPEØCKU), St. Joseph, Mo.
Barry Tepperman (VE3PE1SD), Toronto, Ont., Canada
David Brown (WPE6EMI), Woodland Hills, Calif.
Steven K. Molnar (WPE8AFX), Elyria, Ohio
David Mark Reed (WPE4FCL), Raceland, Ky.
William McGrath (WPE1FBH), Norwich, Conn.
Robin Martin (WPE2GEF), Glen Head, N. Y.
Joseph C. Perez (WPE6LN), Santa Clara, Calif.
Joseph L. Snyder (WPE3BDU), Baltimore, Md.
Ken Rusnak (VE3PE1XL), Port Arthur, Ont., Canada
James Jackson (WPE7BSN), Reno, Nev.
Herbert Keesecker (WPE8FAX), Cortland, Ohio
John Long (WPE3CYU), Lebanon, Pa.
Michael C. Clapshaw (WPE7BSJ), Port Angeles, Wash.
Robert Reinecker (WPE3BZK), Coraopolis, Pa.
Howard G. Bogrow (WPE8ANI), Detroit, Mich.
David L. Borino (WPE7EZ), Cheyenne, Wyo.
A. L. Pelletier (VE3PE1VD), Toronto, Ont., Canada
Richard Shannahan (WPE2GJC), Binghamton, N. Y.
Craig F. Anderson (WPE9BTA), Orono, Maine

The impressive line-up of units in the listening post of Grant Power, VE2PE6K, Montreal, Quebec, includes a National NC-57 receiver with an Explor-Air as a stand-by, VHF converter for 136 mc., Gonset G-15X transceiver, and tape recorder. Grant is a commercial radio operator with the calls XM52470 (base) and XM52210 (mobile). As an SWL, he has 32 countries confirmed so far. His antenna farm is even more impressive—it contains a 90′ inverted L, 40-meter Windom, a quad for 2 and 6, a 20-meter dipole, 33′ vertical, and ground planes for 10 and 11.

sionary staff was injured. The missionary engineers (Phil Turrel, Art Larson, and Bob Moore) and national employees immediately started to repair the damage. Until the job is finished, however, they will be using a temporary long-wave antenna which can handle only about half the power normally used. Normal functioning on 16 and 19 meters to Europe is possible thanks to antenna repairs already completed.

This would seem to be a good time to emphasize to our readers that their receiving antennas should be protected against lightning. A lightning bolt striking an antenna can cause far more damage than the loss of the antenna wire—property and lives may be lost also. Granted, this particular time of year is not conducive to thunderstorms, especially in the northern half of the country,

(*Continued on page* 101)

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

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

COUNTRY	STATION	FREQUENCY *(kc.)*	TIMES *(EST)*
Australia	Melbourne	17,840, 15,220	2030, 2130, 2330
		9580	0745
Bulgaria	Sofia	6070 (and/or 9700)	1900, 2000, 2300
Canada	Montreal	15,190, 11,720, 9625	1800 (Caribbean)
East Congo	Leopoldville	11,755	1630, 2100, 2230
West Congo	Brazzaville	11,725	2015
Czechoslovakia	Prague	11,990, 9795, 9550, 7345, 5930	2030, 2330
Denmark	Copenhagen	9520	2100, 2230
Finland	Helsinki	15,185	1530 (Mon., Fri.)
West Germany	Cologne	15,405, 11,795	1010
		9640, 6160	2035
		11,795, 9735, 6145	0000
Hungary	Budapest	11,910, 9833, 7220	1900
		9833, 7220	2230
Italy	Rome	9575, 5960	1930, 2205
Lebanon	Beirut	11,770	1630
Netherlands	Hilversum	15,445, 11,950	1030 (Tues., Fri.)
		17,810, 15, 445	1415 (Tues., Fri.)
		15,445, 9715	1630 (exc. Sun.)
		9590, 5985	2030 (exc. Sun.)
Portugal	Lisbon	6185, 6025 (and/or 9740)	2105, 2305
Spain	Madrid	9360, 6130	2215, 2315, 0015
Sweden	Stockholm	17,840	0900
		11,805	2045, 2215
U.S.S.R.	Moscow	9740, 9730, 9700, 9680, 9660, 9650, 9620, 9610, 9570, 7320, 7310, 7240, 7200, 7150 (may not all be in use at any one time)	1730, 1900, 2000 2100, 2300, 0040
Vatican City	Vatican City	9645, 7250	1950

Short-Wave Broadcast Predictions

NOVEMBER 1963

BY STANLEY LEINWOLL, Radio Propagation Editor

SINCE January 1963 the basic propagation data on which these predictions are based have been derived from a numerical mapping technique with the aid of an electronic computer. This has increased the accuracy of the information published each month by the Central Radio Propagation Laboratory (CRPL) of the National Bureau of Standards. The computer program and methods for calculating the maximum usable frequency on specific point-to-point paths are described in the recently published "NBS Handbook 90, Handbook for CRPL Ionospheric Predictions." The do-it-yourself DX'er interested in propagation data for paths other than those appearing in the tables below can obtain this handbook for 40 cents from the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C.

TIME (EST)

Between Eastern USA and:	00	02	04	06	08	10	12	14	16	18	20	22	24
Western Europe	6	6	6	9	11	15	17	15	11	9	6	6	
Eastern Europe	6	6	6	9	15	17	15	11	9	6	6	6	
South & Central America	9	9	9	15	17	17	17	17	17	15	11	11	
Near East	6	6	6	9	15	17	17	15	11	9	9	6	
North Africa	7	6	6	11	15	17	17	17	17	9	9	7	
South & Central Africa	7	7	7	15	17	21	21	21	15	11	9	7	
Australia & New Zealand	9	9	7	7	9	9	*	17	21	21	15	11	

TIME (CST)

Between Central USA and:	00	02	04	06	08	10	12	14	16	18	20	22	24
Western Europe	6	6	6	7	15	17	17	15	9	6	6	6	
Eastern Europe	6	6	6	7	11	15	11	7	7	6	6	6	
South & Central America	9	9	6	15	17	17	17	17	15	11	9	9	
North Africa	6	6	6	9	11	17	17	17	9	6	6	6	
South & Central Africa	6	6	6	9	15	17	17	17	17	15	9	6	
Far East	7	6	6	6	7	7	7	9	15	15	15	9	
Australia & New Zealand	11	9	9	7	9	9	*	21	21	21	15	11	

TIME (PST)

Between Western USA and:	00	02	04	06	08	10	12	14	16	18	20	22	24
Western Europe	6	6	6	9	15	15	11	9	6	6	6	6	
Eastern Europe	6	6	6	9	15	11	9	6	6	6	6	6	
South & Central America	9	6	6	15	17	17	17	17	17	15	11	11	
Africa	7	7	7	15	17	21	17	15	11	9	6	6	
Far East	6	6	6	6	6	6	7	15	17	15	11	7	
South Asia	6	6	6	6	7	9	11	9	15	17	11	7	
Australia & New Zealand	9	9	6	6	9	15	21	21	21	21	17	11	

To determine the frequencies and times for best short-wave reception in the United States, select the table for the area you are located in, read down the left-hand column to the region you want to hear, then follow the line to the right until you are under the figures indicating your approximate local time. The boxed numbers will tell you the frequency band (in megacycles) to listen to during any 2-hour interval. Asterisk (*) indicates that signals will probably not be heard.

On the Citizens Band

with **MATT P. SPINELLO,** 18W4689, CB Editor

TO START a Citizens Band radio club is one thing. To orient the attitudes of its members towards a worthwhile goal—and then achieve it—is another matter! In the past year we have spotlighted successful CB clubs in the West, the Midwest, the South and Canada. This month we move to the East Coast and visit the Delaware Valley Citizens Band Association (D.V.C.B.A.).

DELAWARE VALLEY CB'ERS

With headquarters in one of our smallest states (in area only), the D.V.C.B.A. is one of the best organized CB clubs around, and one of the first to start functioning following the FCC's allocation of 11 meters to CB in 1958. The D.V.C.B.A. came into being early in 1960 when most of the equipment used on 11 meters was either home-brew or could be purchased in a brown paper bag from a local distributor. (In case you've forgotten, this bag contained a bundle of parts with a printed schematic and some brief instructions. This was a kit! This was CB!) Just three months short of their fourth birthday, the D.V.C.B.A. now numbers over 150 strong, and it's still growing.

Following a January, 1960, meeting with organization-minded CB'ers from Trappe, Pa., a planning committee was elected. Among those chosen to put the machinery in motion were Delaware CB'ers Bill Young, 3W3140; Chick Dean, 3W1590; Gerry Gastor, 3W1750; and Jim Crosby, 3W2285. Today, the D.V.C.B.A. credits these gentlemen as being the pioneers who started the CB ball rolling in the Delaware Valley.

Before the first organizational meeting was held, the planners saw to it that the proposed organization received exposure via radio, newspapers and personal contacts. Before the third meeting was over, members had finalized the club name, bylaws and constitution, rules and regulations, the club motto ("Service Through Unity"), and made information available to new members covering FCC Rules and Regulations, sources of equipment, applications for licenses and literature regarding CB, its uses and applications. They also enlisted the services of an attorney to draw up bylaws, ratified their new constitution, established club dues, set up functional committees and elected officers—in just three meetings!

Originally, the organization was named the Delaware Citizens Band Association, but

(*Continued on page* 84)

Some of the current officers—there are 13 in all—of the Delaware Valley Citizens Band Association. Twelve committee chairmen and their committees plus a newspaper ("On Frequency") staff complete the administrative roster. The fact that approximately 150 people are working to hold the association together is the main reason for the continuing success of the D.V.C.B.A., which, organized early in 1960, was one of the first CB clubs to get started.

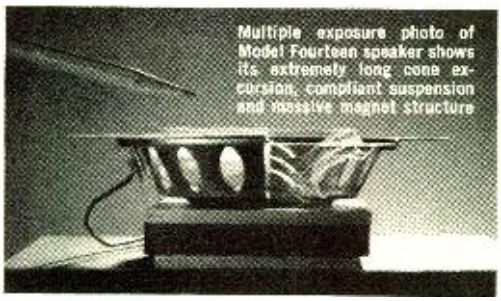
Breaking the 'small enclosure barrier' with... *frequency contouring*

KLH Model Fourteen
18 x 14 x 3¾"
$49.50*

KLH has introduced a new, small speaker system — the Model Fourteen — designed to reproduce music (a) with the natural, musical, octave-to-octave balance for which KLH speakers are famous, and (b) with more uniform bass than has ever before been possible for a compact speaker system.

There are two major problems in achieving good reproduction in a small speaker — to reduce distortion and to provide decent bass performance. Always, the process of solving one of these problems has intensified the other. To reduce distortion, we need precise control over the movement of the cone. To provide adequate bass output, we need to move large volumes of air. The smaller the cone in relation to the size of the magnet. the more precisely it can be controlled. But the larger the cone, the more air it can push. The customary solution — a separate large speaker for the bass — can not be fully effective in a small enclosure. The unavoidable compromise of these factors in a small speaker system has always meant unacceptable bass performance and/or unacceptable distortion.

In order to solve these problems, the KLH Model Fourteen embodies a series of vital departures from any speaker system ever produced before. The Model Fourteen contains two extremely compliant speakers. The diameter of their cones is only 3". Yet they are



full-range speakers. Their maximum excursion (the forward and backward travel of the cone) is an unprecedented ⅜". This excursion is controlled by the highest ratio of magnet power to cone weight ever engineered into a loudspeaker.

FREQUENCY CONTOURING. The combination of a small speaker with a very powerful ceramic magnet and long excursion provides two great advantages — the precise control over cone movement necessary for freedom from distortion, and the ability to move an ample volume of air. It also creates a new problem, since the damping effect of the heavy magnet increases at the lower frequencies, tending to restrict the bass output of the speaker. The crucial innovation in the Model Fourteen — designed to extend its bass output while preserving the advantages of a heavy magnet and a small cone — is the first use, in a small multi-speaker system, of the revolutionary technique called frequency contouring. This technique was pioneered by KLH in the now famous Model Eight FM Receiving System and Model Eleven Portable Stereophonic Phonograph. Incorporated in the Model Fourteen is a passive electronic network which has been designed with the speakers as an integrated unit. This network reshapes the power output of any conventional amplifier to match exactly the low frequency power requirements of the speakers, so that their bass output remains flat far below its normal roll-off point. Through the magic of this new technique, it is at last possible to avoid the drawbacks of tweeter, midrange speaker, woofer and crossover networks in a compact speaker system. It is now possible to have all the advantages of a small-diameter, high-compliance speaker and heavy magnet — flawless smoothness throughout its frequency range; clean transparent midrange and highs — and full, undistorted bass performance, too. The KLH Model Fourteen, at any given loudness level within its operating range, will deliver more bass power. at lower frequencies, with less distortion than any other speaker of comparable size or cost.

The unique smoothness and balance of sound quality in the Model Fourteen can only be achieved commercially in a speaker which can be manufactured to duplicate precisely a particular response profile. Only because the speakers used in the Model Fourteen — including their impregnated paper cones and the special miniature rubber-and-cloth suspensions which permit such a long excursion — are designed, manufactured and assembled in our own plant can they be held to the rigid uniformity required to justify the use of frequency contouring. No commercially supplied cones have the necessary uniformity. No other manufacturer of small full-range speakers produces its own cones.

During its development, the Model Fourteen has been tested against every other small speaker system with any claim to respectability, in order to help us define and solve the special problems of the small speaker. The result of this development is a clarity, smoothness and freedom from distortion, a frequency range, dynamic range and bass performance you have never heard before in a compact speaker. You will find that the overall sound quality of the Model Fourteen is not only beyond that of all other compact speaker systems, but also beyond your fondest hopes for any compact speaker.

*Slightly higher west of Rockies

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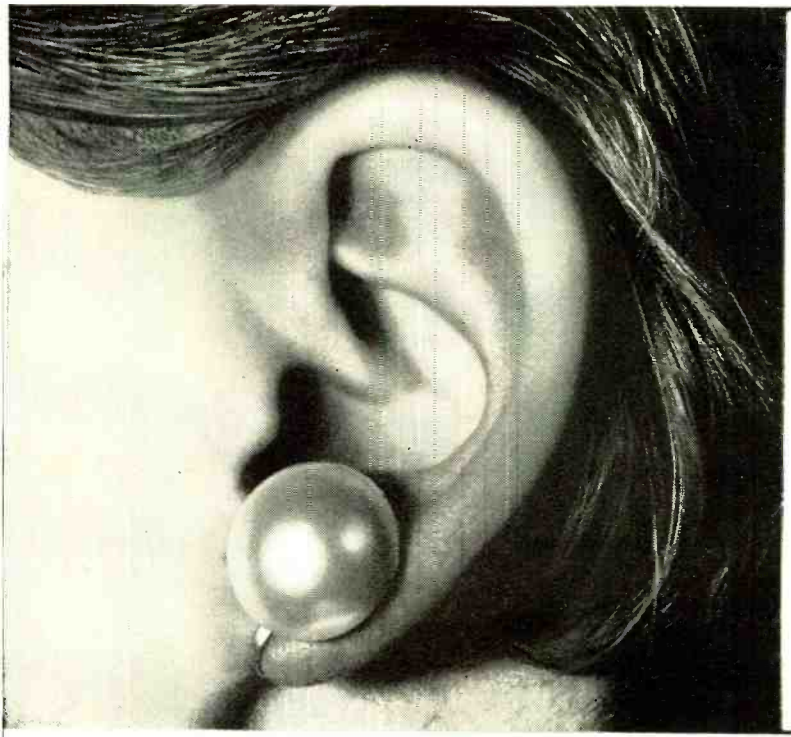
Look!

New "Lifetime Coding!" ...Your assurance of highest quality! A permanently printed legend continuously repeated on the back of all new EASTMAN Magnetic Sound Recording Tapes (1) identifies Eastman Kodak Company as the manufacturer; (2) provides a convenient means of indexing tapes

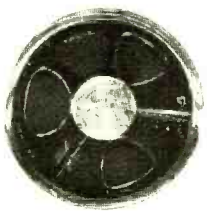
Three important new developments give you sound recording at its best!



Listen!

The new "R-type" binder, a super-smooth, tougher homogeneous oxide layer suppresses tape noise and distortion . . . prevents oxide build-up on the head; at the same time, chemical stability extends longevity. Even more important are the superb magnetic characteristics of the new "R-type" binder dispersions. These make possible two superlative tapes of widely different performance characteristics...an extra-low print-through and a high-output low-noise tape.

Remember: It's Eastman for superb sound recording tapes.



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

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

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The neat-looking shack at left belongs to Bob Bryant, the D.V.C.B.A.'s president. Bob also serves as civil defense director of Ashton Township, Green Ridge, Pa.

Both state police and fire companies take advantage of the D.V.C.B.A.'s services. The shot above was snapped during "Operation Sky Rocket," at which plans were laid for an emergency net. Fire chief Harvey Grant is the one with the straw hat.

Among the more unusual public service activities of the D.V.C.B.A. is scuba diving. Here, Ray Houck, director of the emergency net committee, instructs various members in proper use of scuba suits and equipment.

avid interest, help and membership from the neighboring states of Maryland, New Jersey and Pennsylvania quickly initiated a change-over to the present name. Besides making possible a larger membership, this move enabled the D.V.C.B.A. to create two-state communications networks. It also brought volunteers from miles around into the fold, insuring the widest possible range of ideas and opinions.

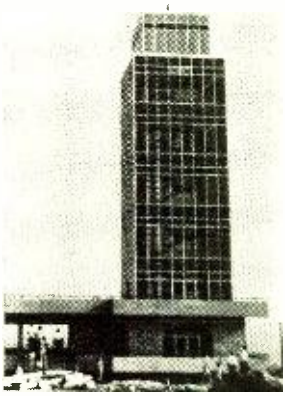
Chick Dean successfully served as president to the rapidly expanding D.V.C.B.A. in its first year. Also serving as club historian, Chick has kept up a detailed record of the club's activities since its organization in 1960. A big factor in the club's successful four years of operation is the number of well-organized committees the D.V.C.B.A. has put into service. Thirteen officers, twelve chairmen, their respective committees, and a newspaper editor, with a staff of writers, make up the administrative roster. When you include the members working with these officers on a dozen different committees, you've got most of the membership involved. This counts—definitely! With every member assigned a duty, an obligation to participate in building a better organization, chances of failure are slim.

As for paper work, club secretary Bill Young, 3W3140, has headed an able staff of writers since 1960 as editor of *On Frequency*, the club's newspaper. Their efforts have created an excellent publication that is currently exchanged on a monthly basis with clubs throughout the country. Additional paper work, as much a part of the club as the newspaper, involves a series of "Know-How" manuals which detail the specific duties of officers and committee members.

The club also furnishes each member with a set of emergency radio network operating instructions, and a complete record of active, paid-up, and "I.O.U." members. All of this paper work is topped by 18 pages of constitution and bylaws which are available to each member.

As a public service organization, the D.V.C.B.A. has participated in public and civic aid from Christmas to Thanksgiving, year to year. To supplement the regular committees and activities, there are special groups to handle technical advice, emergency net communications, programming

Bill Kirkman, vice president of the Dixie Communications Club of Decatur, Ga., stands by while Bud Horton, president, keys the mike of their station on top of Stone Mountain for the first time.



Located on the sixth floor of the Stone Mountain tower, which stands 1686 feet above sea level, the Dixie Monitor now keeps a tuned ear on channels 9 and 15 from 7 to 11 p.m. week nights and 24 hours a day on week ends. Transportation to and from the tower is via cable car.

and entertainment, public relations, and practices and procedures. The D.V.C.B.A. emergency net was put into operation near the end of 1960; since that time they have made their services available to civil defense agencies in the area, the state police, fire companies and any other worthwhile group requiring communications.

Not to be outdone, the YL's and XYL's have their own ladies' auxiliary within the D.V.C.B.A., led by a full complement of officers. Their duties include assists at picnics, meetings, outside activities and other club functions that may require the feminine touch. Current chairman of the auxiliary is Jean Grubb, 3Q3040, wife of D.V.C.B.A. club treasurer, Alex Grubb.

As we see it, this is the type of makeup that builds and strengthens any organization. Sure, the D.V.C.B.A. has problems, but with 150 people working to hold the association together, rather than a handful (which is true in most cases of CB club failure) things just *seem* to work out in the long run.

Many congrats—Delaware Valley Citizens Band Association—for a very commendable four-year performance! Also, our humble thanks for our honorable membership in the D.V.C.B.A.—expiration date, March 31, 1968.

A Page From the Log. The following data was taken from the *Dixie Monitor* log book. It is a record of the type of communications and aid being handled by the Dixie Communications Club of Decatur, Ga., and all other CB clubs in a 100-to-150 mile radius of Stone Mountain.

2:30 p.m.: KDB-3209—Mrs. Parnell advised that Athens CD and Tri-County CB Club request assistance in search for Oconee River drowning victims. Need 12-15 men with walkie-talkies to search five miles of river bank.

2:35 p.m.: KDD-1100—Lawrenceville CB Club offers help for Athens search. Advised to stand by.

3:35 p.m.: KDD-3209—Info on units in search area. State and county CD present.

4:00 p.m.: KDD-1100—Lawrenceville CB Club to proceed to rescue control in Athens.

4:20 p.m.: KDD-0547—Dixie Monitor *advised all DCC mobile units to report to base for instructions.*

5:10 p.m.: 6W1458—Dixie Monitor *advised Dixie Communications Club en route to Athens.*

11:00 p.m.: Duty change. Marvin Ramge, Dixie Monitor duty officer.

12:20 a.m.: KDB-0264—DCC returning from Athens. Car believed located under water. Search to continue by daylight.

Dick Elder was the duty officer who handled the above communications during a tragic June afternoon and evening in which two adults and six children met with death when their automobile plunged into the Oconee River at Athens, Ga. CB'ers, quick to answer the call for assistance, aided authorities by patroling the river bank with walkie-talkies for one solid week until they had recovered all of the victims' bodies.

As many will remember, we stated in our March, 1963, OTCB column, that the Dixie Monitor Station, atop the 1686-foot, one-and-a-half billion tons of exposed granite better known as Stone Mountain, was near completion. As this material goes to press, the station has been in successful operation for over two months. The skeleton framework we showed you in March has since been shaped into a highly efficient observation and communication tower, in which the *Dixie Monitor* has become the sixth-floor occupant. At present the station is in operation from 7:00 p.m. to 11:00 p.m. weeks nights and from 7:00 p.m. Friday evenings straight through to 11:00 p.m. on Sunday.

A strict set of rules and regulations has been initiated for the monitoring station by the D.C.C. which has been allocated the authorized call-sign of KDD-0547 by the FCC. The station's purpose is to serve as a control point for mobile vehicles providing communications for Civil Defense, for governmental agencies, or for civic organizations. The station will also attempt to render assistance to any mobile CB unit seeking aid, or in emergencies to those without telephone service available. They will also relay messages of importance for other monitoring stations.

The D.C.C. has chosen channel 9 (national emergency and calling channel) and channel 15 (national transportation channel) as the official monitoring channels of the Dixie Monitor Station. Both channels are monitored continuously.

Headset Walkie-Talkie. "Look, ma, no hands!" That would appear to be a fitting quote for the operation of the Sony Corporation's new CB-106 100-mw. unit. While basically a hand-held transceiver, operable in the conventional manner, the CB-106 features a separate foam-cushioned boom-type microphone-headset which may be plugged into the unit. Included is a shoulder case which is worn around the waist by means of a special strap supplied. The transmitter is keyed with a fingertip cable much the same as those used for photographic purposes. And that's about as "hands-free" as you can get.

Features of the CB-106 include ten-transistor, two-diode circuitry, crystal control, a built-in 5′ telescopic antenna and built-in 2″ microphone-speaker. The unit operates on eight penlight batteries and weighs just 1.23 pounds. The complete CB-106 package includes chassis, headset-microphone, cable release, shoulder case and batteries. Sony claims the unit will average an effective range of from 1.8 to 9.3 miles, depending on location and terrain. Price tag on this latest CB innovation is $99.95.

Club Chatter.—The Corn Belt Citizen Banders will hold their third annual dinner on Nov. 23 at the Sinorak, located at the intersections of U. S. Highways 66 and 51 in Bloomington, Ill. Last year's event drew close to 200 CB'ers, including out-of-staters from Texas, Pennsylvania and Indiana. The club plans an excellent dinner, entertainment, displays and door prizes. (Your CB Editor has humbly accepted an invitation to speak at this event. If you decide to attend, bring your QSL cards; I'll expect one from each of you!) For more information regarding this hoopla, contact A. James

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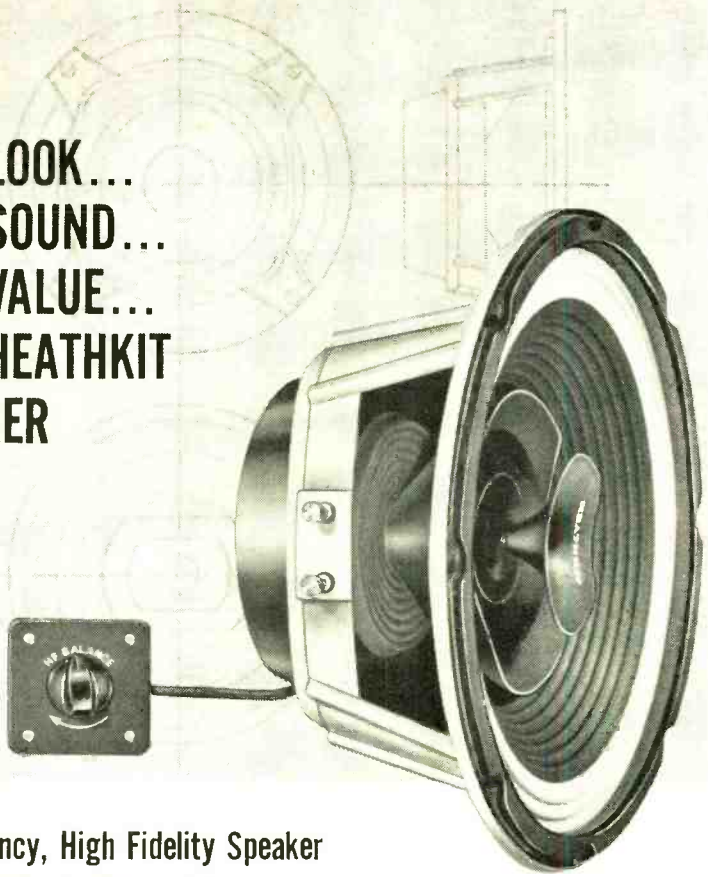

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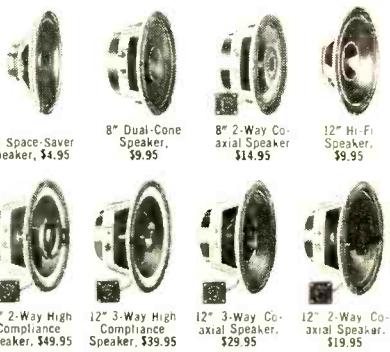

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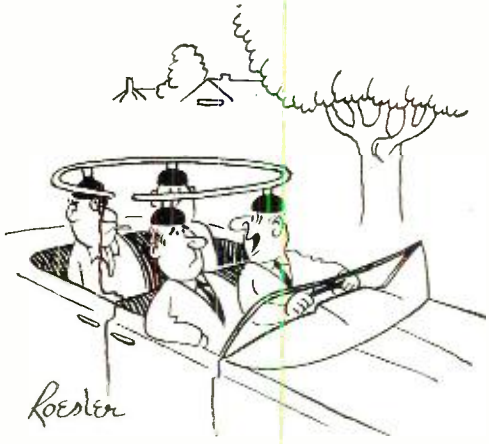
Rosalind Hoxsie, KFC1363, co-editor of *Break-Break*, official publication of the Santa Clara County Citizens Radio League, has forwarded us one of the neatest-looking CB club papers we've read while at this desk. The illustrations jump out and "grab" you; the articles are well-written and interesting. Comparing one part of the paper in particular with some we've seen, *Break-Break* just won the National Spelling Bee! Rosalind states that club membership totals 80 at present. Current projects for the clan include the formation of a Volunteer Emergency Communications (V.E.C.) unit, association with Civil Defense, and increasing membership.

The Athens Contact Club of Athens, Ga., has made up a "travel packet" to be presented to mobile units passing through town. The packets contain QSL cards from all the club members, a copy of the 10-Code, a Georgia road map showing the call letters of various CB units throughout the state, historical information on the city of Athens, and a city street map with all of the members' addresses marked. The packet may be obtained from any member's "transmitter site!" You can't get any more hospitable than that!

The Delaware County Citizens Radio League of Havertown, Pa., dates back to November, 1959. Present officers are: Jack Coleman, 3W3207, president; Charles Matson, KCC3207, vice president; Ray Cox, 3Q0175, treasurer; Frank Howerd, KCC-1169, secretary. The group meets on the second Thursday of each month and they have an Emergency Patrol and a club newspaper—the *Citizens Broadcaster*. (So send us one, Charlie.)

Membership is now open for CB'ers in



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the Oregon Citizens Band Association, 13633 S. E. Stephens Place, Portland 33, Ore. This group participates in several events throughout the year, meets on the first and third Thursday of each month. Interested parties should contact Chester A. Mumper, secretary, at the address above.

The CB-Aires meet on the third Thursday of each month at Rathskeller of Hamiltonian in the Federal Savings and Loan Building, St. Louis, Mo. More information regarding this group may be obtained from Michael D. Kersulov, 722 Brookridge Drive, Webster Groves 19, Mo.

That does it for now! Keep the news, the pictures and the club papers coming.

I'll CB'ing you,

—Matt, 18W4689

Inventors Quiz Answers

(*Quiz on page 67*)

1 - F John Bardeen, Walter H. Brattain, and William B. Shockley invented the point-contact transistor in 1948.

2 - J Lee De Forest invented the grid Audion, the first practical three-element amplifier tube, in 1906.

3 - E Thomas A. Edison invented the cylinder phonograph, the forerunner of the modern record player, in 1877.

4 - I Michael Faraday discovered the principle of the electric motor in 1821, and of the transformer in 1831.

5 - H Benjamin Franklin invented the lightning rod in 1750.

6 - G Jules A. Lissajous first observed the combination of two waveforms now called "Lissajous figures" in 1857. The effect is often seen when using the modern oscilloscope.

7 - B Wilhelm K. Roentgen first observed the effects of "Roentgen rays," or X rays, in 1895.

8 - C Edward Weston invented the Weston cadmium cell in 1893. It is still in worldwide use as a standard of electromotive force or voltage.

9 - A Sir Charles Wheatstone first demonstrated the bridge circuit that now bears his name in 1843. It was originally devised by Samuel H. Christi in 1833.

10 - D Hidetsugu Yagi developed his directional, parasitic element antenna in Japan in the early 1920's.

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The Lightning Bug

(*Continued from page 73*)

"Turn off the flashlight!" Carl shouted.

She obeyed, and instantly the "animal" seemed to die in its tracks.

Jerry turned the headlights back on once more, and they all got out and joined Jodi. As the weird creature headed back toward the car, Carl fearlessly picked it up and did something to it that seemed to quiet its snapping and flashing.

Standing around the object in the light from the automobile, the girls saw that it was crudely shaped like a huge lightning bug. The body of the "bug" was some 30 inches long and a foot high, and tucked down out of sight under the body were three small rubber-tired wheels. The rear two were on a straight axle, but the front one swiveled. Most of the mechanical creature was made of painted plywood, but the back lower half was constructed of translucent plastic. Carl lifted off the top to show the girls a couple of small electric motors operating through gear trains and belts to drive the two rear wheels. There were also some six-volt lantern batteries and a few other electronic parts wired together.

"Tell us how it works," Jodi said, obviously impressed by the device.

"Well," Jerry began, "both rear wheels are driven by a separate PM, high-torque motor. They don't draw much current, and they're geared way down so they don't have much work to do."

"But what makes that thing come after you when you shine a light on it?" Thelma asked.

"These two 'eyes' here on the head that look sort of like glass-topped power transistors are actually special-type photocells whose resistance varies with the amount of light falling on them," Jerry explained.

"The right eye is in series with a lead to the motor driving the left wheel, and the left eye is in series with a lead to the motor driving the right wheel. Each eye 'looks' toward the side as well as straight ahead because they're mounted at a forty-five degree angle. If light comes

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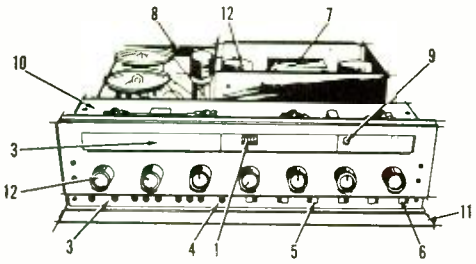

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from the right, the resistance of the right eye drops, and the left-hand motor starts up and turns the bug toward the light. When it's facing the light, both eyes receive the same amount and the two motors make it move straight ahead. As more and more light falls on the photocells, the faster the motors run."

"Aren't photocells only supposed to carry tiny currents?" Jodi asked. "I don't see how you can run the motors."

"This brand-new LDR-25 Power Photocell developed by the Delco Radio Division of General Motors at Kokomo, Indiana, is the only one I know of that will carry the kind of current needed," Jerry answered. "When you mount one on a heat sink, it'll dissipate twenty-five watts without any trouble. It's nonpolarized and handles d.c. current up to half an amp, and a.c. or d.c. up to two hundred volts.

"In the dark, its resistance is half a meg, but it falls to four hundred ohms with ten foot-candles of light, to eighty ohms at a hundred foot-candles, and to fifteen ohms at a thousand foot-candles. I tried putting a little NE-two-H neon lamp right up against it, and the resistance dropped to seventy-five ohms!"

"What sort of things can you use it for?" Thelma wanted to know.

"Almost any kind of photocell control circuit handling up to forty watts," Jerry replied. "It can be hooked in series with a small a.c. motor of the type used on food mixers or electric sewing machines, and the speed of the motor can be varied continuously just by regulating the amount of light falling on the cell."

"I suppose we could make the cell even more sensitive by using a lens to concentrate the light," Carl suggested.

Jerry shook his head. "That's not a good idea with this cell. The active area is about nine-tenths of a square centimeter, and all of this should share in the heat dissipation. A lens would concentrate the current and the heat in a small portion and might damage that spot even though the total heat dissipated was below twenty-five watts."

"Are these cute little antennae that curve down and back from below each eye just for looks?" Thelma asked.

"No, those are really fiber-optic rods made up of bundles of very thin glass

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fibers treated so that they can conduct light just like a wave guide conducts radio waves. The rods are curved so light coming from angles at the rear of the bug will be conducted to one or the other of its eyes and make it wheel around. A snapper working off the wheels makes the clicking sound. It's just for effect. So is the pulsing light shining through the plastic. A light-blinker inside is turned on by a relay in series with the com-

mon battery lead so it comes on when either motor is drawing current. The lantern batteries are hooked in series to produce twenty-four volts for the motors. That's about all there's to it."

"I think it's wonderful," Jodi exclaimed. "Boy, will it scare those pledges to death tomorrow night, especially since it's Halloween!

"On the way out to that old barn where we're holding the initiation we'll talk about the battle between man and insects and how super-insects born of resistance to insecticides and mutations caused by atomic radiation may even now be lurking in dark corners ready to attack."

"Then we'll send them into the old barn to make sure it's safe for the rest of us to come in," Thelma broke in. "The Lightning Bug will be there waiting in a dark corner for their flashlight to bring it to life. It still scares me, even though I know how it works. I can just imagine what it will do to them in that dark, cobwebby old barn."

"We'll be sure not to arrive before ten o'clock," Jodi promised. "That will give you boys plenty of time to set up the Bug and get out of there before we send in the pledges."

NINE o'clock the next night found Carl and Jerry walking across a field toward the old deserted barn that stood beside the charred ruin of what had been a house. While a road ran past the ramshackle building, the boys decided it would be wiser to park in a lane down the road and walk back. The weather was still warm, but a strong damp wind was blowing gustily from the south, and now and then a fast-flying cloud scudded across the face of the full moon just coming up over the horizon.

Carl and Jerry let themselves into the dark, musty-smelling barn through a door whose rusty hinges squeaked with a spine-tingling sound right out of a Class-B horror movie.

"I've seen cozier places," Carl muttered as he played his flashlight around over the dusty floor and the rotting harness hanging on pegs beside the empty stalls. "What say we put the Bug right over there in that corner? The girls will be sure to shine their light there, and when the Bug starts moving it will seem like it's trying to cut off their exit through the door."

"Sounds good to me," Jerry agreed. "Let's hurry up and get out of here. This place gives me the creeps."

He held the flashlight while Carl carefully arranged the Bug in the corner and swept away the straw in front of it so that the rubber wheels would have good traction. Just as he finished, Jerry abruptly turned off the flashlight and whispered hoarsely, "Someone drove up in a car! Do you suppose it's the girls already?"

"I don't know, but we've got to get out of sight or we'll spoil the whole thing. Let's climb up in the hayloft until we see what gives."

Guided by the moonlight shining through cracks in the side of the barn, Carl led the way up a rickety ladder he had spotted when they first entered. Jerry was right behind him.

They barely had time to stretch out on the floor of the empty hayloft and wipe the cobwebs off their faces when the screeching hinges of the door announced the arrival of company. Peering down through wide cracks in the floor, the boys could make out the restless beam of a flashlight and two shadowy masculine figures.

ARE YOU sure this is the barn you heard Thelma talking about, Roger?" a voice asked.

"Sure I'm sure. I just want to look it over a bit, and then we'll park the car down the road and come back. Sid, we're going to give those girls a scare they'll never forget, and I don't mean just the pledges! Let's take a look up in the hayloft. That's where we'll hide when the girls get here."

In the darkness Jerry could *feel* Carl's head turn toward him questioningly, but he never had to make a decision. The wandering spot of light below fell on the Lightning Bug, and it immediately came to life. Flashing its tail, snapping menacingly, it crawled out of the corner straight toward the frozen boys.

"Wh—wh—what's that?" Sid quavered. edging toward the door.

"I don't know, but don't leave me here with it," Roger, who held the flashlight. begged as he circled out of the way of the relentlessly approaching machine. His dodging did no good. for the Bug followed every move of the flashlight.

"It's getting mad . . . its tail is flashing faster and its teeth are snapping worse! I think it's getting ready to spring!" Sid shouted from the open doorway.

Roger had backed into a corner directly beneath the boys. As the light grew brighter on the photocells. the motors speeded up and the Bug seemed to be literally lunging at the horrified youth. He gave a scream of pure terror, dropped his flashlight, and made a great leap over the attacking machine. There was a wild scramble of feet on the gravel outside, and then a car motor started and roared off into the night.

Carl and Jerry, peering down through the hole in the hayloft floor, saw the Lightning Bug crawl to the still-burning flashlight and then stop as the shadow of its own body cut the light off from the photocells.

The boys scrambled down and placed the Lightning Bug back in the corner to await the arrival of the girls. Then they walked to their car and started toward the campus. They had gone only half a mile when two cars, headed in opposite directions but stopped side by side in the middle of the highway, blocked their way. In one car were Jodi,

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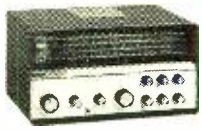

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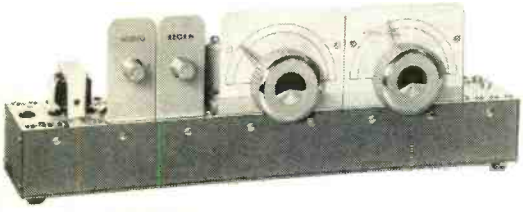

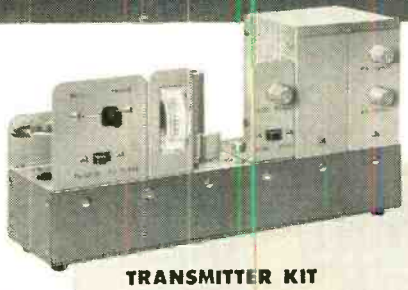

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*AOR-41 uses a tuned rf circuit with 6BA6

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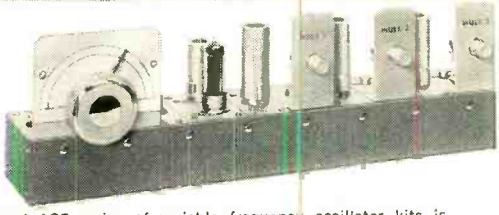

VFO KITS

The International AOF series of variable frequency oscillator kits is available in three versions. For example, the AOF-91 kit is a complete driver unit to be used with 6 meter and 2 meter transmitters. Approximately .5 watt of power is available on both bands. Tube lineup: 6BH6 oscillator, OB-2 voltage regulator, 12BY7 buffer-amplifier/multiplier. Shipping weight: 5 lbs.

Kit	Frequency	Price
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AOF-90	VFO 8 mc — 9 mc plus buffer multiplier and 6 meter output	29.00
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Thelma, two sorority sisters, and two wide-eyed pledges. Roger and Sid were talking earnestly to them.

"I tell you," Roger said to Thelma and Jodi, "you're crazy to go into that old barn. It's infested with some kind of horrible rats as big as Shetland ponies, and—I know this sounds kooky—but their tails light up. One attacked us not more than twenty minutes ago, and we were lucky to get out alive. I wouldn't go back there for a guaranteed six-point-zero index for the semester—and believe me I could use it."

"The things have long curving tusks, too," Sid threw in.

Jodie looked questioningly at Carl, who nodded very slightly.

"It's awfully sweet of you fellows to warn us," she said smoothly in her rich Southern drawl, "but membahs of this sorority have to be brave. They really do. Drive on, Thelma."

"I just hope," Carl reflected as he watched them drive away, "that those pledges turn out to be braver than Roger and Sid!" —30—

Short-Wave Report

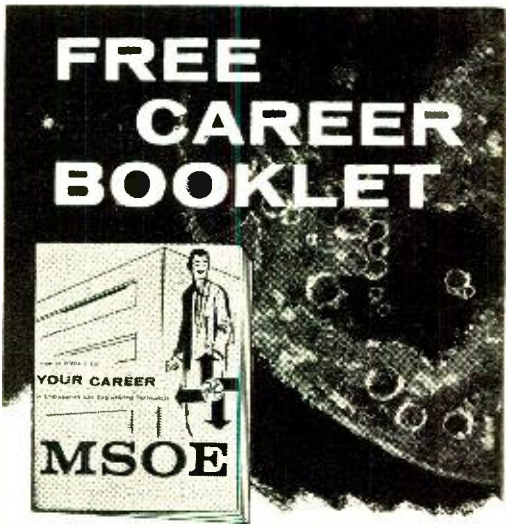
(*Continued from page 78*)

but we have seen serious lightning strokes even during a heavy snowstorm.

Make sure that your antenna is properly guarded by the correct installation of a lightning arrestor—these gadgets, available at any hardware store, are extremely inexpensive, and the protection they afford far outweighs the cost.

Club News. We recently received sample bulletins from two of the newer radio clubs, one being the bulletin of the Canadian International DX Club. The activities of this group are now centered in and around the Winnipeg-St. Charles area but they hope to expand operations soon. Their publication covers the SWL, ham, and medium-wave bands, and runs around 14-18 pages; a sample can be obtained for 10 cents from Jim Rzadkiewicz, 112 Hespeler Ave., Winnipeg 5, Manitoba. Membership dues are $3.00 yearly.

The second bulletin is from the Kentucky DX'ers Association. Published in conjunction with Browning Laboratories, Inc., Laconia, N.H., this bulletin consists of four legal-



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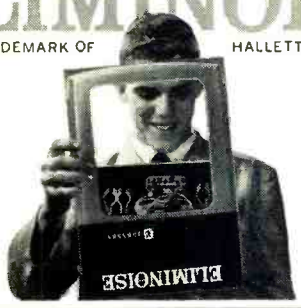

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sized pages and primarily covers SWL'ing, but does include a few items on the medium waves and card swapping. The price is 20 cents per copy. Further details can be obtained from David Reed, WPE4FCL, 546 Pond Run Rd., Raceland, Ky.

In listing various new clubs in this column, please keep in mind that we cannot assume any responsibility for their future. We can only give you the facts as they are presented to us. Many new clubs spring up from time to time, and within a few months most of them silently fold up or wither away. The reader is strictly on his own if he wants to join one of the newer groups.

On the other hand, the small clubs need your support. Two of the small organizations that have made the "big time," largely through excellent leadership, are the Canadian DX Club and the American SWL Club. Should you see fit to join a new club, do so, by all means; and then give them all the help and support you can.

Current Station Reports

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

Argentina—*Radiodifusion Argentina Al Exterior*, Buenos Aires, is scheduled to Eastern N.A. at 2000-2300 (Eng. from 2200) and to Western N.A. at 2300-0200 (Eng. from 0100) on 9690 kc. Their General Service is listed as 1400-2000 on 11,730 kc., 1400-1700 on 6090 and 11,780 kc., 2000-0200 on 11,730 kc., and 2100-0200 on 6090 kc.

Bahamas—DX'ers needing this country might try for the commercial telephone stations that operate around 4500 kc. Noted within a short time were: ZSM2, Nassau; ZSM3, Morse Island; ZSI, Spanish Isle; ZSQ6, Nassau; ZSQ4, Normans Cay; ZSH6, Rose Island; and ZSK5, Alvins Cay.

Bolivia—*R. San Jose*, Casilla 314, Oruro, 5872 kc., is back on the air with a Philips xmtr and asking for reports. It has been noted as early as 1715 in Spanish to around 2130, but later on Saturdays. Station CP74, *R. Indoamerica*, Potosi, is noted on 4786 kc. with frequent ID's and Spanish commercials from 2117 to 2158/close. Station CP75, *La Cruz Del Sur*, La Paz, 4985 kc., has Eng. at 2130-2200 but c.w. QRM is usually heavy.

Brazil—The correct call for *R. Guarani*, Belo Horizonte, 6175 kc., is PRH6; a 24-hour station, it is listed at 10 kw. power, and verification is by registered airmail. Station

ZYR60, *R. Cultura de Araraquara*, Sao Paulo, 4915 kc., is heard well from 0300 s/on with music, ads, and local Portuguese news. A new outlet on 4855 kc. is either *Radiodifusora de Bahia* or *Emissoras da Bahia;* this one has been tuned from 0330 s/on to 0430 fadeout.

British Honduras—A *VOA* Eng. newscast is given over *R. Belize*, 3300 kc., at 2200-2215.

Cambodia—*R. Cambodge*, Phnom Penh, is heard on 17,705 kc. at 2055-2130 with news in Eng. at 2100, news in French at 2115.

China—The latest Eng. schedule from Peking reads: to United Kingdom and W. Europe at 1400-1500 on 6210, 7080, 9457, and 11,650 kc. and at 1530-1630 on the same channels plus 9595 kc.; to Eastern N.A. at 2000-2200 on 9480, 9945, 11,945, 11,975, and 15,095 kc.; to Western N.A. at 2200-0000 on 9457, 11,715, 11,820, 15,060, and 17,745 kc.; to Australia and New Zealand at 0330-0530 on 9945, 11,650, 15,060, and 17,835 kc.; to S.E. Asia at 0700-0800 on 9480, 11,685, 11,800, and 15,060 kc.; to Ceylon, India, Nepal, and Pakistan at 0900-1100 on 7350, 9480, 11,685, 11,740, and 15,140 kc.; to Africa at 1100-1300 on 7350, 9775, 11,705, 12,055, and 15,095 kc., at 1300-1400 on 6125, 7350, 9595, 9785, and 12,055 kc., and at 1630-1730 on 5950, 7480, 9570, and 11,980 kc.

Colombia—HJLB, *La Voz de Tolima,* Ibaque, 6040 kc., was heard at *noon* local time (in Iowa—Ed.) with a readable signal. *La Voz de Llano,* Villavincencio, 5950 kc., was noted from 2015 to 0000 s/off (at times to past 0100 with special events) with Latin American programs and Spanish ads; listed as HJIQ, the on-the-air ID is definitely HJIK.

Comores Island—*Radiodiffusion Francaise,* Dzaoudzi, 7260 kc., has s/on daily at 2200 in French, and is heard only until about 2240 when London signs on in Russian. It can be heard again after 2300 with news in French and at 2315 with music.

Congo (West)—A new frequency for Brazzaville is 9675 kc., heard from 1545 to 1601 s/off with music and anmts in French.

Denmark—Copenhagen's xmsns to N. & S. Africa have been reversed and now read: to N. Africa and Middle East at 1445-1545, to S. Africa at 1330-1430, both on 15,165 kc. All other xmsns remain unchanged including the ones to N.A. at 2030-2130 and 2200-2300 on 9520 kc.

Ecuador—*R. Internacional,* Quito, is a new outlet operating on 10,136 kc. (heard) and 19,615 kc. (not heard) with usual Latin American programming around 1800; no commercials were noted. Station HCJA5, *R. La Voz del Tarqui,* Cuenca, 3995 kc., has a request program in Spanish from 2337 to past 0115.

Ethiopia—*R. Voice of the Gospel* (ETLF-?) Addis Ababa, 15,410 kc., has news at 1430; s/off at 1454, after request for reports to P. O. Box 654, Addis Ababa.

France—Paris has terminated all of its Eng. programs "as an economy measure." The French lessons and the Far Eastern Service will continue as before.

Ghana—The Eng. schedule that appeared in the June issue is still intact. However, your Short-Wave Editor omitted the following two Eng. xmsns: to W. Africa at 1500-1545 and 1630-1715. (The 1545-1630 broadcast is in French.) Reports go to Propagation Engineer, Ghana Broadcasting Corp., P. O. Box 1633, Accra.

Guinea—Conakry is noted on 9650 kc. at 1530 with news in French and at 1545 with African instrumentals. It is also heard on 3375 kc. from 0130 in English.

India—*All India Radio,* Delhi, has Eng. to S. E. Asia at 1930-1940 on 9765, 11,785, and 15,125 kc.; to E. Africa and Mauritius at 2330-2340 on 15,130, and 17,855 kc.; to N. E. Asia at 0500-0600 on 11,710, 11,730, 15,105, 15,290, and 17,855 kc.

The U. S. Information Agency has announced an agreement to build a *VOA* relay station in Calcutta, rated at one million watts. The U.S. will broadcast for five years to S. E. Asia, after which the station will be turned over to Indian officials. No frequency was given.

Iraq—*R. Baghdad* is again broadcasting at 1530-1600 in French, to 1630 in German, and to 1700 in Eng. on 6030 and 6095 kc.

Lebanon—Beirut has been noted on 15,175 kc. with news in Spanish at 1600 and s/off at 1618. English to N.A. is broadcast on 11,770 kc. at 1630-1645; Arabic and French follow to 1715.

Malaya—*R. Malaya,* Kuala Lumpur, 7200 kc., is noted in England in Eng. with the Home Service around 0500. There is considerable QRM from *R. Australia* on 7190 kc.

Martinique—Try for Fort de France on 4895 kc. at 1700-1800 in French with dance music;

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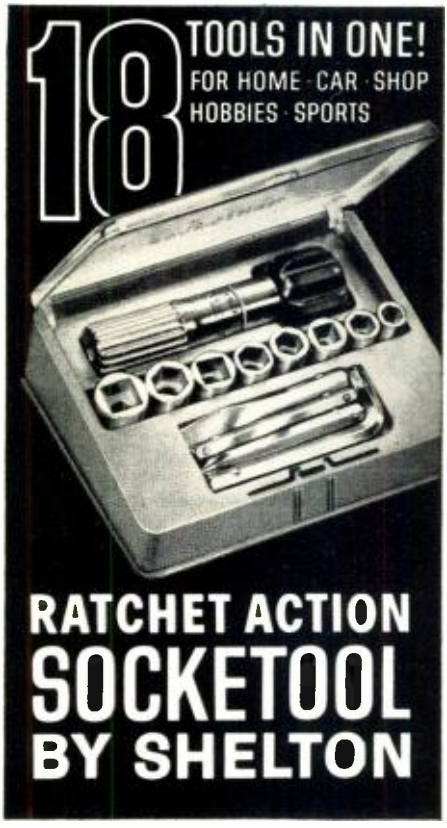

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SHORT-WAVE ABBREVIATIONS

anmt—Announcement
c.w.—Morse code
Eng.—English
GMT—Greenwich Mean Time
ID—Identification
IS—Interval signal
kc.—Kilocycles
kw.—Kilowatts
N.A.—North America
QRM—Station interference
R.—Radio
s/off—Sign-off
s/on—Sign-on
VOA—Voice of America
xmsn—Transmission
xmtr—Transmitter

the 3315-kc. outlet is also noted around 3315 with generally better signals than on 4895 kc.

New Guinea—A verification lists the new outlet on 5015 kc. as being VLT5; no schedule is given but presumably it is the same as on VLT6. Another new outlet is VLK3, 3925 kc., 10 kw., scheduled Sundays to Fridays at 0200-0930 and 1500-1700 and Saturdays at 0200-0900 and 1530-1700. It was heard in Iowa fighting it out with and eventually winning over JOZ2, Japan, at 0330-0430.

Peru—Among the stations being heard are: OAX4Q, *R. Victoria*, Lima, 6010 kc., to 0100 with music and ads; OAX6S, *Onda Popular*, Lima, 6260 kc., also to 0100 with music and ads; *R. Progresso*, Piura, 5910 kc., to 0100 (they play the "Happy Birthday" song and the "Anniversary Waltz" nightly at 2359); *R. Cuzco. La Voz de la Capital Arqueologica de America*, 6250 kc., with Latin American programs and many ads to 2100, then a 'live' audience musical show; and OAX5V, *R. Villarica*, Huancavelica, 4943 kc., at 2207-2250 in Spanish but heavily QRM'ed by HCXZ1, Ecuador, and ZYE23, Brazil.

St. Pierre & Miquelon—*Radiodiffusion Television Francaise* operates a medium-wave outlet on 1375 kc. with 1 kw. that has been heard in the northeast. The schedule: Mondays, Tuesdays, Wednesdays, and Fridays at 0500-0700, 1000-1130, and 1630-2000; Thursdays at 0500-0700, 1000-1300, and 1630-2000; Saturdays at 0500-0700, 1000-1300, and 1600-2100; Sundays at 0500-1300 and 1630-2100. The ID is generally given in both French and English.

Surinam—Paramaribo, 15,465 kc., is noted around 1935 with Eng. pop music and Dutch anmts. An ID in Dutch at 1954 was followed by more pop music, news in Dutch at 2001.

Thailand—Bangkok is scheduled to N.A. at 2315-0015, to Thai Forces in Korea, Vietnam, and Cambodia at 0430-0520, in the General Overseas Service at 0525-0657, and with a Home Service relay at 0800-0900, all on 11,910 kc. Additionally, the N.A. service and the General Overseas Service are also carried on 7305 and 6160 kc. National Home Service programs in Thai are given at 1900-2000 and 0700-1030 on 4830, 6070, 7305, and 11.910 kc. Other xmsns: Laotian at 2005-2310 on 4830 kc.; Chinese at 2130-2145 on 6097 kc.; French (Monday to Friday) at 0030-0100 on 11.910 kc.; Malay at 0130-0145 on 4830 kc.; and Laotian at 0800-0830 on 6097 kc.

U.S.A.—According to the American Shortwave Listeners Club, the *VOA* has set up a mobile station near Yuma, Arizona, and is operating at 1400-1530 on 15,350 kc., and at 1530-1700 on 11.760 kc.

U.S.S.R.—*R. Yerevan*, Armenia, broadcasts to Armenians in N., S., and Central America on Saturdays and Sundays at 1430-1530 on

11,850 kc.; there is some Eng. during this period. Another Russian station, on 12,030 kc., is noted from 1700 s/on. The regular Moscow IS is given at the opening but an IS given during the program differs from that used in the Home Service. Apparently not a Pacific Coast Siberian station, this one may be in use for a special xmsn to Russians in Cuba.

Vatican City—The latest English schedule from *R. Vatican* reads: to N.A. daily at 1950 on 7250 and 9645 kc.; to E. Africa daily at 0500 and to S. and Central Africa daily at 0520, both on 17,735 and 21,490 kc.; to Australia and New Zealand at 0630 daily on 15.120 and 17,840 kc., and at 1700 on 9645 and 11.740 kc.; to the British Isles daily at 1000 on 9645, 11,740, and 15.120 kc. and at 1315 on 7250, 9645, and 11.740 kc.; to India, Pakistan, and Ceylon on Mondays, Wednesdays, and Saturdays at 1100 on

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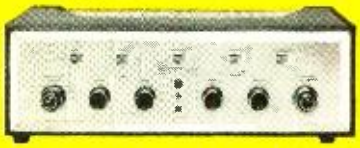

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Vietnam (North)—Hanoi has Eng. from 1029 to 1057/close on 15,100 kc. News is given at 1030.

Windward Islands—A new frequency for St. Georges is 11,730 kc., noted in dual to 3280 kc. at 2000-2115. A newscast is given at 2100.

Clandestine—*World Radio TV Handbook* reports that an unidentified station on 11.400 kc. is *Radio Peyk e Iran*, which broadcasts in languages of the Near East on 9559, 11,410, and 11,696 kc. No times were given. This station is believed to be in the German Democratic Republic. —30—

Transistor Topics

(*Continued from page* 76)

The battery drain, according to Melvin, is quite low and, since the batteries are used only intermittently, their operating life should approximate normal battery shelf life.

Transitips. Base bias is perhaps the most important single factor affecting transistor operation. With incorrect bias, a transistor oscillator may fail to operate or may deliver a very distorted output signal—an amplifier may be completely "dead," be weak (have low gain), or may distort the amplified signal. Where power transistors are used, incorrect bias may not only cause poor operation but, under some conditions, may cause the transistor to overheat and even burn open.

A number of years ago, when the transistor was still relatively new, it was common practice to use a separate battery to supply base bias. Today, a single power supply is generally used for both collector and base current. Any of several techniques can be employed to supply the base bias, depending on circuit requirements and intended application.

As far as hobbyists and experimenters are concerned, the most popular biasing method is the use of a series resistor between the base and the power supply, as illustrated in Fig. 3 (A). Here, base bias is supplied by *B1* through series resistor *R1*. Resistor *R2* is *Q1*'s collector load, which in some circuits is replaced by a relay, coil, or transformer primary winding.

The series technique, while inexpensive and effective, has one serious disadvantage: it is extremely sensitive to temperature variations. If the ambient temperature rises, the transistor's internal base-emitter resist-

ance drops. This in effect reduces the total resistance in the bias path and thus increases the bias current. In some cases, an increase in bias current leads to internal heating due to the resulting increase in emitter-collector current and this, in turn, increases the bias current still more.

In order to reduce the effects of temperature variations on bias currents, many designers supply base bias through a voltage divider network, as illustrated in Fig. 3 (B). Here, the base bias is determined by the relative values of voltage-divider resistors *R1* and *R2*. Since *R2* shunts *Q1*'s base-emitter circuit, it tends to minimize changes in over-all base-emitter resistance with

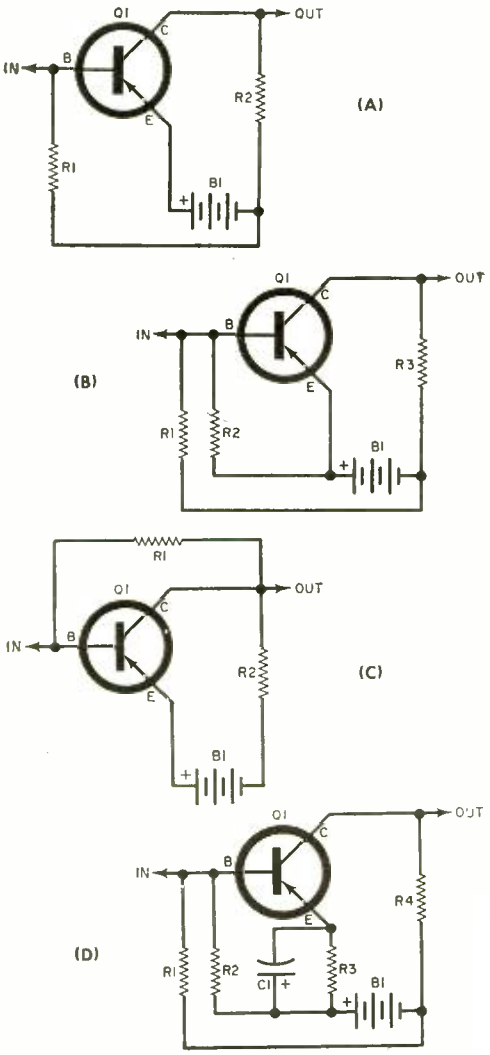

Fig. 3. Methods of supplying base bias: (A) series technique; (B) voltage-divider network; (C) collector feedback; and (D) emitter-compensated bias.

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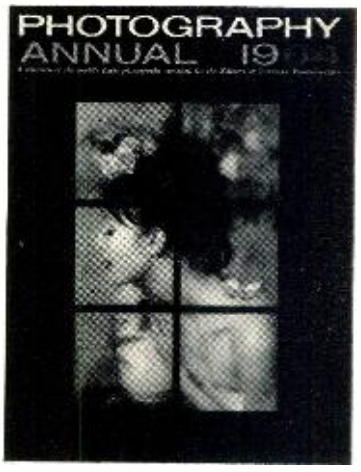

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changes in temperature and thus to stabilize the base bias.

Another technique for stabilizing the base bias is shown in Fig. 3 (C). Here, base bias is fed back from the collector through series resistor *R1*. If there is a tendency for collector current to increase, the voltage drop across the collector load (*R2*) increases, reducing the d.c. voltage available for bias and thus the base bias current. This, in turn, reduces collector current and tends to return it to the designed value.

The collector feedback technique has one disadvantage. The amplified a.c. signal as well as the bias current is coupled back to the base. Since this signal is of opposite polarity when compared to the input signal, it reduces the effectiveness of the input signal and thus stage gain. However, it is an excellent biasing technique where maximum gain is not needed, for the inverse (a.c.) feedback introduced stabilizes over-all operation, reduces distortion and, in general, extends the circuit's frequency response.

Where maximum stage gain coupled with maximum bias stability is needed, the technique shown in Fig. 3 (D) is often used. Here, a voltage-divider bias network, *R1-R2,* is used in conjunction with a series emitter resistor, *R3,* bypassed by a large capacitor, *C1.* In operation, the base bias established through *R1-R2* is offset by the d.c. voltage drop across *R3* which, in turn, varies directly with emitter-collector current. If collector current tends to increase, as with increasing temperature, the voltage drop across *R3* also increases, reducing the base bias current and restoring collector current to its design value. The bypass capacitor, *C1,* serves as a "short" for a.c. signal currents and thus prevents inverse feedback, permitting the stage to operate at maximum gain.

The emitter-compensated bias method is perhaps the most popular of these four techniques for industrial and commercial equipment, but is the most costly, for it requires the most components per stage.

In summary, if a proven transistor circuit fails to work properly, and all components check "good," one of the first steps should be a check on the base bias current. If necessary, the base bias can be readjusted experimentally for optimum performance. Where a circuit works well on the workbench, but fails to operate under field conditions (outdoors, for example) where different temperatures are encountered. it may indicate the need for a compensated biasing method, such as those illustrated in Figs. 3 (B), (C) and (D).

That concludes our semiconductor story for this month. Adios, amigos . . .

—*Lou*

C Bridge

(*Continued from page 66*)

needed for mounting the parts. Note that in the unit shown the transformer, line fuse, and a neon pilot lamp (optional) are all mounted in one end of the box, with all connections for the null detector at the opposite end. One of the two terminal strips is mounted near the center of the box lid, and supports *D1*, *R1*, and the common ends of capacitors *C1*, *C2*, and *C3*. Use a heat sink when soldering *D1*.

Standard capacitors *C1* and *C2* can be bought in 10%, 5%, 2%, or even 1% tolerance. The 5% tolerance is recommended for *C1* as the best compromise in price and accuracy. For *C2*, the saving for the 10% tolerance may be enough to be worthwhile. Capacitor *C3* is actually made up of two small 25-w.v.d.c. electrolytics in parallel. This was necessary in order to bring *C3* to within the desired 5% accuracy, since ordinary electrolytics are not made to close tolerances. The writer found that two Sprague Type TE capacitors marked 6 and 2 μf. totalled 10 μf. when paralleled.

An optional neon pilot lamp was included in the writer's unit. If you wish to add this feature, connect a plastic-encased NE-2A (or similar) neon lamp in series with a 200,000-ohm, ½-watt carbon resistor across the primary of transformer *T1*.

Calibration. The C Bridge is calibrated by connecting known values of capacitance across the "unknown" binding posts, adjusting potentiometer *R2* to the null point, and marking the position of the knob pointer with the value of the known capacitor. To do this, connect the null detector by plugging it into the appropriate jacks (*J1*, *J2*, or *BP3* and *BP4*), and plug the C Bridge into the a.c. line.

You can use high-impedance phones, a VTVM, or best of all, an amplifying type a.c. VTVM as the null detector. The higher the impedance and the greater the sensitivity, the better. If you have only headphones, the "Phone-Boost" (see page 55) will greatly increase the accuracy of measurement. -30-

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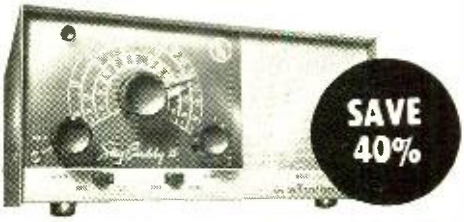

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Across the Ham Bands

(Continued from page 72)

dividual contacts were made between the six Air Force, Army, and Navy stations (AIR, WAR, NSS, AG6AA, A6USA, and NPG) operating on regular military frequencies, and radio amateurs operating on amateur frequencies.

In addition, 654 perfect copies of the message from the Secretary of Defense, Robert S. McNamara, to radio amateurs sent on c.w. at a speed of 25 wpm were made, as well as 583 perfect copies of the radioteletype (RTTY) message. Four Novices, KN1YRP, WN4LUO, WN5ERR, and WN9GQC, were among those who copied the c.w. message perfectly!

News and Views

Robert C. Garceau, KN1YRP, 241 Providence St., Putnam, Conn., really must have concentrated on his code practice; after six months as a Novice, he recently took his General Class exam with an ARRL 30-wpm code certificate on the shack wall! On the air (mostly on 80 meters), his Heathkit HX-11 transmitter running 50 watts, Hallicrafters S-120 receiver, and dipole antennas ran up 200 contacts in 24 states. Bob rates the state of Washington worked on 80 meters as his best DX. . . . **Steve A. Corbitt, WN4KXC,** 4055 Three Notch Rd., Rt. 2, Mobile, Ala., is a 40- and 15-meter man. With five months to go on his Novice ticket, he has 48 states and 10 countries confirmed—he is still waiting for QSL cards from another 13 countries to show up in his mail box. A Heathkit DX-60 transmitter agitating a 40-meter dipole antenna, 40′ high, and a Hallicrafters SX-110 receiver are his secret weapons. . . . **John Zuris, WN9ICQ,** 11412 So. Maplewood Ave., Chicago, Ill. 60655, reversed the usual belief that it is easier for a beginner to make contacts on 40 or 80 meters than on 15 meters by spending six weeks on 40 meters without making a single contact. Then he went on 15 meters, and presto! In two weeks, he worked 20 states, Canada, Panama Canal Zone, Corsica, and Vashman Island in the Irish Sea. An EICO 720 transmitter pushes his signal out through a 40-meter dipole surrounded by rain gutters, and a Knight-Kit R-100 receiver handles the incoming signals.

Are you among those hams who think there's no DX to be worked on the 40-meter Novice band? Well, **Jim Hartwell, K7UDG,** Chief Op. at DL4IZ in Germany, has news for you. Jim has heard U.S. Novices in most call areas regularly on 40 meters, and he has called many, as well as "CQ WN KN"—all in vain. As DL4IZ has a power of 500 watts feeding a beam antenna 90′ high and has no

trouble working U.S. Generals, Jim is certain the trouble is that Novices just don't listen for DX outside the Novice band (he generally uses 7145 kc. when calling Novices). Ivor, VK3XB, had the same trouble in Australia a few years ago, but when word got around that he was hearing and calling Novices on 7149 kc., Ivor worked 7-mc. Novices in all 50 states! Unfortunately, Jim will probably be back home at K7UDG by the time you read this, so he won't have a chance to work you from DL4IZ. But all is not lost. **John Stone, DL4ZF,** will be on 40 meters almost every night until next summer looking for Novices. In turn, look for John around 7145 kc., usually between 0100 and 0500 GMT (8:00 p.m. and midnight, EST).

Marty Kapp, WN2DYV, 16 Largo Lane, Livingston, N.J., is a busy ham. He works 80, 40, and 15 meters using a Lafayette HE-30 receiver and a Heathkit DX-40 transmitter feeding separate antennas for each band. He has logged 43 states and five countries on these bands. On two meters, Marty uses a Heathkit Twoer feeding a "home-brew," 5-element beam for local rag-chews. When not hamming, Marty SWL's as WPE2ICT. . . . If you still need a Nevada contact for your worked-all-states (WAS), **Norm Thompson, K7LWK,** and **Tony Morgan, K7TRG,** will be glad to arrange skeds. They can nominate you for the Rag Chewers' Club, too. Write them at 925 Mezpah St., Las Vegas, Nevada. . . . **Tom Barker, KN7SWX/WPE7BPN,** 5613 North 12th St., Phoenix, Ariz. 85014, uses two "ionosphere agitators," a Heathkit Apache—crystal-controlled and held down to 75 watts—and a Heathkit DX-40. He receives on a Hammarlund HQ-170C, and alternates between an 80-meter doublet, a Hy-Gain 14-AVS vertical, and a home-brew 15-meter beam. Forty-eight states and 48 countries confirmed and 761 QSL cards on hand indicate that everything, including the operator, is working properly.

Eric Keener, WN6EST/WPE6EJQ, 719 Bungalow St., El Segundo, Calif., finds a home-built crystal calibrator a big help in spotting frequencies on his Hallicrafters S-120 receiver. He transmits with a Heathkit DX-60 via a coaxial dipole antenna. . . . **Tom Cote, WN81BO,** 1807 Long Point, Pontiac, Mich., started out by building his own 30-watt transmitter, and he still uses it more than the 50-watt commercial unit he obtained later. A 40-meter dipole antenna radiates his signal to far places (17 states so far), and a well-aged RME-69 receiver separates the wanted from the unwanted incoming signals. . . . **Walt Hughen, WNØGJZ,** 745 Glenvista Pl., St. Louis 22, Mo., took an Advanced Radio course in summer school, which made it easy for him to "bone up" for his General exam. In a month on the air, his Hallicrafters S-38E receiver, plus Q-multiplier, Heathkit DX-40 transmitter, and inverted-V antenna have racked up 275 contacts in 28 states and Canada.

Remember, *Across the Ham Bands* is your column; so let's see your "News and Views," pictures and comments. Send them to: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana 46401. 73,

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Crystal Super Calibrator

(*Continued from page 54*)

broke," and complete the final assembly, or you can hook everything up on the bench with clip leads and make sure it works before assembling the unit in the box. If it doesn't oscillate, recheck everything, particularly the transistors.

When you're ready, mount the circuit board on the inside of the prepared box cover, taking care to space it clear of the cover with quarter-inch spacers, or with extra nuts on the mounting screws. Put the cover on, and complete the wiring to the battery, on-off switch, and the output binding post. Last, connect the two wires going to the crystal and padder capacitor, put on the second cover, and you're ready to fire up.

Adjustment. To adjust for zero beat with WWV, tune in the 10-mc. transmission (or the 5-mc. signal if you can't hear the 10-mc. signal at your location). Couple the output of the calibrator to the receiver antenna, either directly or through a small capacitor, and fully mesh the padder capacitor plates. Then back off on the padder slowly, listening as the beat note gets lower, until zero beat is reached.

When the frequency difference between the calibrator harmonic and the standard signal gets down to a few cycles, a regular oscillation of the receiver signal strength meter will be seen. This indication is more sensitive than the audible one, and permits adjustment to within one cycle per second or better! If you adjust your calibrator this carefully, the harmonic will be within 15 cycles of the correct frequency, even at 150 mc!

Bear in mind that, while the unit will function with a 1.5-volt, one-cell battery supply, it will also operate on higher voltages (safely to at least 10 volts), and will give commensurately greater output, at some small sacrifice in thermal stability. And you can even use an a.c. power supply running off the receiver heater circuit, as shown in the schematic, if the few milliamperes of battery drain worry you. —30—

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MPX Meter

(*Continued from page 44*)

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Adjustment. Tune to a station you know is transmitting stereo, and adjust the slug of *L1* for maximum meter reading. If the meter "pins," detune the slug until the meter reads about 80 per cent of full scale. Try other stations, and adjust your MPX Meter for the best all-around compromise—a setting that will give satisfactory readings on all stations in your area.

Some jumping of the meter needle may be seen between stations due to the high-frequency noise components present. However, when you are clearly receiving a station, the MPX Meter will either be reading positively, or not at all; there is no ambiguity.

If your meter is transistorized, try to place it in a ventilated spot—not on top of the amplifier or tuner—since there will be increased leakage current if the unit gets very hot.

While there are other types of stereo "beacons"—a light or an audible tone that comes on when a stereo program is being transmitted—all require relatively

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Assemble a Phone-Boost

(*Continued from page* 56)

a 100,000- or 250,000-ohm potentiometer into the circuit, adjust for best results, and measure the resistance with an ohmmeter.

The input resistor, *R1*, is not needed for circuit operation, but is included simply to provide a "d.c. return" when the unit is connected to other equipment. A larger or smaller value can be employed here, or *R1* may be omitted entirely if not needed by the equipment with which the Phone-Boost is used.

Assembly. A can, small box, plastic container, or even a short length of tubing will serve as a housing for the Phone-Boost. The model shown in the photos was constructed in a metal cough-drop box and finished with two coats of enamel.

Carefully solder *Q1* in place, using a heat sink to protect it (a transistor socket can be used if you desire). Battery voltage is not critical, and any battery furnishing 3 to 9 volts will work. A standard phone plug (*PL1*) and open-circuit jack (*J1*) were employed in the author's model as input and output connectors, but other types of connectors—phone tips and jacks, etc.—can be substituted.

The Phone-Boost is easy to use. Simply plug it into your receiver or other piece of equipment and connect a pair of magnetic phones to the unit's output. When the Phone-Boost is not in use, unplug the headphones to avoid a steady drain on the battery. The Phone-Boost's power requirements are low, however, and a fresh battery should give good service for up to a year or more. —30—

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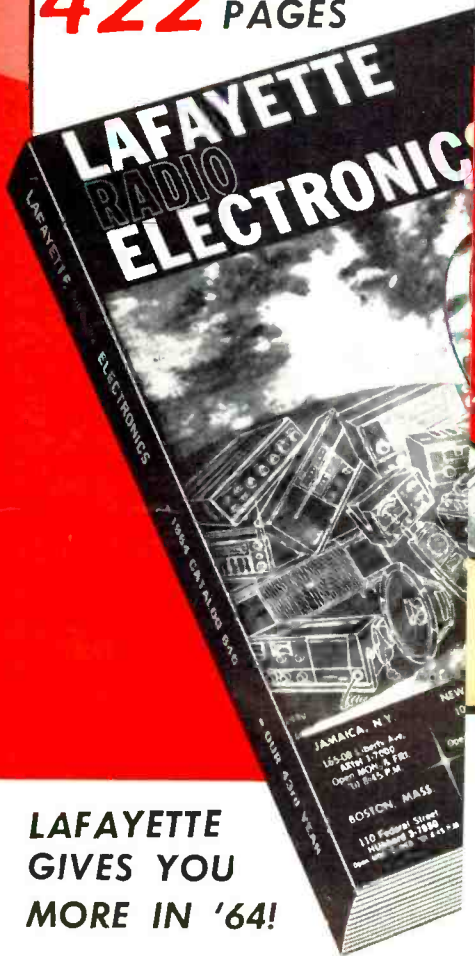

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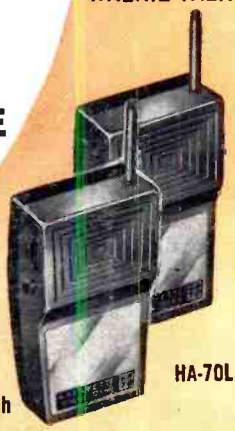

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169.95

(F) LAFAYETTE PROFESSIONAL-TYPE 4-TRACK STEREO RECORDER

(D) LAFAYETTE AMATEUR COMMUNICATIONS RECEIVER

RK-140

(G) LAFAYETTE DELUXE 4-TRACK STEREO TAPE DECK

99.50 less case

HE-30 Wired **79.95**

KT-320 Semi-Kit **64.95**

(A) LAFAYETTE 12-TRANSISTOR "WALKIE-TALKIE" With Squelch

Features separate microphone and speakers for better sending and receiving, positive push-to-talk action and 46" telescoping antenna. May be operated on AC with optional 117VAC power pack. Includes crystals, earphone, leather carrying case, batteries. Imported

(B) LAFAYETTE 3-TRANSISTOR "WALKIE-TALKIE"

Completely Wired—Not a Kit

A terrific little Walkie-Talkie for up to ¼ mile reliable communications. Ideal for hunting, fishing, camping, golfing, etc. Great fun for kids too — at a price even they can afford. Complete with antenna, crystal, battery and plastic carrying case. Imported.

(C) LAFAYETTE 1-WATT 13-TRANSISTOR "WALKIE-TALKIE" With Squelch

10 times more powerful than conventional 100 mw units — with 40% greater range. Uses powerful silicon transistors, automatic noise limiter, push-pull audio output. Plug-in battery case for penlight or optional, rechargeable nickel cadmium batteries. Comes complete with antenna, earphone, leather carrying case, penlight batteries, crystals. Imported.

(D) LAFAYETTE AMATEUR COMMUNICATIONS RECEIVER

Designed for Today's Crowded Amateur Bands

8-tube superheterodyne circuit covers 4 bands. Outstanding bandspread, selectivity with a built-in Q-multiplier. Imported

(E) LAFAYETTE 24-WATT STEREO AMPLIFIER

A dual 12-watt stereo amplifier, coupled with a versatile stereo preamplifier, offering a full range of control facilities for complete stereo capability and flexibility. Complete with case and legs. Imported.

(F) LAFAYETTE PROFESSIONAL-TYPE 4-TRACK STEREO RECORDER

Records Sound-On-Sound

Plays back 4 and 2-track stereo and 4-track monaural, records 4-track stereo and monaural. Features built-in amplifiers, two full-tone stereo speakers, two level meters. 2 speeds — 3¾ and 7½ ips. With case, two dynamic mikes, output cables, tape reel, 1200-ft. reel of tape. Imported

(G) LAFAYETTE DELUXE 4-TRACK STEREO TAPE DECK

Records Sound-On-Sound

Features built-in, transistorized stereo record/play preamps. Plays 4-track stereo, 2-track stereo, 4-track, 2-track and full track mono. Records 4-track stereo and mono, 2 speeds 3¾ and 7½ ips. Plays reels up to 7". 4 connecting cables. Imported