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POPULAR ELECTRONICS

APRIL 1962

35 CENTS

MAC 4

9 Projects in this issue

- Hybrid AM Receiver
- Battery Charger
- Loudspeaker Code Oscillator
- R.F. Sampler
- Transistor Thermostat
- Printed-Circuit PA
- GP Antenna
- Transistor Beta Tester

GABBLE KILLER (p. 41)
A CB Selective Calling System

Iome Study School of its Kind ing in Industrial ELECTRONICS

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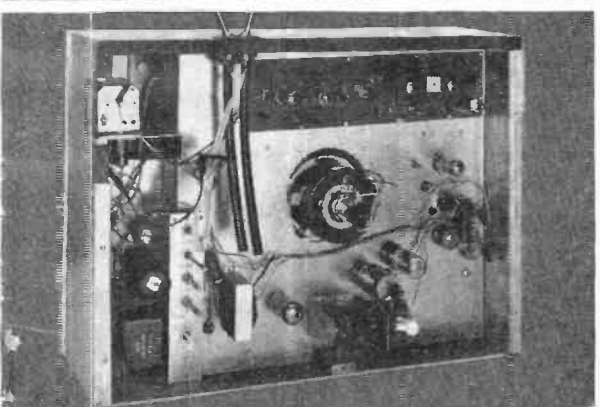

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POPULAR ELECTRONICS

VOLUME 16 APRIL 1962 NUMBER 4

ZIFF-DAVIS PUBLISHING COMPANY

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

This month's cover photo by Bruce Pendleton
CB Transceiver TR-27 courtesy Tram Electronics Inc.;
Ceramic Mobile Microphone 714SR courtesy Electro-Voice, Inc.

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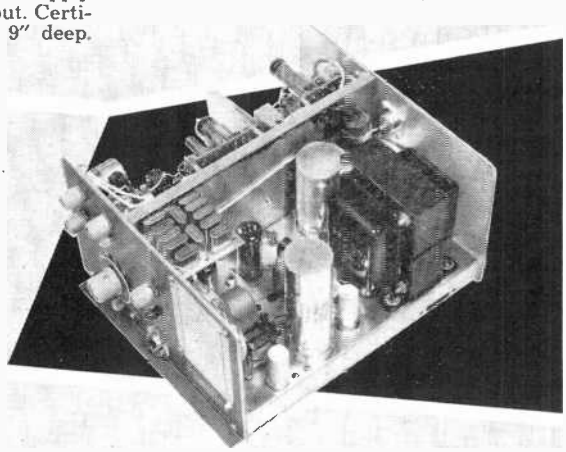

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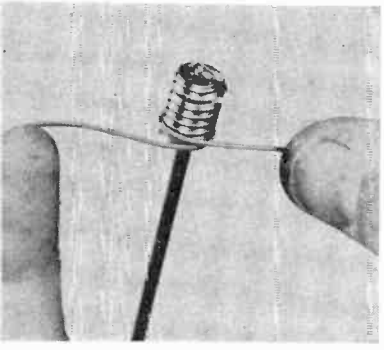
POP'tronics

NEWS SCOPE

TUBELESS TUBE—Since the vacuum in outer space is far greater than man can create here on Earth, ITT scientists decided to dispense with the usual glass shell on a multiplier photo-tube destined for use in a space probe. Once the tube is rocketed to outer space, it functions like any other tube but with increased performance. The super vacuum of space permits gains of up to 100,000, and the bonus is that certain light frequencies previously filtered out by the glass envelope can now be measured. The key to the new device was the development of cathode materials that would not be poisoned when exposed to the Earth's atmosphere prior to use in space.

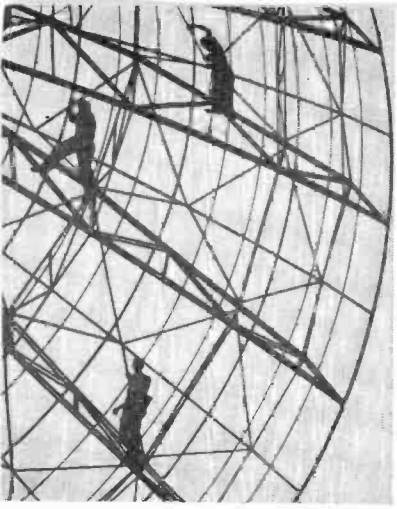
BYE BYE, TICKER TAPE! An instantaneous stock quotation service which combines all market information into a single electronic system has been developed by the Teleregister Corporation of Stamford, Conn. Designed for stock brokers, the service is called "Telequote II." It presents on one viewing screen individual bid and asked quotations, and last prices of all stocks listed on any exchange, as well as data on commodities. Push-button control permits selection of individual last prices or groups of prices, as well as current stock, ticker and news tapes. Designed with future expansion in mind, Telequote II will be able to grow with the nation's brokerage and financial industries' communication needs.



SPRING IS HERE—A new device, smaller than a thumbnail, permits plastic-insulated wires to be connected to terminals without first stripping the insulation. Called a "coil spring connector" by its Bell Telephone Laboratories' designers, it will be used in such places as terminal boxes on telephone poles and in basements of buildings to replace currently used screw-type binding posts. Besides cutting connection time by one half, the device allows a wire to be connected or removed without disturbing wires on the same terminal. Telephone linemen can soon throw away their wire strippers!

"CORONA" HUNTER—Aiming an ultrasonic "gun" at a high-voltage transmission line, with both feet planted firmly and safely on terra firma, a Westinghouse research engineer tests the line for electrical leakage, or "corona." If present, the corona produces high-frequency (ultrasonic) sound waves, which result in wasted electrical power and sometimes static in nearby radios. The "gun" utilizes 20 ultrasonic transducers in a circular array to detect these sound waves when the device is aimed at the leakage point. Just a squeeze of the trigger brings to life an electronic circuit which provides audible signals to the "gunner." Corona can then be eliminated or reduced by shielding the sources of discharge electrically or replacing the parts that cause it.

(*Continued on page* 8)

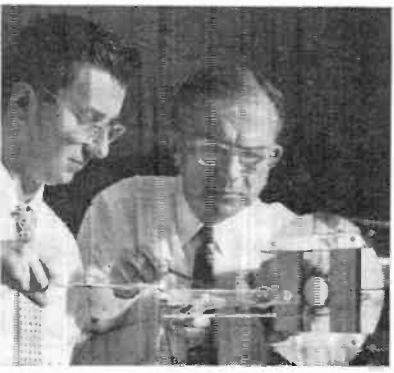


POP'tronics

NEWS SCOPE

Continued

CAUGHT IN THE WEB of national defense, workmen cling to the frame of a huge radar tracking antenna being readied for the U. S. Air Force's Ballistic Missile Early Warning System, commonly called BMEWS. The antenna is being built by Goodyear Aircraft Corporation at Akron, Ohio, and ultimately, when it is tied in with BMEWS, it will provide the North American continent with up to 15 minutes warning of a missile attack. This time interval is considered sufficient to initiate and launch an ICBM counter-offensive.



GROWING RIBBONS—Silicon ribbons with a thinness of one micron (about one twenty-five-thousandth of an inch) can now be grown from a vapor. Cooked up at the Bell Telephone Laboratories, the ribbons are near-perfect crystals which grow rapidly in a hot tube to lengths of from one to three centimeters and about 0.1 millimeter wide. The crystals contain few—if any—defects, are very strong mechanically, semi-transparent, and quite flexible due to their extreme thinness. These physical properties will eventually make it possible to incorporate them directly into semiconductor devices with little mechanical preparation. Nothing like growing ribbon crystals for a growing transistor industry.

LANGUAGE COMPLEX—G.I. students use electronic equipment set up in individual booths for a "crash" language-learning program at the U. S. Army Language School in Monterey, California. A custom-designed General Electric closed-circuit television system permits the showing of one film, simultaneously, to students of several languages; all students watch the same picture but each hears the audio portion in the language he happens to be studying. For example, one such film can be shown to students of Japanese, Burmese, and Vietnamese at the same time. To accomplish similar results with individual motion picture and slide projectors in separate classrooms would be very costly not only in duplication of equipment but also in film, tapes and slides. The new facilities help the school turn out yearly 2000 G.I.'s expert in one of 28 foreign languages.

A CAPSULE HEARING AID no larger than a child's aspirin tablet, and weighing only one-fifth of an ounce, battery included, has been developed by Zenith Radio Corporation. In spite of its tiny size, the miniature hearing aid, called the "Cameo," has a peak gain of 43 decibels and more than covers the audio frequencies basic to the understanding of speech. Specially recommended for use in cases of sensory-neural hearing losses characterized by declining sensitivity in the high frequencies, the Cameo sports an on-off switch and volume control, and fits neatly into the ear.

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William F. Bratton, Jr., 435 Etna Street, Bussell, Ky.	1st	12
Darrell E. Clece, 25 E. 32nd St., Kansas City, Mo.	1st	12
Thomas J. Hoof, 216 S. Franklin St., Allentown, Pa.	1st	22
P. B. Jernigan, Route 2, Benson, North Carolina	1st	12
Edward R. Barber, 907 S. Winnifred, Tacoma, Wash.	1st	20
Claude Franklin White, Jr., c/o Radio Sta. WJMA, Orange, Va.	1st	12
John M. Morgan, c/o KIRI-TV, 1530 Queen Anne Ave., Seattle, Wash.	1st	9½

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Letters from our readers

"Short Wave for Beginners"

■ In the chart included with "Short Wave for Beginners" (January 1962 issue), you indicate that Leopoldville is in the Congo and Brazzaville

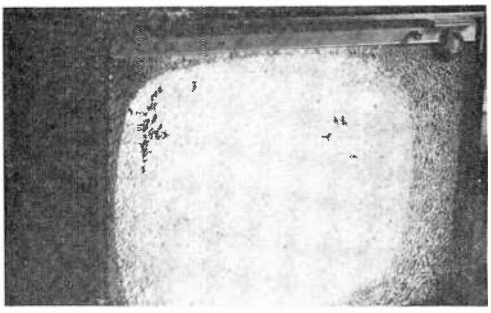
is in Katanga. As far as I know, Leopoldville is still in Katanga and Brazzaville in the Congo.

LEONARD PHELPS
Washington, Oregon

Hank Bennett, our Short-Wave Editor and the author of this article, assures us that his attempt to relocate these two cities has failed. And he thanks you, reader Phelps, as well as all the others who picked up the error and took the time to contact him about it.

Cracked TV Mask

■ I read, in the June 1961 "POP'tronics News Scope," about a gentleman whose glass TV-tube mask mysteriously acquired a fine network of



cracks. The same thing happened on my TV set recently, and I'm enclosing a picture to prove it.

BRUCE R. GRANT
Fort Lauderdale, Fla.

Startling, isn't it?

Compactron V.H.F. Receiver

■ Here's a letter on the "Compactron V.H.F. Receiver" (September 1961 issue) to add to the ones you published in January, 1962. In my opinion, this project is the best one you've published, to

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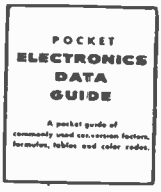

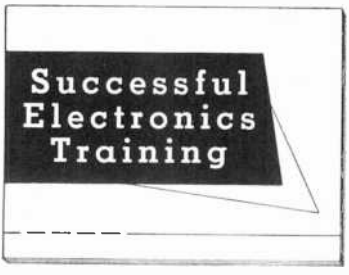

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In what branch of Electronics are you interested?

Name ..... Age .....

Address .....

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

PE89

Letters

(*Continued from page* 10)

date, for v.h.f. "bugs." I work for an airline and enjoy listening on the company frequency while at home in the shack. Unlike a few of the readers who wrote in, I had no difficulty obtaining any

of the parts. And I'd be glad to help people who are having trouble finding a source of supply.

CHARLES H. LATHE, JR.
3560 65th Ave.
Oakland 5, Calif.

The "BBS" CPO

■ I built the code practice oscillator recently described in your magazine ("BBS—Black Box Special," December 1961), and it works fine. Though I had some difficulty mounting parts in the small BC-451-A control box, the results were worth it. Thanks to author Barbee for a good project.

BILL BURKE, WPE2FVP
Yorktown Heights, N.Y.

Glad you enjoyed the "BBS," Bill, and we hope that your hard work will soon be justified by your increased code speed.

Don't Junk Those Antiques

■ Although I'm not a ham, I enjoyed reading the article "How to Talk to Non-Hams" in your November 1961 issue. One phrase on page 122 bothered me, however, and I quote:

"The warm-up feature is actually an audio-visual aid as I fuss over ancient ham gear—a spiral-wound oscillation transformer, rotary spark gap, huge capacitors, and loose capacitors. *It's junk,* but the effect is terrific."

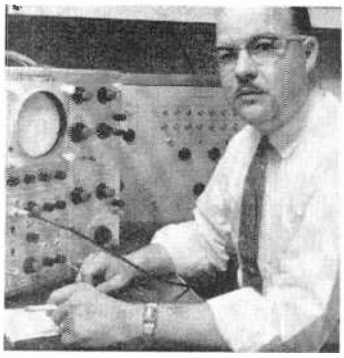
I realize that this article was essentially fiction, but unfortunately many people who have such old equipment *do* think it's junk—and give it to the nearest junkman. People who collect antique radio equipment, like myself, would love to get their hands on it.

PAUL H. FUGE
Somerville, N.J.

It certainly is a shame to destroy a piece of antique radio equipment. Such apparatus is becoming increasingly rare, and is of great interest to any serious electronics enthusiast. We hope all of our readers who own old equipment will preserve it—or pass it along to a collector. —30—

"A CREI Home Study Program helped me increase my salary by a factor of four (4)."

—Mearl Martin, Jr., SENIOR ENGINEER, Field Support Manager, Tektronix, Inc., Portland, Oregon



"I AM INDEED GRATEFUL TO CREI for my success," says Mearl Martin, Jr. "Since enrollment in a CREI Home Study Program in Electronic Engineering Technology, I have progressed from Junior Technician to licensed Senior Engineer. My present title is Field Support Manager and my salary has increased by a factor of four (4)."

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WHEN YOU ENROLL IN a CREI Home Study Program, you study courses to which a number of today's leading engineers and scientists have made substantial contributions. You are guided by qualified instructors. Robert Wruble, Group Manager (center) and Rollie Smith, (right) Field Training Manager at Tektronix, Inc., are shown here with Mearl Martin.

ASSURE A BETTER FUTURE and get more out of life with CREI Home Study. CREI alumnus Martin enjoys living in this comfortable home in Portland, Ore. CREI men are in such companies as Pan American Airways, Federal Electric Corp., The Martin Co., Northwest Telephone Co., Mackay Radio, Florida Power and Light, etc. This attests to the high calibre of CREI Programs.

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

Employed by .....

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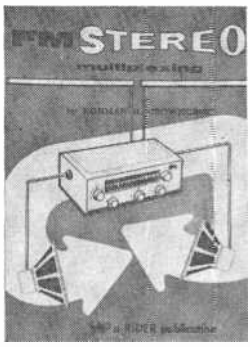
POP'tronics Bookshelf

FM STEREO MULTIPLEXING

by Norman H. Crowhurst



Produced because of the interest in FM stereo aroused by the recent FCC "go-ahead," the text describes in detail this system of broadcasting and reception. The FCC standards are carefully explained and illustrated, and reception methods are covered both in theory and in practice. In addition, many complete schematics of FM stereo adapters are included. Of particular interest to the technician are chapters on the installation, alignment, checking, and general trouble-shooting procedure for FM stereo multiplex receivers.

Published by John F. Rider Publisher, Inc., 116 W. 14th St., New York, N.Y. 72 pages. Soft cover, $1.25.

RCA RECEIVING TUBE MANUAL, Technical Series RC-21

Technical data on over 900 receiving tubes, including nuvistor, novar, and other new types, can be found in this latest edition of the well-known RCA Receiving Tube Manual. Data is given, too, for more than 100 types of black-and-white and color picture tubes. The text material on electron-tube theory, characteristics, installation, and applications has also been expanded, and the "Circuits" section contains 26 schematics. Among the latter are plans for several broadcast receivers, a 144-mc. receiver, a 10-meter nuvistor preamplifier, and two stereo amplifiers. Completely new charts aid in the selection of receiving tube types for specific applications and present picture-tube characteristics in capsule form.

Published by Radio Corporation of America, Electron Tube Division, Harrison, N.J. 480 pages. Soft cover. $1.00.

(Continued on page 20)

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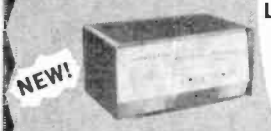

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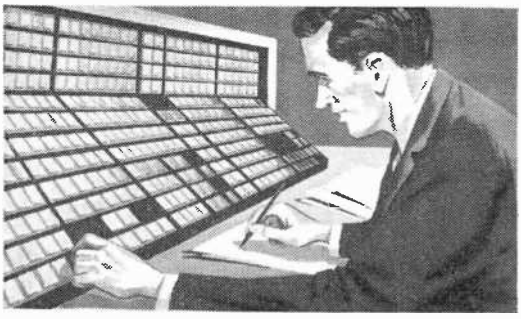

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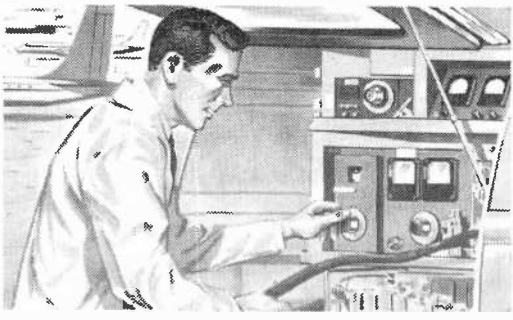

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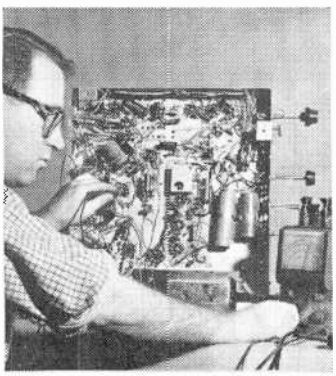

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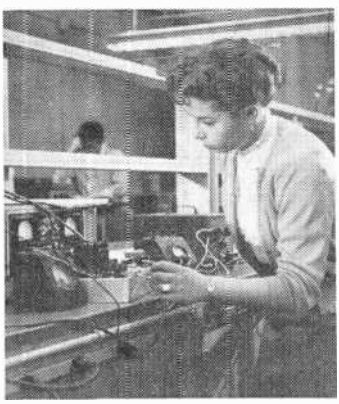
Free Placement Service. RCA Institutes graduates are now employed in important jobs at military installations such as Cape Canaveral, with important companies such as IBM, Bell Telephone Labs, General Electric, RCA, and in radio and TV stations all over the country. Many other graduates have opened their own businesses. A recent New York Resident School class had 92.06% of the graduates who used the FREE Placement Service accepted by important electronics companies . . . and had their jobs waiting for them on the day they graduated!

Coeducational Day and Evening Courses. Day and Evening Courses are available at Resident Schools in New York City and Los Angeles. You can prepare for a career in electronics while continuing your normal full-time or part-time employment. Regular classes start four times each year.



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RCA INSTITUTES, INC. DEPT. PE-42 A SERVICE OF RADIO CORPORATION OF AMERICA, 350 WEST 4TH ST., NEW YORK 14, N. Y.
PACIFIC ELECTRIC BLDG., 610 S. MAIN ST., LOS ANGELES 14, CALIF.

The Most Trusted Name in Electronics

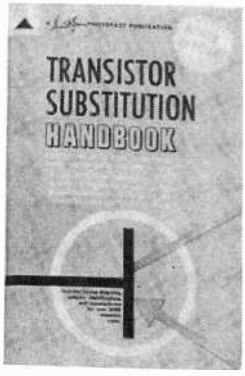
Bookshelf

(*Continued from page 14*)

TRANSISTOR SUBSTITUTION HANDBOOK

by the Howard W. Sams Engineering Staff

This revised edition of the *Transistor Substitution Handbook* lists 8800 direct transistor substitutions. Related text material tells why substitution is feasible, when to use a substitute, how to choose the most suitable replacement, and what precautions to observe. Also, just as in the first edition, base diagrams, polarity identifications, and manufacturers of over 3000 transistor types are included. Separate sections list 630 semiconductor diode substitutions and 800 American substitutes for Japanese transistors.



Published by Howard W. Sams & Co., Inc., 1720 East 38th St., Indianapolis 6, Ind. 112 pages. Soft cover. $1.50.

New Literature

Descriptive information and complete specifications on Browning's newest CB transmitter, the Model 23/S-Nine, are contained in a 6-page, 2-color brochure available from Browning Laboratories, Inc., 100 Union Ave., Laconia, N.H. Included with the brochure are an order form and information on four convenient purchase plans.

A 17" x 22" chart listing 2000 transistor types and their "Semitron" replacements is now available free from Semitronics Corp., 370 Broadway, New York 13, N.Y. In addition to the transistor types most commonly used in television, radio, hi-fi, automobile, and home-entertainment equipment, the chart indicates the proper replacements for Japanese and other foreign-made transistors. Base diagrams of five typical transistor types are also provided. -30-

National Library Week
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Check these outstanding characteristics

- **High Output**—can accept signals with dynamic range to realize the full potential of even the finest professional equipment.
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- **Humidity and Temperature Protection**—special coating, priming, and binding techniques help keep Tarzian tape in new condition longer in ordinary good tape storage conditions.

■ Given great sound in the first place, Tarzian Tape will keep it for you, and give it back undiminished and undistorted. It is a tape of truly professional fidelity, worthy of your most valued recordings, at a price that lets you use it for all your work (or play).

The proof is in the listening...of course. But you can see the smooth, tightly bonded oxide surface that doesn't flake, that does run smoothly without abrasion and without contributing to wow or flutter. Hold a reel to the light. You can see that Tarzian Tape is wound on the reel at perfect tension. You'll find a written replacement guarantee in every box. The box is well made, with ample identification space. You'll see that the tape is factory sealed in a plastic bag, with labels and a tape-end clip included.

Try Tarzian Tape...let it speak for itself. Available on standard 3-, 5-, and 7-inch reels and in professional lengths on reels or hubs, 1½ and 1 mil acetate, and 1 mil Mylar.* Ask your dealer. If he cannot supply you, send us his name and we will see that your needs are promptly supplied.

Helpful new booklet free on request: "The Care and Feeding of Tape Recorders."

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Hi-Fi Showcase

*A quick look at new products in the stereo/hi-fi field**

AS a music lover, you know that both reverberation and resonance must be kept in hand. But what you may not know is that a product developed by ***American Felt*** lends itself admirably to this end. Ideal for anyone building or remodeling a music room, "Hushalon" acoustic felt wall covering comes in 54"-wide rolls and in 30 colors. The result: a look of warm richness in any room, and sound-absorbing qualities to control vagrant sound waves. (A few areas of hard, unbroken surfaces may be best in most listening rooms, but good acoustic treatment often necessitates some additional damping material.) "Hushalon" provides the answer . . . A self-powered multiplex adapter designed to match performance specifications of hi-fi tuners, ***Bogen's*** new PX 60 is housed in a metal enclosure which complements the Bogen line. Measuring a compact 4½" x 4½" x 9", the PX 60 has a frequency response within 3 db all the way from 50 to 15,000 cycles; installation requires no tools or wiring changes and is simply a matter of making a few patch-cord connections. Price, $69.50. . . . Two bookshelf speaker assemblies by ***Cabinart*** are just the thing for low-cost stereo setups or for a third-channel output. The larger of the two, the "Mark II," utilizes a 12" speaker with a coaxially mounted 3" tweeter; power rating is 12 watts, and input impedance is 8 ohms. The other unit, designated the "Mark I," incorporates a single 8" speaker and is intended for low-level monaural or stereo reproduction. Prices: $15.00 for the Mark I, $22.50 for the Mark II, both f.o.b. Haledon, N.J.; de luxe versions in genuine walnut veneer are priced at $25.00 and $36.00, respectively.

Four new ***Grommes*** amplifiers carry power ratings from 10 to 50 watts. An outstanding buy in the low-priced field, the LJ8 monaural preamp/amp has an output of 12 watts, separate bass and treble controls, and inputs for tuner, tape, crystal and magnetic phonos. The unit is priced at $39.95; an optional cover sells for $5.00. Second in the series, a low-cost 10-watt stereo pre-

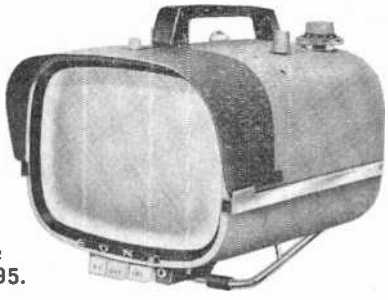
**Write to the manufacturers listed at the end of this column for more data on products mentioned*

New SONY®

* RESEARCH MAKES THE DIFFERENCE

CB-901 transceiver— has a separate microphone and speaker

The new Sony 9 transistor Citizens Band Class D transceiver uses a SEPARATE MICROPHONE AND SPEAKER. A quality product of the world's foremost research and development team in transistor electronics, weighs only one pound and is powered by 8 penlite cells for up to 50 hours of operation. The crystal controlled CB-901 employs a sensitive variable reluctance microphone and 2¼" PM speaker. Note how the microphone and speaker are each placed in the most natural position for transmitting and receiving. With 5 foot telescoping whip, push-to-talk button and volume control, the SONY CB-901 lists at **$149.95** per pair, including batteries, earphones and leather case. Stop in at your dealer's and test it today. Also see the amazing **SONY 8-301W TV**, the only truly portable, fully transistorized set that works on its own battery pack, 12v auto/boat battery and AC. Weighs a mere 13¼ lbs. List **$249.95.** BCP-2 alkaline battery power pack, **$39.95.**



SONY CORP. OF AMERICA

514 Broadway, New York 12, N. Y.
Regional Offices
Western: 627 South Towne Ave., Los Angeles 21, Calif.
Central: 4959 W. Belmont Ave., Chicago 41, Ill.

* T.M.

Please send me the Sony "FACTS" booklet covering the SONY 8-301W TV and information on the SONY CB-901 Transceiver.

NAME _____

ADDRESS _____

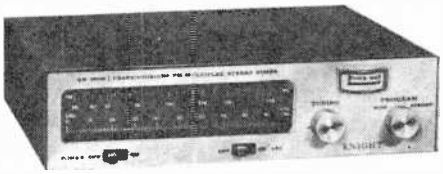
CITY _____ ZONE ____ STATE _____

SONY CORP. OF AMERICA, 514 B'WAY, N.Y. 12, N.Y.

Showcase

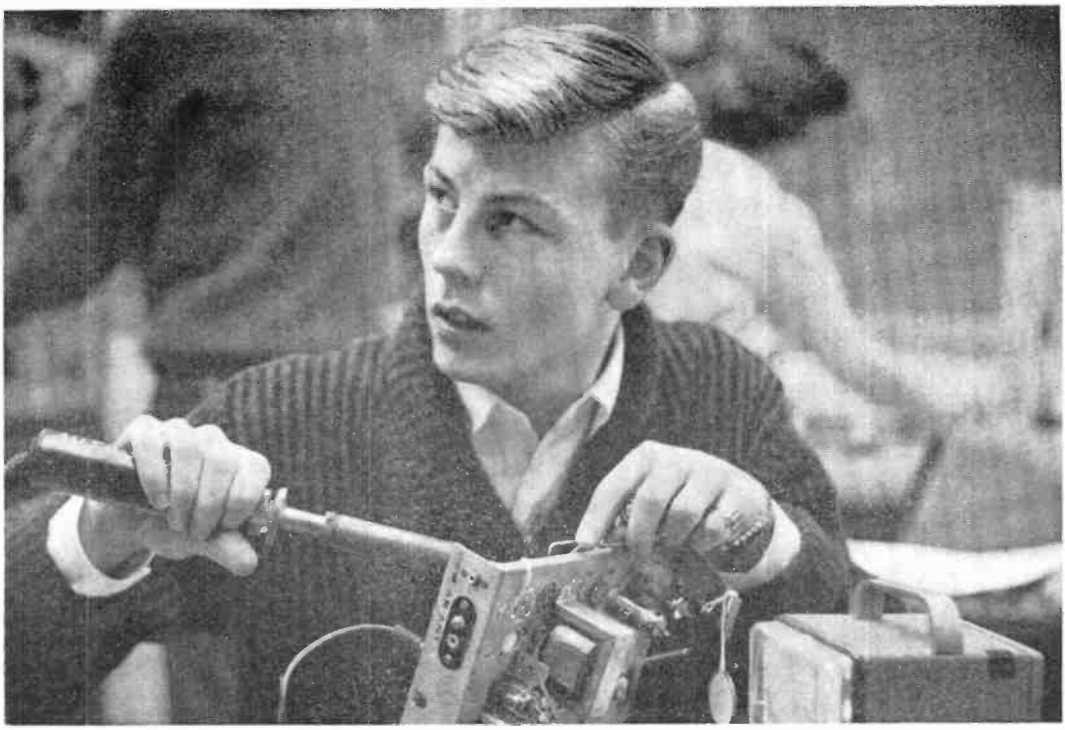
(*Continued from page* 22)

amp/amp designated as the 10LJ, has inputs for both magnetic and crystal pickups and separate bass and treble controls for each channel. Price is $59.95, less cover, and a cover is again available for $5.00. Third and fourth in the listing, the 36PG "Altair" and the 50PGA "Vega," are complete stereo amplifiers on one chassis with power outputs of 40 and 50 watts, respectively. Controls are ganged for simplicity of operation, and a special "center-channel" output requires no additional amplifier. Prices are $129.95 and $169.95, respectively; matching covers are an additional $7.50 each for both models. . . . Another new product from Grommes is the 101GTM stereo FM tuner. Featured are a cascode r.f. stage, a triode mixer, two wide-band i.f. and two limiter stages, flywheel tuning, and a magic-bar tuning indicator. Price: $119.95, less cover; an optional cover is $7.50 extra. . . . Two new releases from *Allied Radio*—a stereo amplifier and a stereo FM tuner—are both transistorized. The KX-60 amplifier, available in kit form as the Knight-Kit KX-60, has five pairs of stereo inputs to accommodate virtually every sound source, including tape heads. Because it uses no output transformers, the KX-60 weighs only eight pounds, and miniaturized components permit ultra-compact styling (the completed unit measures only 2¾" x 11" x 9¼"). Delivering 25 watts per channel, the KX-60 kit is priced at $79.95, less case. The Model KN-250M tiny transistor/nuvistor



Knight KN-250M FM stereo tuner

tuner measures 2⅝" x 9¾" x 8" and incorporates a multiplex circuit for reception of stereo as well as monophonic FM broadcasts. A signal-strength meter shows when you've tuned the signal for maximum center-channel reception, and an automatic frequency control circuit (a.f.c.) prevents drift. Price, $139.95. A similar unit, but without the FM stereo circuitry, sells for $99.95; and a third model, incorporating a built-in clock-timer, is priced at $154.50 . . . A "universal" multiplex adapter for FM stereo reception, *Lafayette's* LT-200 is self-



Career-minded William A. Shaw of Royal Oak, Michigan, asked...

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This question faces every young man completing high school. For it is in these years that he must start his career. Last year Bill Shaw answered his question by joining the U.S. Air Force. This year some 100,000 young Americans will take the same forward step.

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First of all there is the sense of pride that goes with serving on the nation's defense team. Then there is a more compelling reason. In the years to come there will be positions of increasing responsibility opening for trained and experienced men. This is what the Air Force offers—training and experience in missile and airplane maintenance, radio, radar, administration, air police work and a host of other specialities.

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U.S. Air Force

Airman 2C Shaw is now an electronics specialist at a base in England. He has completed a technical training course at Keesler Air Force Base, Mississippi. He is learning a valuable skill in his first year in the Air Force.

Career Information
Dept. TP 24, Box 7608
Washington 4, D. C.

I am a citizen (or resident) of the U.S.A. Please send me your illustrated booklet.

Name_____ **Age**____

Address_____

City_____ **County**_____ **State**_____

Showcase

(*Continued from page 24*)

powered and ready-to-attach to any FM tuner equipped with a multiplex output jack. Four tubes (two of them dual-purpose) insure top-quality performance: a low-impedance "plate follower" output allows you to place your stereo amplifier almost anywhere. Price, $54.50. . . . Versatility is the word for one of the newest tape recorders to reach the American market. Manufactured in Sweden, the ***Luxor*** Magnefon will record and play back two-track stereo or four-track monaural tapes. It can also record and replay two programs simultaneously on two separate tracks, and it has features enough to satisfy even the most demanding audiophile. There are separate "magic-eye" record-level indicators for each channel, outlets for external amplifiers and speakers (including an optional center-channel speaker), an easy-to-read numerical "cue-meter," and a fool-proof interlock to prevent accidental erasures. Designated as Model MP-410-A, the Luxor Magnefon operates at 7½, 3¾, and 1⅞ ips; net price is $279.00.

Luxor MP-410-A Magnefon

Remember the famous "Sweet Sixteen" speaker system described in POPULAR ELECTRONICS some months back (January and April, 1961)? A carefully designed kit by ***Olson*** enables even the most inexperienced electronics hobbyist to assemble a "Sweet Sixteen" system for his own hi-fi setup. The white birch frame is pre-assembled, holes for the 16 speakers are pre-cut, and everything down to hardware and grille cloth is included. The kit is available with or without speakers, and the price is $29.95 for the enclosure alone, $39.88 for the enclosure plus the speakers.

American Felt Company, 2 Glenville Road, Glenville, Conn.
Bogen-Presto Div., Siegler Corp., P.O. Box 500, Paramus, N.J.
Cabinart Acoustical Dev. Corp., 31-39 Geyer St., Haledon, N.J.
Grommes Div., Precision Electronics Inc., 9101 King Ave., Franklin Park, Ill.
Knight (Allied Radio Corp.), 100 N. Western Ave., Chicago 80, Ill.
Lafayette Radio Electronics Corp., 111 Jericho Turnpike, Syosset, L.I., N.Y.
Luxor (AmeLux Electronics Corp.), 60 E. 42nd St., New York 17, N.Y.
Olson Electronics, Inc., 260 S. Forge St., Akron 8, Ohio.

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- ★ No Additional Parts or Tools Needed
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The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL.

You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis.

You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying instructional material.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the small price you pay. The Signal Tracer alone is worth more than the price of the entire Kit.

THE KIT FOR EVERYONE

You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment.

Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble shooting—all in a closely integrated program designed to provide an easily-learned, thorough and interesting background in radio.

You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

Included in the "Edu-Kit" course are Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator and Signal Injector Circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instruction necessary to build several different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, hardware, tubing, punched metal chassis, instruction Manuals, hook-up wire, solder, selenium rectifiers, volume controls and switches, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C.-type Questions and Answers for Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

FREE EXTRAS

- SET OF TOOLS
- SOLDERING IRON
- ELECTRONICS TESTER
- PLIERS-CUTTERS
- ALIGNMENT TOOL
- WRENCH SET
- VALUABLE DISCOUNT CARD
- CERTIFICATE OF MERIT
- TESTER INSTRUCTION MANUAL
- HIGH FIDELITY GUIDE • QUIZZES
- TELEVISION BOOK • RADIO TROUBLE-SHOOTING BOOK
- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

SERVICING LESSONS

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

FROM OUR MAIL BAG

J. Stataitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend $240 for a Course, but I found your ad and sent for your Kit."

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

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

Choose From These Popular "Edu-Kit" Models

#10A: 10 Circuits $14.95

#15A: 15 Circuits $19.95

#16A: 16 Circuits (includes Printed Circuitry) $22.95

#20A: 20 Circuits (includes Printed Circuitry and 4 Advanced Circuits) $26.95

#25A: 25 Circuits (includes Printed Circuitry and 9 Advanced Circuits) $30.95

UNCONDITIONAL MONEY-BACK GUARANTEE

Please RUSH my Progressive Radio "Edu-Kit" to me.

BE SURE TO INCLUDE all the FREE EXTRAS and BONUS RESISTOR and CONDENSER KITS WORTH $7.00.

MODEL desired ..... Price .....

☐ Send "Edu-Kit" postpaid. I enclose remittance in full.
☐ Send "Edu-Kit" C.O.D. I will pay postage.
☐ Send me FREE additional information describing "Edu-Kits."

Name .....

Address .....

.....

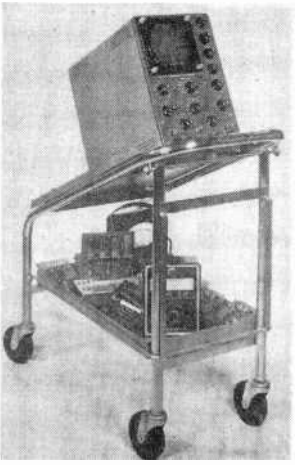
PROGRESSIVE "EDU-KITS" INC.

1186 Broadway, Dept. 591-D, Hewlett, N. Y.

NEW products

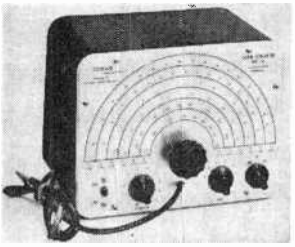
SCOPE CART

A handy scope cart available from *Atlantis Metal Products* (a division of Atlantis Electronics Corp., P.O. Box 451, Garland, Texas) has two trays supported on a framework of 1"-diameter steel tubing. To hold a scope at the proper viewing angle, the top tray is tilted 25 degrees; made of 20-gauge steel, it has an adjustable back stop to accommodate instruments of all sizes. An assortment of smaller instruments and tools can be held in the 24-gauge steel bottom tray. The cart is mounted on swivel casters and is collapsible for easy storage. Overall dimensions are 29" x 15" x 27". Price, $29.95 f.o.b. factory.



SIGNAL GENERATOR

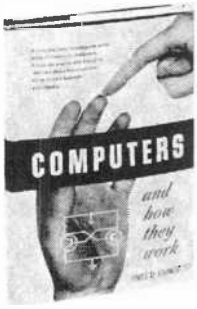
A Hartley-type oscillator gives high stability to the Conar Model 280 signal generator, which comes both in kit form and factory-assembled. Covering the range from 170 kc. to 60 mc. in six bands, the Model 280 has usable harmonics to over 120 mc. Three types of output signal are provided: unmodulated r.f., modulated r.f., and 400-cycle a.f. A single output cable, in conjunction with a front-panel switch, is used for all tests. Preset tuned r.f. coils and ceramic trimmers are employed on the low bands and high bands, respectively. The average accuracy of the assembled kit is 2%; the



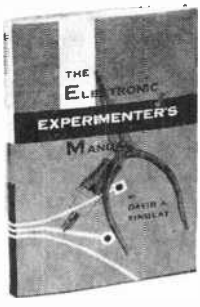
The most informative books for the experimenter and electronic hobbyist

VACUUM-TUBE CIRCUITS FOR THE ELECTRONIC EXPERIMENTER by Julian M. Sienkiewicz. At last in one book—all the basic diagrams, schematics, and other vital information on vacuum-tubes and their circuits. 192 pgs. 100 illus. **$4.95**

CLASS D CITIZENS RADIO ***by Leo G. Sands***
The first complete book on the two-way radiotelephone. Its history, rules, how it works, applications, equipment, receiver circuits, transmitters, antennas, installations, illus. **$4.95**



COMPUTERS AND HOW THEY WORK ***by James D. Fahnestock***
A fact-filled guidebook to electronic computers. More than 110 illus. easy-to-follow tables in nine sections will help you understand all major types of computing mechanisms. **$4.95**



THE ELECTRONIC EXPERIMENTER'S MANUAL
by David A. Findlay
With this guide you can put theory into practice. Learn about every component used in experimentation, every tool, its function and why it is used. A perfect guide to professional know-how. **$4.95**

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ELECTRONICS BOOK SERVICE—A. S. Barnes & Co. Inc.
11 East 36th Street, New York 16, N.Y. PE 21A

Please send me the books I have checked below:

I enclose $_____ (You pay all postal charges.) ☐ Send C.O.D. (I pay charges)

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___copy(ies) COMPUTERS AND HOW THEY WORK $4.95
___copy(ies) THE ELECTRONIC EXPERIMENTER'S MANUAL $4.95

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ADDRESS _____ CITY _____ ZONE ____ STATE _____

If I am not fully satisfied I can return these books in seven days for a full and prompt refund.

products

(*Continued from page 28*)

factory-assembled version has a guaranteed accuracy of 1%. Price: $21.50 for the kit; $29.50 factory-assembled. Postage extra. (*Conar Instruments*, 3939 Wisconsin Ave., Washington 16, D.C.)

COMPACTRON SOCKETS

Experimenters making use of the new 12-pin compactron tubes have occasionally had trouble finding sockets, but G.E. is now producing them. The compactron sockets have a raised surface between pins 1 and 12 which acts as a tube-insertion guide, and each pin terminal is numbered. A 1⅛"-diameter chassis hole is required for the socket proper, and the mounting-screw holes are spaced 1 5/16" apart. Packaged in a plastic bag, a pair of sockets sells for 39 cents. (*General Electric Co.*, Electronic Components Division, Owensboro, Ky.)

LICENSE-FREE BASE STATION

Lack an FCC license? A 2-way radio base station available from *Electra International Co.* (1346 Foothill Blvd., La Canada, Calif.), can be operated without one. The fully transistorized "Miniphone 600" is about one-sixth the size of an ordinary telephone. When used with the companion "Miniphone

400 Mark II" shirt-pocket transceiver, it has a range of about three miles. A selection of indoor and outdoor plug-in antennas assures dependable communications in and around all types of buildings, and an automatic noise limiter reduces electrical interference from plant equipment and vehicles. Provision is made for either battery or 115-volt a.c. operation. The Miniphone 600 is priced at $99.50, while the Miniphone 400 Mark II sells for $89.75.

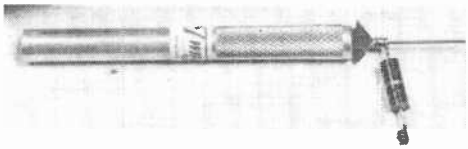
D.C.-TO-A.C. CONVERTER

Table-model radios, electric shavers, or any other low-power devices designed for 110-volt a.c. operation can be used in cars or boats with the Terado "Dynamo" converter. Working from a 12-volt d.c. source, the Model 50-196 "Dynamo" produces 110-volt,

60-cycle current. Unusually compact, it measures 2" x 2" x 3¾" and weighs 1½ pounds. Price, complete with cigarette lighter plug, generator condenser, and ignition noise suppressor, $12.95. (*Terado Co.*, 1068 Raymond Ave., St. Paul 8, Minn.)

PIGTAIL TOOL

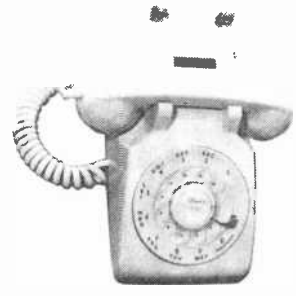
Spiral "pigtails" can be made quickly with the "Twirl-Con," which is available in three sizes. The No. 1 size (most used in



radio and TV work) forms a spiral which slips over 18-gauge wire; the spirals formed by the No. 2 and No. 3 sizes fit 16- and 13-gauge wire, respectively. Ideal for splicing to leads broken off close to components, Twirl-Con formed pigtails are useful in the repair of TV tuners, surplus equipment, printed-board circuits, and other compactly designed equipment. The tools are priced at $2.00 each (any size), postpaid in U.S.A. (*Twirl-Con,* 1101 N.E. St., Edna, Texas)

"MELODY PHONE"

A mechanical version of P.E.'s electric "Musical Telephone Holder" (June 1961 issue), the Mourra "Melody Phone" makes "holding the line" a pleasure. To install it, just slip the sturdy music box over the back of your telephone. When it's necessary to ask a caller to wait, the receiver is set on the unit, where it depresses a button, starting the music. To rewind the device, you simply pull out a convenient handle. Melody Phones, which are available with popular, classical, spiritual, or commercial music, come in standard telephone colors, and are priced at $4.95 each, postpaid. When ordering, specify type of music and color desired. (*Melody Phone,* Dept. D3, 110 Madeira Ave., Coral Gables, Fla.)

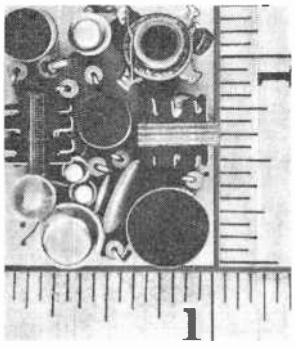


AUTOMATIC KEYER

An automatic keyer by Hammarlund (Model HK-1B) is transistorized and battery-powered. Both the keying speed and the ratio of dot length to dash length are adjustable, and a keying relay is employed for trouble-free transmitter control. The unit has a built-in monitor speaker (with volume control), and can also be used as a code-practice device. Located on the front panel along with the "Volume," "Speed," and "Ratio" controls, and the monitor speaker, is a switch allowing the selection of manual, automatic, and "hold" functions. Price. $39.95. (*Hammarlund Manufacturing Co., Inc.,* 460 W. 34th St., New York 1, N.Y.)

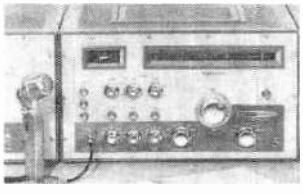
RADIO-CONTROL RECEIVER

Smaller than a special-delivery stamp, the fully transistorized radio-control receiver now being marketed by Otarion is said to be the world's tiniest. It measures 1" x 1¼" x ⅝" and weighs less than half an ounce. Containing 27 miniaturized components on a printed-circuit board, the receiver has a built-in tuning indicator, eliminating the need for external meters or earphones. All 27-mc. Citizens Band channels are covered, and the circuit is temperature-compensated from 0 to 120° F. Power is supplied by miniature batteries, and sensitivity is high enough for operation with ordinary, hand-held transmitters. Price, $29.95. (*Otarion Electronics, Inc.,* P.O. Box 711, Ossining, N.Y.)



DE LUXE TRANSMITTER KIT

The Heathkit Model HX-10 "Marauder" is a complete desk-top transmitter operating on CW, SSB (upper or lower sidebands), FSK, and AM. It delivers 100 watts of r.f. into a 50-ohm load on CW and SSB, 25 watts on AM. A temperature-compensated VFO covers the 80-, 40-, 20-, 15-, and 10-meter amateur bands in seven 600-kc. segments. Among the many "luxury" features are provisions for VOX operation and connections for a monitoring scope, phone patch input, and antenna switching. The HX-10 uses 21 tubes, in-



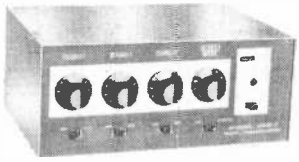
products

(*Continued from page* 31)

cluding rectifiers and voltage regulators, and can be used as an independent transmitter or as an exciter for a high-power linear amplifier. Price, $334.95. Write for a free schematic. (*Heath Company,* Benton Harbor, Mich.)

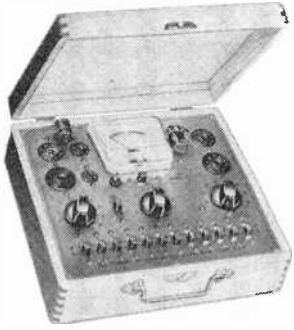
P.A. MIXER/PREAMPLIFIER

The latest addition to the Harman-Kardon "Commander" series of public address equipment is the DPR-7 combination mixer/preamplifier. Designed for use with any sound system, the unit offers a practical method of expanding a p.a. or recording installation. Seven input channels are provided—five low-level, high-gain, and two high-level channels. All inputs can be controlled from the front panel, and one channel converts to a master volume control at the flick of a switch. A low-impedance cathode-follower output permits long line runs to the main amplifier, or amplifiers. Price, $75.00. (*Harman-Kardon, Inc.,* Plainview, N.Y.)



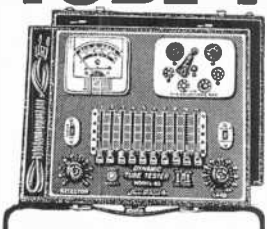
TUBE TESTER KIT

Designed to be obsolescence-proof, the EMC Model 213 tube tester checks for shorts, leakage, and intermittents, as well as for quality. In addition to standard octals, loctals and miniatures, such tubes as the Compactron, Nuvistor, Novar, magic-eye, voltage-regulator, hi-fi, and 10-pin types can be accommodated. Instructions and tube charts are supplied in a ring-bound manual, and free supplementary tube listings are periodically made available. Housed in a Bakelite case, the Model 213 sells for $18.90 in kit form, $28.90 wired. The same unit in a wooden case (Model 213P) is priced at $21.90 for the kit, $32.25 wired. (*Electronic Measurements Corp.,* 625 Broadway, New York 12, N. Y.) —30—



SUPERIOR'S NEW MODEL 85 **TRANS-CONDUCTANCE TYPE**

TUBE TESTER



Model 85—Trans-Conductance Tube Tester. Total Price $52.50 Terms: $12.50 after 10 day trial, then $8.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

• Employs latest improved TRANS-CONDUCTANCE circuit. Test tubes under "dynamic" (simulated) operating conditions. An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured as a function of tube quality. This provides the most suitable method of simulating the manner in which tubes actually operate in radio, TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading.

• SYMBOL REFERENCES: Model 85 employs time-saving symbols (•, +, ◦, ▲, ■,) in place of difficult-to-remember letters previously used. Repeated time-studies proved to us that use of these scientifically selected symbols speeded up the element switching step. As the tube manufacturers increase the release of new tube types, this time-saving feature becomes necessary and advantageous.

• "FREE-POINT" LEVER TYPE ELEMENT SWITCH ASSEMBLY marked according to RETMA basing, permits application of test voltages to any of the elements of a tube.

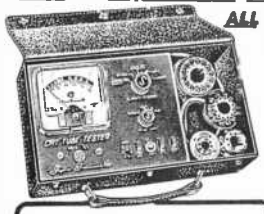
• FREE FIVE (5) YEAR CHART DATA SERVICE. Revised up-to-date subsequent charts will be mailed to all Model 85 purchasers at no charge for a period of five years after date of purchase.

Model 85 comes complete, housed in a handsome portable cabinet with slip-on cover. Only **$52.50**

SUPERIOR'S NEW MODEL 83A

C.R.T. TESTER

Tests and Rejuvenates ALL PICTURE TUBES



Model 83A — C. R. Tube Tester. Total Price ..... $38.50 Terms: $8.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

ALL BLACK AND WHITE TUBES

From 50 degree to 110 degree types —from 8" to 30" types.

ALL COLOR TUBES

Test ALL picture tubes—in the carton—out of the carton—in the set!

Model 83A provides separate filament operating voltages for the older 6.3 types and the newer 8.4 types.

Model 83A properly tests the red, green and blue sections of color tubes individually — for each section of a color tube contains its own filament, plate, grid and cathode.

Model 83A will detect tubes which are apparently good but require rejuvenation. Such tubes will provide a picture seemingly good but lacking in proper definition, contrast and focus.

Rejuvenation of picture tubes is not simply a matter of applying a high voltage to the filament. Such voltages improperly applied can strip the cathode of the oxide coating essential for proper emission. The Model 83A applies a selective low voltage uniformly to assure increased life with no danger of cathode damage.

Comes housed in handsome portable Saddle Stitched Texon case—complete with sockets for all black and white tubes and all color tubes. Only .. **$38.50**

SUPERIOR'S NEW MODEL 79

SUPER-METER

WITH NEW 6" FULL VIEW METER

Model 79—Super-Meter Total Price ..... $38.50 Terms: $8.50 after 10 day trial, then $6.00 per month for 5 months, if satisfactory. Otherwise return, no explanation necessary.

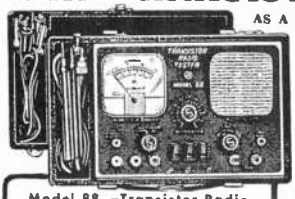
SPECIFICATIONS: D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500 • A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 • D.C. CURRENT: 0 to 1.5/15/150 Ma. • 0 to 1.5/15 Amperes • RESISTANCE: 0 to 1,000/10,000 Ohms • 0 to 10 Megohms • CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. • REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms • INDUCTANCE: .15 to 7 Henries, 7 to 7,000 Henries • DECIBELS: —6 to +18, +14 to +38, +34 to +58.

The following components are all tested for QUALITY at appropriate test potentials. Two separate BAD-GOOD scales on the meter are used for direct readings. All-Electrolytic Condensers from 1 MFD to 1000 MFD • All Selenium Rectifiers • All Germanium Diodes • All Silicon Rectifiers • All Silicon Diodes

Model 79 comes complete with operating instructions and test leads. Only **$38.50**

SUPERIOR'S NEW MODEL 88

TESTS ALL TRANSISTORS AND TRANSISTOR RADIOS



Model 88 —Transistor Radio Tester and Dynamic Transistor Tester. Total Price ..... $38.50 Terms: $8.50 after 10 days trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

AS A TRANSISTOR RADIO TESTER

An R.F. Signal source, modulated by an audio tone is injected into the transistor receiver from the antenna through the R.F. stage, past the mixer into the I.F. Amplifier and detector stages and on to the audio amplifier. This injected signal is then followed and traced through the receiver by means of a built-in High Gain Transistorized Signal Tracer until the cause of trouble is located and pinpointed.

AS A TRANSISTOR TESTER

The Model 88 will test all transistors including NPN and PNP, silicon, germanium and the new gallium arsinide types, without referring to characteristic data sheets. The time-saving advantage of this technique is self-evident. A further benefit of this service is that it will enable you to test new transistors as they are released!

Comes housed in a handsome portable case. Complete with a set of Clip-On Cables for Transistor Testing, an R.F. Diode Probe for R.F. and I.F. Tracing; an Audio Probe for Amplifier Tracing and a Signal Injector Cable-Only. **$38.50**

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

Try any of the above instruments for 10 days before you buy. If completely satisfied **then** send down payment and pay balance as indicated on coupon. **No Interest or Finance Charges Added!** If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC, INC.
Dept. D-924, 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked on approval. If completely satisfied I will pay on the terms specified with no interest or finance charges added. Otherwise, I will return after a 10 day trial positively cancelling all further obligations.

Name .....

Address .....

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

☐ Model 85.....Total Price $52.50 $12.50 within 10 days. Balance $8.00 monthly for 5 months.

☐ Model 79..... Total Price $38.50 $8.50 within 10 days. Balance $6.00 monthly for 5 months.

☐ Model 83-A....Total Price $38.50 $8.50 within 10 days. Balance $6.00 monthly for 5 months.

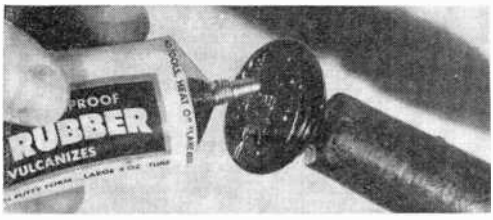
☐ Model 88.....Total Price $38.50 $8.50 within 10 days. Balance $6.00 monthly for 5 months.

All prices net, F.O.B., N. Y. C.

Tips and Techniques

PLASTIC RUBBER ANCHORS TV TABLE LEGS

Light TV tables, especially those equipped with furniture rests, often slip easily on tile floors. To prevent such slippage, you can coat the bottoms of the legs with "plastic rubber." Also, when this material



is applied in heavy dabs to the bottom of a portable radio, it will prevent the set from accidentally being pushed off a table. It cushions against shock and vibration, too.

—Ken Murray

LOW-COST ON-THE-AIR LIGHT

You can quickly improvise an "on-the-air" light from a glass jar, a coffee can, and a piece of flexible, translucent plastic. Cut a hole in the can bottom of the proper size to accept the threads on the top of the jar, then mount a light bulb inside the can. Stencil appropriate lettering on the plastic, roll it up, and slip it inside the jar. When the jar and can are screwed together, light from the bulb will illuminate the plastic—making the lettering stand out. The bulb can be wired to a manual switch or connected to your transmitter "send-receive" relay.

—Ross A. Sheldon, K5UCH

PORCELAIN "TOUCH-UP" IS HANDY WORKBENCH ADDITION

Available at most "5 and 10's" and hardware stores at very low cost, a bottle of porcelain touch-up compound is a handy addition to any electronics workshop. This material dries about as quickly as fingernail polish and is much more durable. Use

it to mark capacitors and resistors, hold coil windings in place, identify terminals, etc. For writing, it may be thinned with an appropriate solvent and applied with a toothpick.

—James Wallace

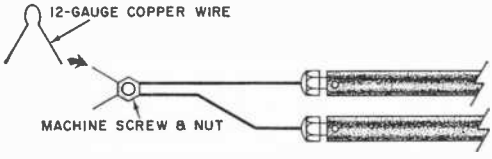
CONTAINERS FOR SMALL PARTS

The bottles in which certain brands of pills are sold make ideal containers for collections of hardware or miniature components. "Bufferin" containers, for example, have wide mouths with handy, snap-on caps; they come in a variety of sizes.

—Lewis Norman Reardon

"UNSOLDERING" AID

To unsolder both connections of a printed-circuit component at the same time, make the attachment illustrated here for your soldering gun. It's nothing more than a scrap of 12-gauge copper wire bent into a keyhole shape. Fastened to the tip of your gun with a machine screw and nut, it will



provide a two-point source of heat. Extra "keyholes" can be attached for components having multiple leads, and the prongs can be easily adjusted to any dimension.

—Arnie Hongo

TINNING TIP FOR SOLDERING GUN

If the new tip for your high-wattage soldering gun oxidizes so quickly after power is applied that you don't have time to tin it, try this method. Remove the tip from the gun, clean it again, and clamp it in a vise. Using your gun with the old tip, heat the working surface of the new one while applying solder. The vise will act as a heat

(*Continued on page* 38)

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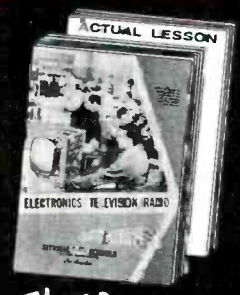

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Edgar Wesatzke

As field director of Berean Mission Inc., I have complete charge of our radio work. With the expert advice and training I am receiving from you I can do my own repairs on our recorders and P.A. systems, besides keeping our radios going. My training from N.T.S. helps keep us on the air. I feel privileged to be a member of such a fine institution.

Rev. Enoch P. Sanford

Thanks to N.T.S. I have a business of my own right in my home. I am still in the Air Force but I hove paid for all my equipment with money earned servicing TV sets. Yes, N.T.S. gave me my start in television.

Louis A. Tabat

I have a TV-Radio shop in Yorkville, Illinois, about 4 miles from my home, and it has been going real good. I started part-time but I got so much work that I am doing it full-time. Thanks to National Technical Schools.

Alvin Spera

SEE OTHER SIDE

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Computers, Data-Processing machines, Electronic Controls, Guided Missile Systems are new fields where Electronics play a vital role.

PHASE 4 SOUND SYSTEMS
New popularity of Hi-Fi-Stereo, as well as industrial sound systems and business intercoms make this a highly specialized and important field.

PHASE 5 FCC LICENSE PREPARATION
FCC License holders have a wide range of top jobs open to them. FCC License now a requirement for most Communication jobs.

PHASE 6 RADAR AND MICROWAVES
These are the communications systems of the future, already used in tracking and contacting satellites.

PHASE 7 AUTOMATION & COMPUTERS
Automation and Computer electronics are the new tools of industry and commerce. Skilled Technicians in these fields are in great demand at top pay.

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New society for kit enthusiasts passes 6,000 membership mark

R·A·E Society now ready with first issue of quarterly Journal

Announcements of the R·A·E Society have brought an overwhelming response from kit enthusiasts all over the country. Membership has passed 6,000 and applications are pouring in daily from long-time kit-builders, new kit builders, and will-be kit-builders who are eager to get started assembling radio, audio, and electronic kits.

KIT ENTHUSIASTS PRAISE R·A·E SOCIETY PURPOSES

Letters accompanying membership applications make it quite clear that this Society fills a long-felt need for a national organization to advance and represent the interests of kit-builders. Applicants are outspoken about the advantages they will have from membership. One letter summed it all up with: "This looks the best $1 investment I ever made."

Most often mentioned as reasons for seeking membership:

- The R·A·E Quarterly Journal available to Society members only — the first and only publication devoted to kits and kit building. (No music articles, no record reviews)
- The R·A·E Advance-Test Panels comprised of members who will be called upon to pre-test newly designed R·A·E Kits before they are marketed, and who will then keep the finished kits as their own equipment — without any cost
- The "Members' Roundtable" and other features of the Quarterly Journal where members offer their ideas and experiences, views and opinions, hints and recommendations in an exchange of helpful information about kits and complete systems.

R·A·E QUARTERLY JOURNAL 1ST ISSUE NOW READY

Members of the R·A·E Society are now receiving their copies of the eagerly-awaited first issue of the Society's unique Quarterly Journal. A limited number of extra copies have been set aside to take care of new-member requirements. By acting now, you can be sure to receive this "first-edition" issue as part of your regular membership privileges.

This issue previews the first kits ever designed by kit-builders. Among the equipment articles are:

New: MODULAR STEREO FM TUNER

New: ELECTRONIC CROSSOVER NETWOK

New: MONO PREAMP CAN BE CONVERTED TO STEREO

New: 36 PLANS FOR HIGH-QUALITY INSTALLATIONS

Plus: Other exciting feature articles and important departments.

YOU CAN'T BUY COPIES OF THE R·A·E JOURNAL

Copies of R·A·E Journal are available ONLY to members of the R·A·E Society. The $1 annual membership dues entitle you to four issues as one of the benefits of membership, free of charge. No copies can be bought anywhere.

MORE ABOUT THE QUARTERLY JOURNAL

Milton B. Sleeper, noted figure in electronics, and Chairman of the R·A·E Society, heads the editorial staff of the Society's Journal. The Journal is devoted exclusively to subjects of interest of kit builders — newly developed R·A·E kit designs; Advance-Test Panel reports; high-quality mono and stereo installations from the simplest to the most complete; recording techniques; testing and maintenance methods; and how-to articles on improving performance from records, tape, multiplex FM, and TV sound.

The Journal includes a regular "I Think" department where members air their opinions about what they like or don't like in available kit designs, circuits, and assembly methods. News and critical reviews of subjects related to radio, audio and electronics are covered by "Notes and Comments". A "Buy, Sell and Swap" section is available to members without charge. In short, the Journal contains a wealth of informative, authoritative, and reliable information not available from any other single source. Its contents are refreshing, stimulating, and provocative.

R·A·E MEMBERS TO SERVE ON ADVANCE-TEST PANELS

This is one of the most original ideas ever adopted for pre-testing new products. Designs intended for kit builders will now reflect the kit builders' point of view, and will be based on actual kit-building experience.

Before any new R·A·E kit is released, 10 prototypes will be tested by an Advance Test Panel comprising 10 Society members. Each will receive a kit to assemble, and will report his findings to the Society. The completed kit will then become his property at no cost to him. A new Panel will be chosen for each new kit; no member will serve twice. Any Society member may qualify to serve on the Advance-Test Panels.

RUSH YOUR MEMBERSHIP APPLICATION TODAY!

Just $1 pays for your first year's dues in the R·A·E Society, and entitles you to all benefits of membership, including four issues of the quarterly Journal. It qualifies you to be chosen to serve on an Advance-Test Panel, and to participate in many other activities to be announced in the Journal from time to time. By acting now, you can still receive a copy of the first issue of the Journal, and you will be eligible to serve on the first Advance-Test Panels.

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I understand that I am not required to purchase any R·A·E kit in order to enjoy full membership privileges.

I am a ☐ Beginner ☐ Experienced Kit Builder ☐ Professional

UNCONDITIONAL MONEY-BACK GUARANTEE. If I am not completely satisfied after I receive the first issue of the R·A·E Journal, my money will be refunded on request. No extra charge outside the USA.

Tips

(*Continued from page 34*)

sink and you'll have plenty of time to complete the tinning.

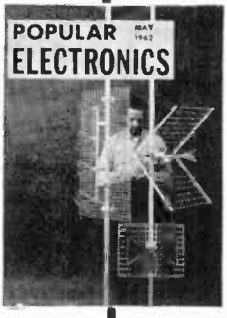
—*Charles Craft, WPE3BIK*

METAL DIVIDERS CHECK CONTINUITY

A pair of small metal dividers, such as those used by draftsmen, comes in handy for detecting tiny breaks in printed-circuit conductors. Set the dividers so that the two points are the same distance apart as the ends of the suspected conductor and bridge across it. If the circuit is restored to normal operation, check the conductor with a magnifying glass to find the break. You can then make a repair by filling in the gap with solder. Before using a set of dividers for this purpose, though, wrap a few turns of insulating tape around the handle and, if necessary, sharpen the points.

—*Art Trauffer*

COMING NEXT MONTH



Your TV set may soon all but double your viewing pleasure, thanks to a whole new set of channels. To find out all about this exciting innovation, don't miss next month's fact-packed article on u.h.f. TV.

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- **MINI—MONO—STEREO**
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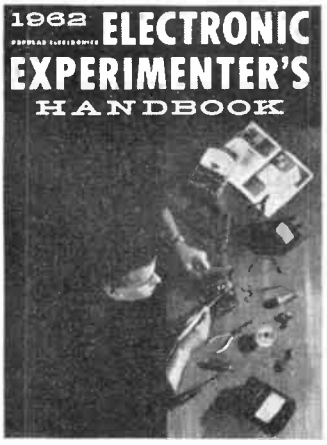

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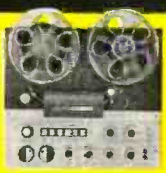

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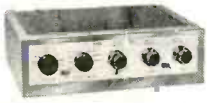

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The GABBLE KILLER

By **HARTLAND B. SMITH,** W8VVD/19W1375

Nerves jangled by QRM? This selective calling system will silence your CB base receiver until the mobile unit calls in

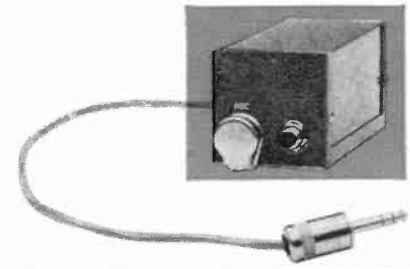
ARE YOU one of the many CB'ers who are rapidly going mad listening to the squawks, squeaks, and channel chatter emanating from their base station receivers? Then here's the answer to your prayers. The pretty CB operator above is triggering the "Gabble Killer," an easily constructed tone-selective calling system described on the following pages. Though the base station receiver is turned on awaiting her call, not a peep will come out of it—till she presses the button.

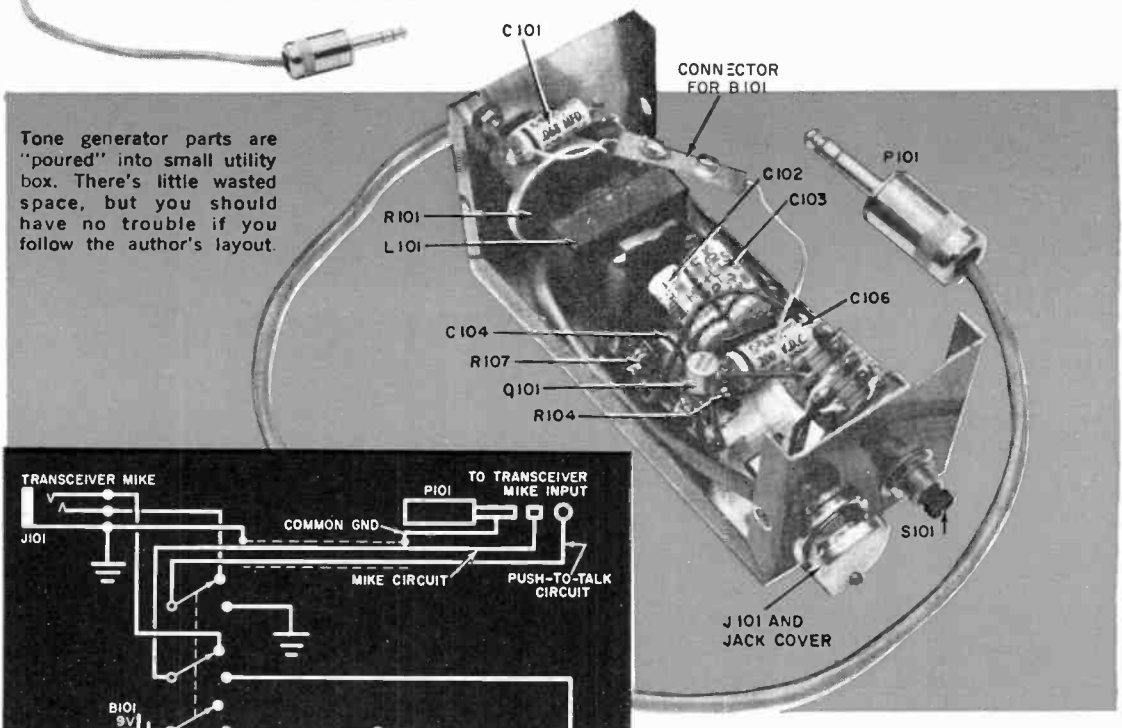
This turns on both her transmitter and a tone generator connected to the rig's mike circuit. The resulting tone-modulated signal is intercepted by the base station receiver, which is operating with its speaker disconnected. A resonant-reed relay, activated by the signal, restores the speaker connection. So if you, too, are fed up with hearing about Uncle Herman's lumbago or Aunt Suzy's favorite recipe, and the ear-shattering noise on 11 meters, read on and build—the Gabble Killer!

(*Continued on next page*)

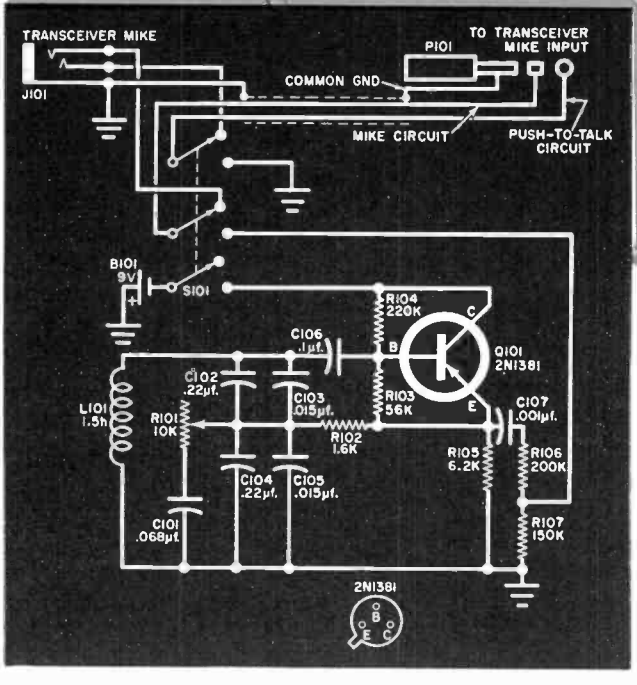
COVER STORY

THE TONE GENERATOR





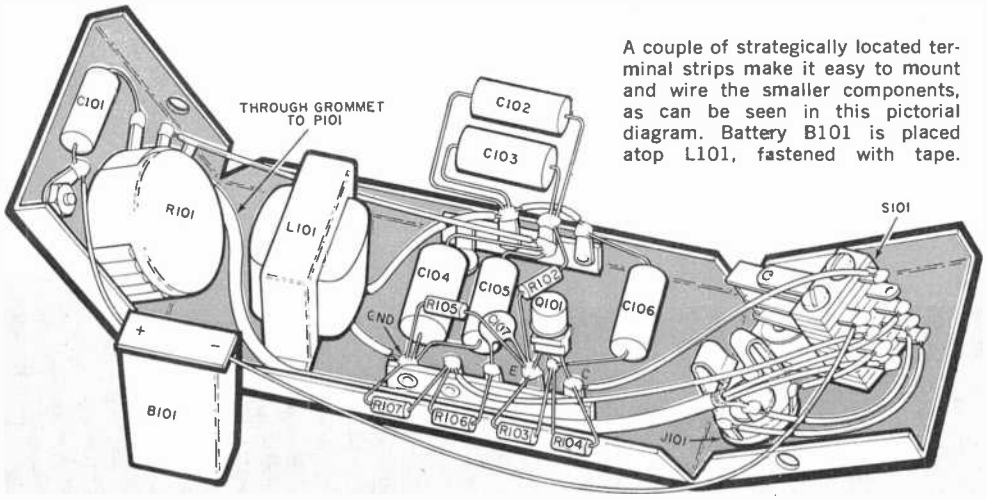
Tone generator parts are "poured" into small utility box. There's little wasted space, but you should have no trouble if you follow the author's layout.



Schematic of tone generator circuit shows phone-type connectors at J101 and P101. Connectors actually used should match those on your mobile transmitter.

Building the Tone Generator. All of the tone generator components are fitted into a 5" x 2¼" x 2¼" aluminum utility box as shown in the photo and pictorial diagram. Since paper capacitors are unstable when subjected to the temperature extremes encountered during mobile operation, don't attempt to substitute them for the Mylar units specified in the Parts List. The heavy-duty potentiometer specified for *R101** was also chosen for its sta-

**To avoid confusion, three-digit numbers have been assigned to each component in this system. The parts used in the tone generator have numbers beginning with "10," while the first two digits of the parts used in the audio-actuated relay circuit are "20."*



A couple of strategically located terminal strips make it easy to mount and wire the smaller components, as can be seen in this pictorial diagram. Battery B101 is placed atop L101, fastened with tape.

PARTS FOR TONE GENERATOR CIRCUIT

B101—9-volt battery (Burgess 2U6 or equivalent)
C101—0.068 μf.
C102, C104—0.22 μf.—see text
C103, C105—0.015 μf.—see text } *all 200-volt Mylar capacitors*
C106—0.1 μf.
C107—0.001-μf. ceramic capacitor
J101—3-conductor, open-circuit phone jack—see text
L101—1.5-henry, 10-ma. choke; d.c. resistance, 95 ohms (Thordarson 26C40)
P101—3-conductor phone plug—see text
Q101—2N1381 transistor
R101—10,000-ohm, 2-watt potentiometer—screwdriver-controlled, with shaft lock (Clarostat Type 53C2 or equivalent)
R102—1600 ohms
R103—56,000 ohms
R104—220,000 ohms
R105—6200 ohms
R106—200,000 ohms
R107—150,000 ohms } *all ½-watt resistors*
S101—3-pole, double-throw, push-button switch (Switchcraft 1009 or equivalent—see text)
1—5"x2¼"x2¼" aluminum utility box (Bud CU-2104-A or equivalent)
Misc.—Transistor socket, shielded cable, rubber grommet, terminal strips, battery plug, etc.

bility during wide temperature changes. It's important, too, that you make no substitution for the recommended choke (*L101*); if you do, the tone produced by your unit may not be of the proper frequency.

A 3-conductor, open-circuit phone jack is shown for *J101*, which accepts the transceiver mike plug. Similarly, a 3-conductor phone plug is shown for *P101*, which plugs into the transceiver's mike input jack. The units actually used for *J101* and *P101*, however, depend on the type of mike jack employed on your transceiver. If, on the other hand, your mike is permanently wired to the transceiver, you'll want to install a plug system so that you can remove the tone generator when required.

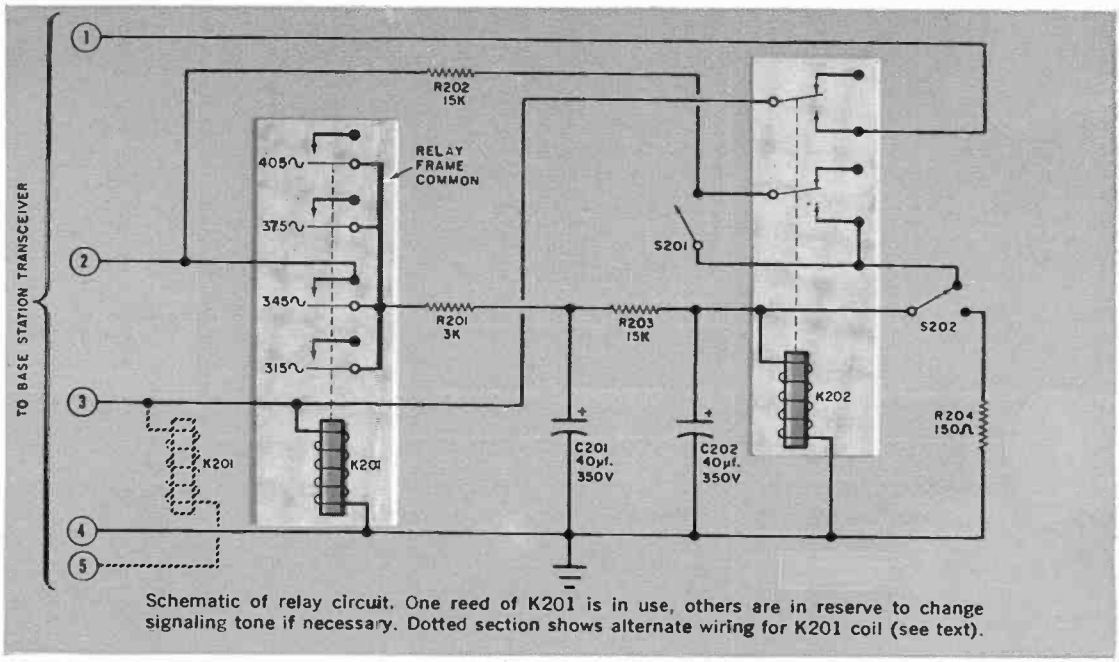
Regardless of what type of plug and jack you use, be sure that the "Common Gnd.," "Mike Circuit," and "Push-to-Talk" leads (see schematic diagram of tone generator) are wired to match the appropriate connections in your mike and transceiver. The wiring shown is typical for *most* transceivers using 3-conductor jacks. If your rig has no provision for "push-to-talk" operation, the wiring associated with the top set of contacts on *S101* will not apply, and you can use a d.p.d.t. switch instead.

Most of the tone generator components can be mounted as illustrated and permanently soldered in place. Capacitors *C104* and *C105*, however, should be only temporarily installed until final adjustment is complete.

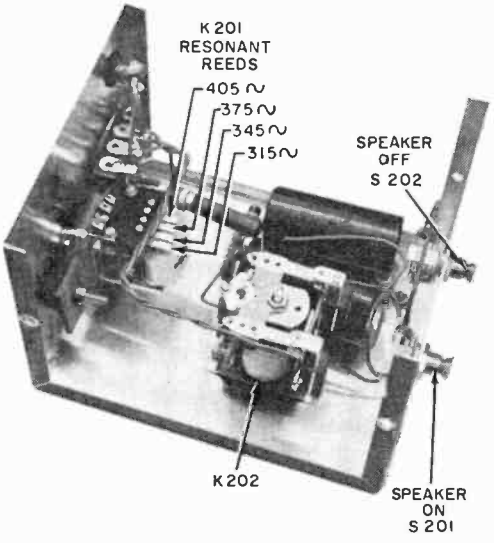
Battery *B101* is placed atop *L101*, where it is held in place with plastic tape. It's wise to use a battery plug rather than soldering directly to the terminals. The battery can then be disconnected during preliminary adjustments, preventing accidental short circuits.

(*Continued on next page*)

THE RELAY CIRCUIT



Schematic of relay circuit. One reed of K201 is in use, others are in reserve to change signaling tone if necessary. Dotted section shows alternate wiring for K201 coil (see text).



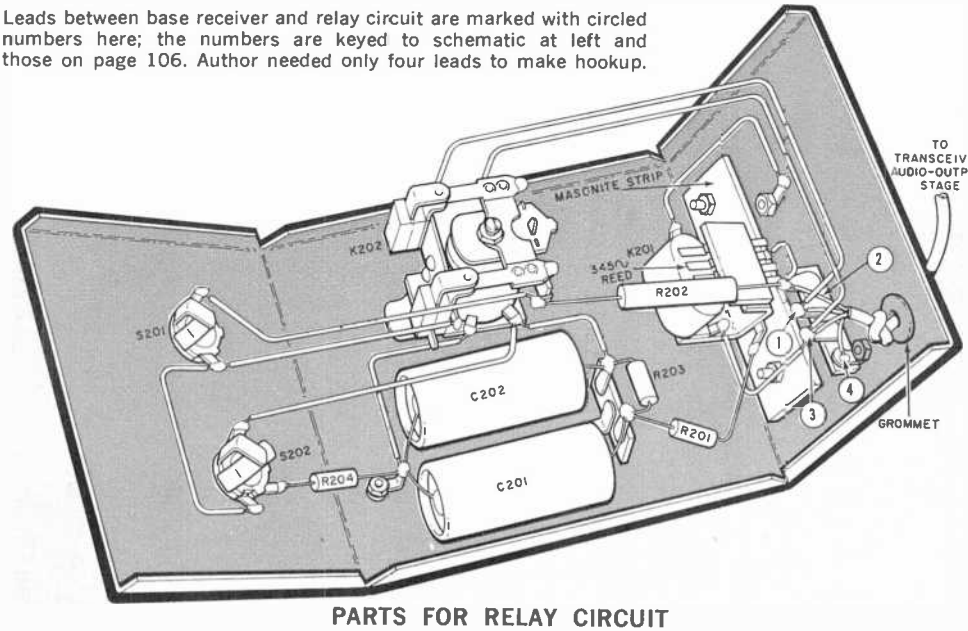
Parts placement for the relay unit is not critical, and there's plenty of mounting room. But be sure to insulate the frame of K201 from the box.

Building the Relay Circuit. The components for the base-station relay circuit are mounted in a 6″ x 5″ x 4″ aluminum utility box. Since the frame of relay *K201* is at a high potential when the contacts are closed, the relay cannot be fastened directly to the box. Instead, mount it on a 1″ x 3½″ piece of Masonite. A solder lug should be installed under one of the mounting screws; this lug will serve as the terminal for one relay contact.

Fasten the Masonite to one of the end walls of the box with machine screws and nuts. A couple of rubber grommets slipped over the screws, between the Masonite and the chassis, will act as spacers and sound deadeners. The rest of the mechanical work needs no comment, and the photos and pictorial diagram of the relay circuit will serve as a guide.

When you're making the connections to the contacts of *K201*, connect *R201* to the solder lug previously installed. The

Leads between base receiver and relay circuit are marked with circled numbers here; the numbers are keyed to schematic at left and those on page 106. Author needed only four leads to make hookup.



PARTS FOR RELAY CIRCUIT

C201, C202—40-uf., 350-volt electrolytic capacitor
K201§—Resonant reed relay (Bramco No. 511A-00085)
K202—10,000-ohm, 4.5-ma. plate relay; d.p.d.t. contacts (Potter & Brumfield Type LM11 or equivalent)

§A special relay designed for this project available from Bramco, Inc., 4501 Belvidere, Detroit 14, Mich., for $9.75 postpaid.

R201—3000-ohm, 1-watt resistor
R202—15,000-ohm, 2-watt resistor
R203—15,000-ohm, 1-watt resistor
R204—150-ohm, ½-watt resistor
S201—S.p.s.t., normally-open, push-button switch
S202—S.p.d.t. push-button switch
1—6"x5"x4" aluminum utility box (Bud CU-2107-A or equivalent)
Misc.—Color-coded cable, rubber grommets, terminal strips, Masonite to mount K201, etc.

connections from lead *2* of the cable interconnecting the transceiver and relay circuit and from *R202* are made to the terminal corresponding to the 345-cycle (next-to-longest) reed.* Don't hook up *K201*'s coil, however, or install the interconnecting cable, until you've read the following paragraphs.

Installation. Insert the tone generator's plug (*P101*) into the mike jack on your mobile transceiver, and plug the mike into *J101*. That's all there is to the mobile installation.

Now remove the base station transceiver from its cabinet and examine the audio output stage. One lead from the output transformer's secondary should be connected directly to the speaker. Break this lead as shown in the sample output stage schematics (on p. 106). The other output transformer lead will either be grounded (see sample schematic "A") or connected to the "Send-Receive" switch (see sample schematic "B").

If the lead is grounded, run a 4-conductor cable between the relay circuit and the receiver. The cable is wired as shown in the pictorial and schematic of the relay circuit and in output stage schematic "A." Corresponding points on the pictorial and schematics are labeled with identical, circled numbers. Ignore the dotted section of the schematic diagram of the relay circuit. Now wire in the coil of *K201*, still ignoring the dotted section of the diagram.

If the lead is not grounded, but connects to the "Send-Receive" switch, you'll have to use a 5-conductor cable. Wire in the coil of *K201* according to the dotted section of the relay circuit schematic; connect the cable according to

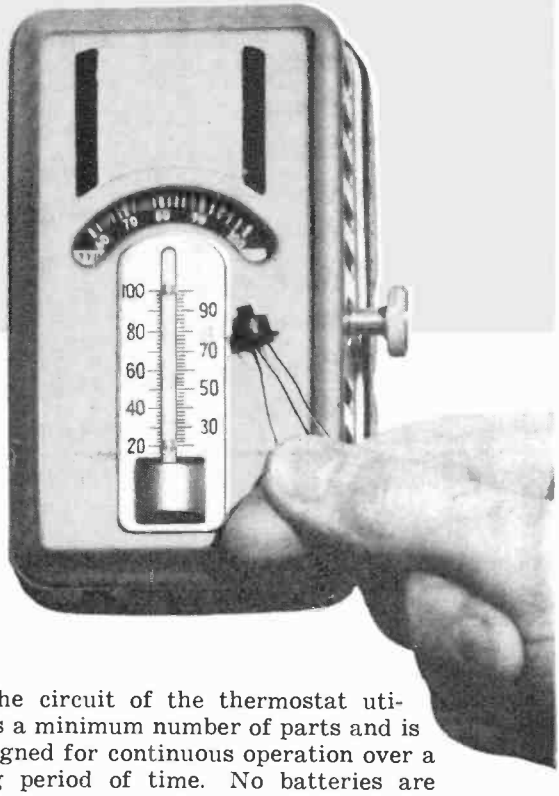
(*Continued on page* 106)

**Relay K201 also contains three other reeds, tuned to three other frequencies. You can switch to one of these (see section on "Changing the Signaling Tone" on page 108) in the event of interference from another station using this calling system.*

TRANSISTOR CONTROLS TEMPERATURE

That's right—a transistor is the transducer in an intriguing home thermostat

By FRED IPPOLITO, Jr.*



EVER CONSIDER that a transistor makes a fine temperature-sensing device? You've probably known for years that some transistors are highly sensitive to temperature changes—and, like almost everyone else, you've likely viewed this sensitivity *only* as an adverse characteristic. But hang on! You're going to learn about a little gadget that puts this "shortcoming" to practical use!

A transistor is the heart of the thermostat described here, and the unit boasts some specifications that are truly spectacular. In brief, this simple circuit will control temperatures within a 30° F range and with a sensitivity far better than that of most ordinary thermostats —at least ±0.5°.

Applications for this novel device are all but unlimited: in addition to its use as a thermostat for the home, it will control blower motors—those used to dissipate heat in electronic equipment racks, for instance. It can also be used to turn household cooling fans on and off during the summer months. And in still other installations, it will control the temperature of crystal ovens, photo-lab darkrooms, incubators, and just about every other enclosure where accurate temperature control is the goal.

The circuit of the thermostat utilizes a minimum number of parts and is designed for continuous operation over a long period of time. No batteries are required, and the entire unit can be assembled for less than $10.00—inexpensive indeed for such precise temperature control.

About the Circuit. As you can see from the schematic diagram in Fig. 1, transistor *Q1* is connected as a conventional common-emitter amplifier, although there is no signal applied to its base. The biasing arrangement, while undesirable for most transistors because of the change in bias with variations in ambient temperature, is ideal for this application.

Capacitor *C1* and diode *D1* develop approximately 8 volts d.c. from the 6.3-volt filament winding of transformer *T1*. Current flowing through resistors *R1* and *R2* in series with the parallel combination of transistor *Q1* and resistors *R4* and

*Amherst Laboratories, Sylvania Electronic Systems-Central, a division of Sylvania Electric Products Inc., Buffalo 7, N.Y.

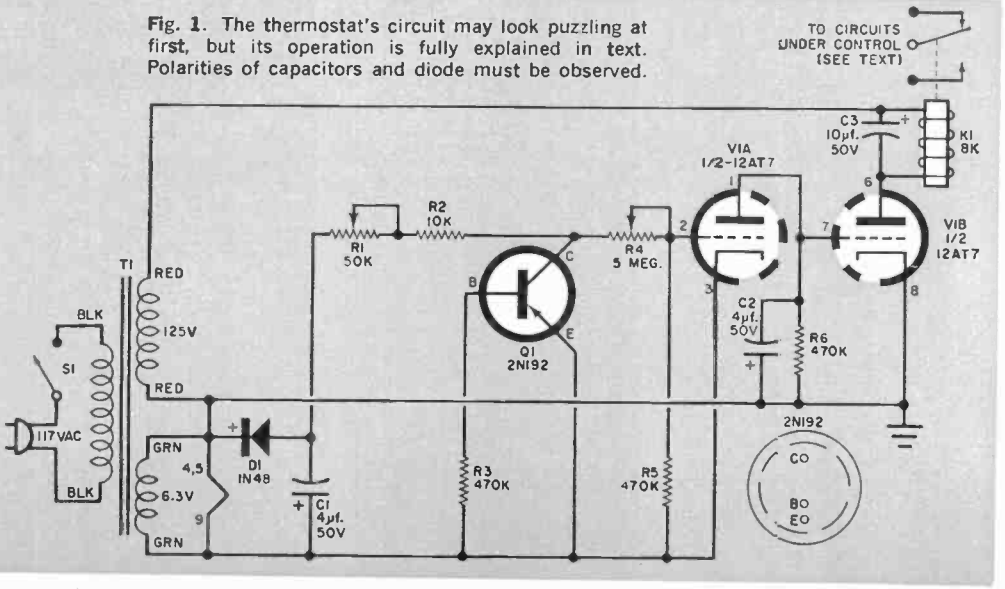


Fig. 1. The thermostat's circuit may look puzzling at first, but its operation is fully explained in text. Polarities of capacitors and diode must be observed.

PARTS LIST

C1, C2—4-μf., 50-w.v.d.c. electrolytic capacitor
C3—10-μf., 50-w.v.d.c. electrolytic capacitor
D1—1N48 diode
K1—Plate relay; s.p.d.t. contacts; 8000-ohm coil (Sigma 4F-8000-S/SIL or equivalent)
Q1—2N192 transistor (General Electric)
R1—50,000-ohm potentiometer, linear taper
R2—10,000-ohm, ½-watt resistor
R3, R5, R6—470,000-ohm, ½-watt resistor
R4—5-megohm potentiometer, linear taper
S1—S.p.s.t. toggle switch
T1—Power transformer; primary, 117 volts a.c.; secondaries, 125 volts @ 15 ma. and 6.3 volts @ 0.6 amp. (Stancor Type PS-8415 or equivalent)
V1—12AT7 tube
1—2" x 7" x 5" aluminum chassis (Bud AC-402 or equivalent)
1—Line cord and plug
Misc.—Hardware, wire, solder, terminal strips, transistor and tube sockets, components for calibration setup (see text), etc.

R5 produces a bias voltage at the grid of triode *V1a*. Under average room conditions, this voltage varies from —0.8 to —7 volts because the collector current through transistor *Q1* varies with changes in the transistor's ambient temperature.

Potentiometer *R1* controls the negative voltage at the collector of *Q1* and thus serves as the thermostat's "temperature" control. Potentiometer *R4*, in contrast, acts as a voltage divider in conjunction with grid resistor *R5*; it controls the bias voltage on tube *V1a* and thus acts as a sensitivity control in the circuit.

The 12AT7 dual triode is connected as a direct-coupled d.c. amplifier and serves both as an amplifier and as a relay control. Because of the amplification within triode *V1a*, changes in the grid voltage of *V1a* cause even more marked changes in the grid voltage of triode *V1b*. The voltage on the grid of *V1b*, in turn, controls the flow of current through this triode, which controls relay *K1*.

Since the plate of triode *V1a* is effectively grounded (through capacitor *C2* and resistor *R6*), this triode will conduct whenever *T1*'s 6.3-volt filament winding drives the cathode of *V1a* negative. A d.c. voltage is then developed across the *C2/R6* combination. The magnitude of this voltage is determined by the negative bias on the grid of *V1a*, and this bias in turn is controlled by the transistor/resistor network discussed above.

The d.c. voltage across *C2* and *R6* is the bias voltage on the grid of *V1b*. As previously mentioned, this bias voltage controls the current through *V1b* and thus the action of relay *K1*. When the high-voltage winding of transformer *T1* drives the plate of *V1b* positive, the triode conducts, and the amount of current flow is determined by the bias on the grid. If the bias is small enough, suffi-

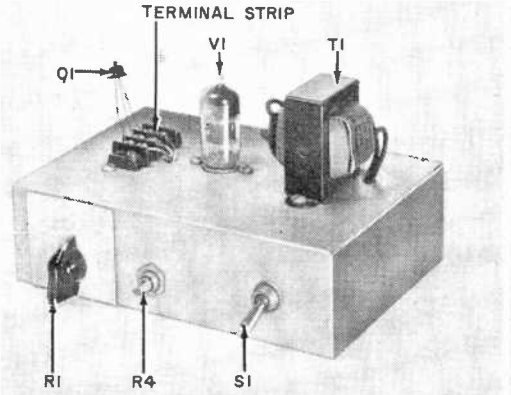


Fig. 2. Top view of thermostat. Transistor is connected to a barrier-type terminal strip.

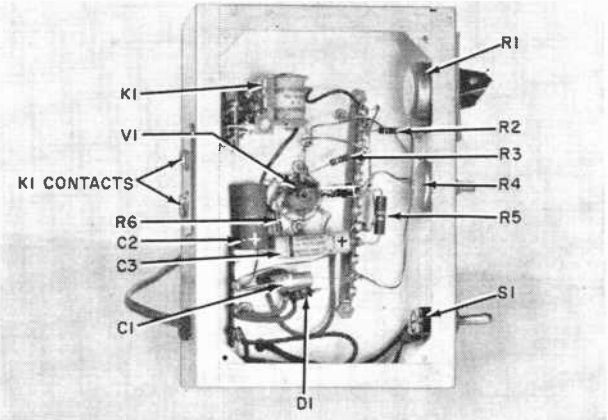


Fig. 3. Bottom view of the thermostat, showing placement of parts. Wiring is not critical.

cient current flows to close relay *K1*; if the bias is too large, relay *K1* remains open.

The circuit shown can be used to control temperatures in a 25°—30° F range, with the maximum and minimum temperatures dependent on the setting of sensitivity control *R4*. With *R4* at minimum resistance (maximum sensitivity), temperature control *R1* may be set for any temperature between 61° and 91° F.

Because of the nature of the circuit, there will necessarily be some interaction between *R1* and *R4*. Generally speaking, however, the setting of *R1* will determine the average of "mean" temperature, and the setting of *R4* will fix the upper and lower limits of control.

Construction. The unit is assembled on a 2″ x 7″ x 5″ chassis, with tube *V1*, transformer *T1*, and transistor *Q1* located above the chassis. (See Fig. 2.) Note that the transistor isn't actually mounted on the chassis proper, but is simply connected to a barrier-type terminal strip. This arrangement makes *Q1* less sensitive to heat radiation from the tube and transformer and makes it an easy matter to remove the transistor for use in remote locations.

Potentiometers *R1* and *R4* should be wired so that clockwise rotation decreases the amount of resistance in the circuit. The maximum clockwise position of the potentiometers will then be the highest temperature and maximum sensitivity settings, respectively. Figure 3 shows the underchassis components—try to duplicate the approximate locations.

Calibration. While it's possible to calibrate the thermostat in a variety of ways, building the calibration setup pictured in Figs. 4 and 5 will greatly simplify the problem. A small cardboard box, approximately 4″ x 5″ x 6″; an accurate, easily read thermometer; some hookup wire; and a Christmas-tree light set with standard, 117-volt a.c. bulbs are all the materials you'll need.

Begin by cutting two holes in the box just large enough to pass the bases of the light bulbs. Push the bases through from the inside of the box and screw them into their sockets; the remainder of the lights on the set can be removed.

Next, cut a small hole in the box and pass a three-wire cable (or simply three wires twisted together) through it, and connect the transistor leads to the three wire ends in the box. (Remember to use a heat sink between the transistor and the soldering gun if you solder the transistor in place.)

Run the other ends of the wires to the proper terminals on the control unit terminal strip, taking care to make the correct base, emitter, and collector connections. Plug the light set into an a.c.

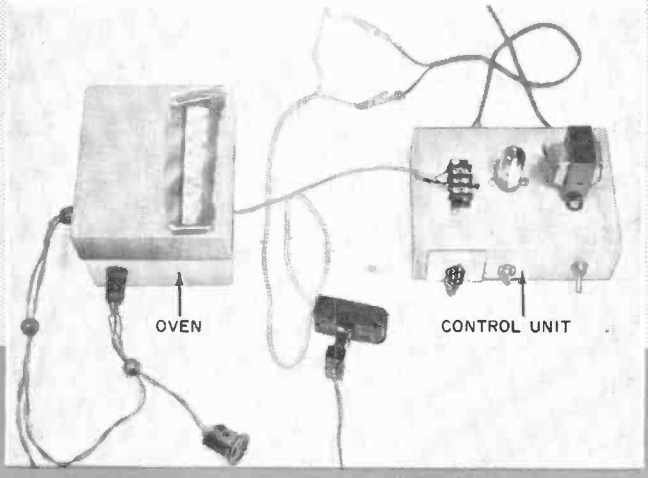


Fig. 4. A cardboard-box "oven" will be required to calibrate the thermostat. Christmas-tree bulbs serve as source of heat.

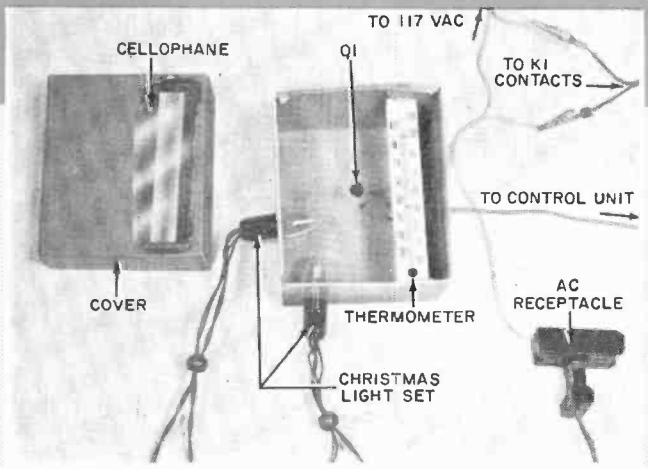


Fig. 5. Transistor is placed inside "oven" to calibrate R1. Cellophane over thermometer prevents undue heat loss from box.

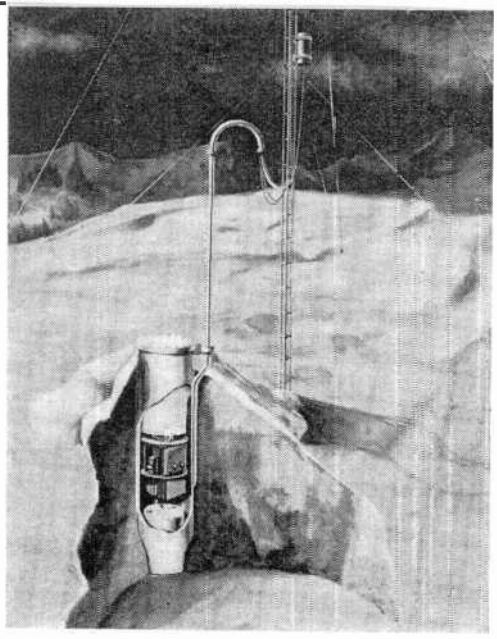
outlet, using the contacts of relay *K1* as a power switch. Finally, cut an opening in the cover of the box to view the thermometer, and paste a piece of cellophane over the opening to minimize heat loss.

Although two light bulbs were used in the setup illustrated, you may find that one will do the trick, depending on the size and nature of the box you've selected and the quality of the thermometer used. Since the reaction time of the transistor to temperature changes is significantly faster than that of the thermometer, it will be difficult to read the temperature changes on the thermometer if the "oven" (the cardboard box) is heated and cooled too quickly. In any case, it's a simple matter to remove one bulb from its socket if necessary.

To use the calibration setup, turn temperature control *R1* and sensitivity control *R4* fully clockwise (highest temperature and maximum sensitivity settings, respectively). Apply power, and the oven lights will go on. Heat generated by the bulbs will raise the oven temperature and the transistor will sense the temperature changes.

Relay *K1* will remain closed (and the lights will stay on) until the temperature of the oven reaches the level for which temperature control *R1* is set. With *R1* turned fully counterclockwise, the oven temperature will rise to approximately 90° or 95° F before the lights go out. If you encounter trouble at this point, recheck your wiring, especially connections to potentiometers *R1* and *R4* and to the diode rectifier (*D1*).

(*Continued on page* 114)

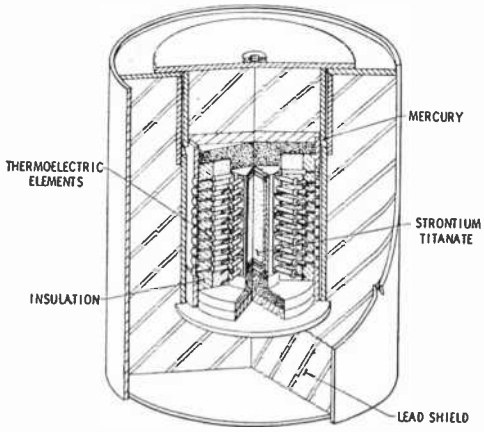


Radioactive Voice for the Northland

THE world's first radioisotope-fueled weather station will soon transmit temperature, wind speed, and barometric pressure reports from a remote site somewhere north of the Canadian mainland. Developed for the U. S. Atomic Energy Commission by the Nuclear Division of the Martin Company, the unmanned weather station will broadcast its reports every three hours on a year-round basis at distances up to 1500 miles.

Completely automatic in operation, the station will derive all its power from pellets of a strontium-90 "mixture." Heat from the pellets is transformed into a continuous flow of electricity by a series of thermo-electric couples. The electrical energy is then stored in rechargeable batteries in order to build up sufficient power to operate the transmitters.

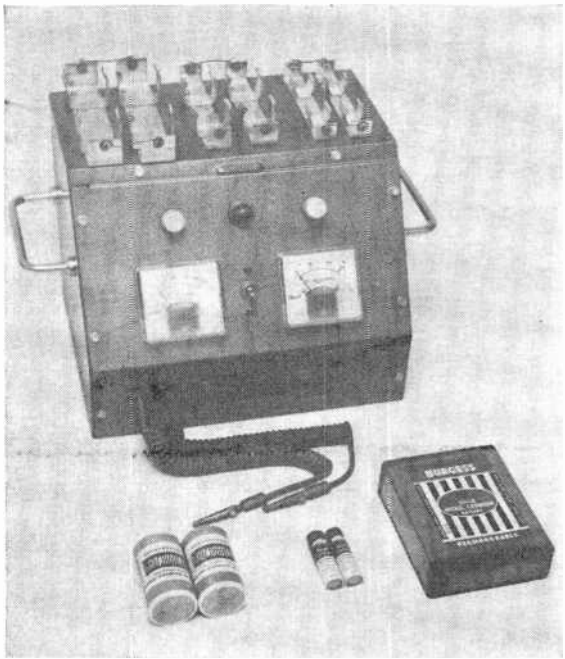
As you might guess, the designers have gone to great lengths to keep the heavily shielded canister of strontium-90 intact under every conceivable condition. In fact, even if the fuel were released, it couldn't be absorbed by living organisms because it's "locked" in an insoluble compound. -30-

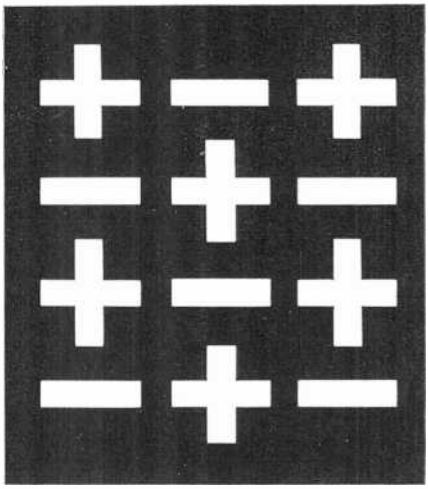


Cutaway drawing (above) shows internal construction of power supply for world's first atomic weather station.

Generator for power station is lowered into half-buried cylinder during tests at Baltimore, Md., plant of the Martin Company. Unmanned station will operate without maintenance or refueling for two years once it is completely assembled and fully sealed.

N-C CHARGER





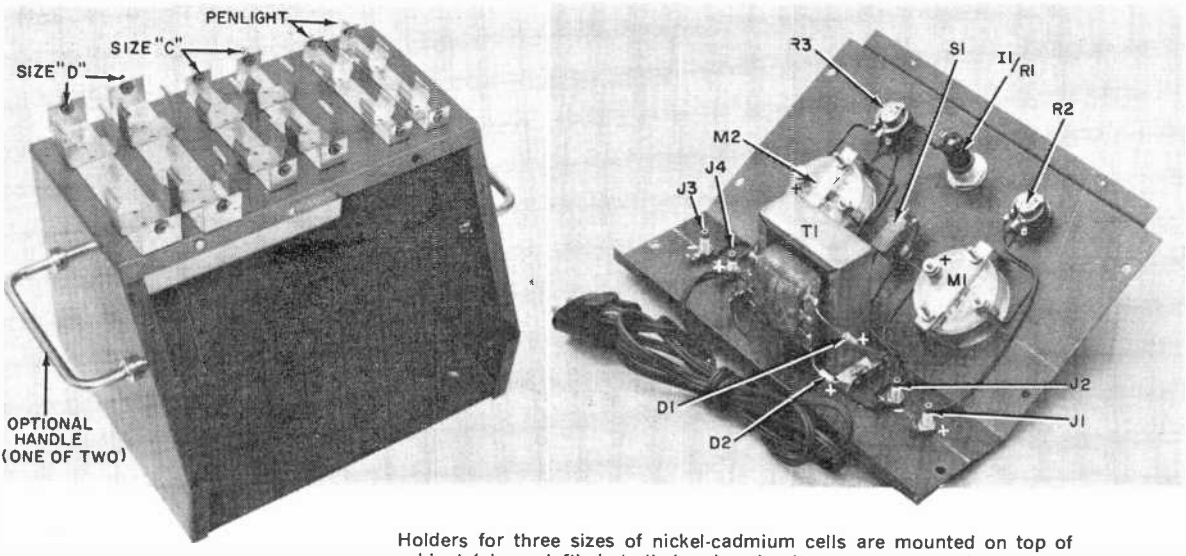
De luxe heavy-duty charger provides two independent fully adjustable outputs, handles almost every type of nickel-cadmium battery

By **HERBERT FRIEDMAN,** W2ZLF

WITH everything from transistor radios to children's toys being powered by batteries these days, even the average family is apt to spend a sizable amount of money each year on battery replacements. Accordingly, the nickel-cadmium battery (once practical only for large-scale industrial use) is now finding its way into many homes and workshops. Though they represent a high initial investment, most nickel-cadmium batteries can be recharged considerably more than a thousand times. In addition, these batteries are virtually leakproof and are now available in a variety of popular sizes.

After making the switch to nickel-cadmium batteries, the author soon found himself using several different types—each having a different charging-current requirement. The "N-C Charger" described here was designed to meet all present needs and to anticipate any which might come up in the future. It has two fully adjustable outputs—one delivering a maximum of 500 ma., the other a maximum of 150 ma. These outputs can be used individually or simultaneously; they'll charge most nickel-cadmium batteries from the smallest flash light types to the largest sizes employed as power supplies for electronic flash guns.

Construction. For neatness of appearance and ease in reading the meters, the unit is housed in an 8" x $10\frac{1}{16}$" x 8"



Holders for three sizes of nickel-cadmium cells are mounted on top of cabinet (above, left), but all charging-circuit components are installed on the front panel (above, right). Jacks J1-J4 must be of the insulated type.

sloping-panel cabinet. All of the components in the charging circuit are mounted on the panel itself, and a series of holders for the batteries to be charged is installed on the cabinet top.

There's no permanent electrical connection between the battery holders and the charging circuit, incidentally. The holders are wired to the charger, as needed, via leads plugged into *J1-J2* and/or *J3-J4*.

You can get a good idea of the parts layout from the photographs and pictorial diagram. Notice that the two current-control potentiometers (*R2* and *R3*) have been mounted *above* the meters, so that any heat generated by the controls will not damage the plastic meter cases. Notice also that, contrary to usual practice, *T1*'s center tap is not grounded. This prevents unwanted contact between the battery holders and the charging circuit. Jacks *J2* and *J3* therefore, like jacks *J1* and *J4*, should be of the insulated type.

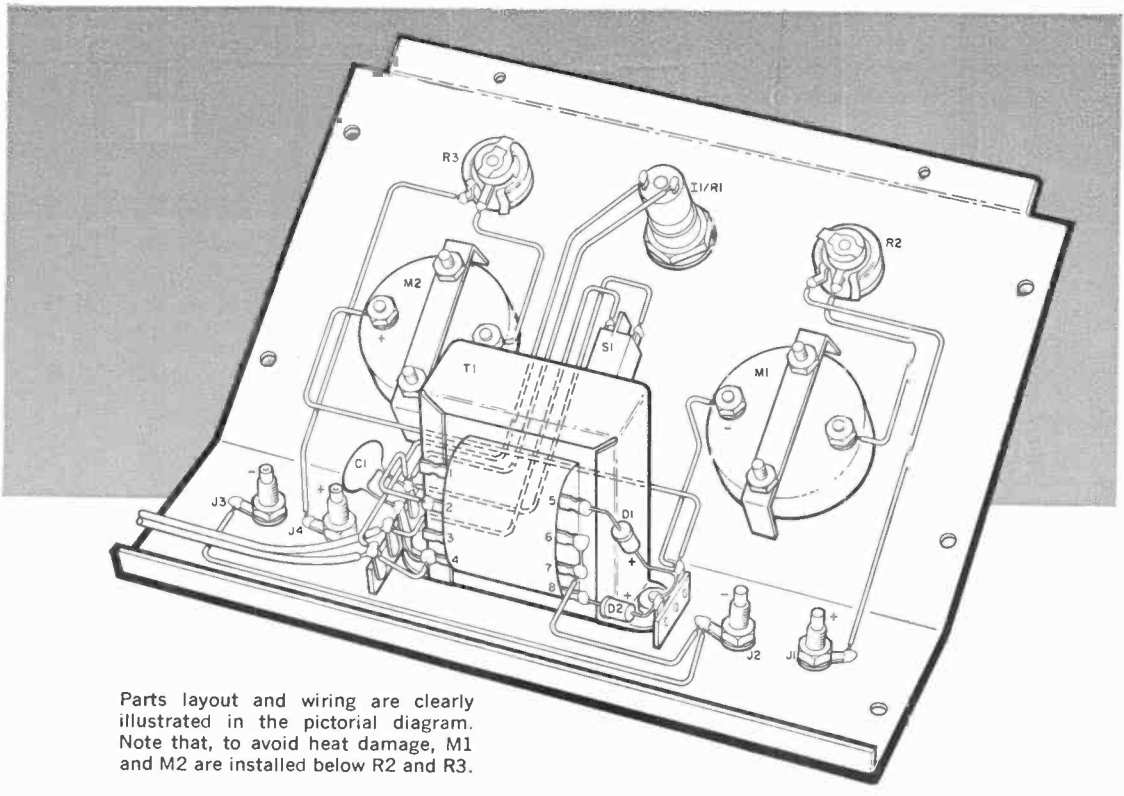
The pilot-light assembly specified in the Parts List has current-limiting resistor *R1* built in. If you use an assembly without this built-in resistor, *R1* must be installed externally.

The choice of the battery holders to be mounted on top of the cabinet is up to you. Six double holders were used by the author: two for "D" cells, two for "C" cells, and two for penlight cells. Each pair of holders was wired in series so that, depending on the placement of the leads, two or four cells of any type could be charged at once. Batteries with clip or screw terminals, of course, can be connected directly to the test leads and need no holders.

To make the charger easier to carry, you can, if you wish, install a pair of handles on the sides of the cabinet. Finally, provide yourself with two sets of output leads, and you're ready to go. The output leads pictured here were made from coiled-cord test leads and will not easily become tangled with other equipment on the bench.

Using the Charger. First determine the charging rate for the battery to be charged. This figure is often printed on the battery case; if it is not, the manufacturer will supply it. Charging rates are usually given in terms of current to be applied for 14 or 16 hours. Some manufacturers also specify a "rapid charge" rate, involving a larger amount of current applied for a shorter period of time.

Try not to use a "rapid charge" unless you are desperate for battery power, and never use it unless you are certain of the exact recommended rate. Too high



Parts layout and wiring are clearly illustrated in the pictorial diagram. Note that, to avoid heat damage, M1 and M2 are installed below R2 and R3.

a charging rate can build up enough pressure to burst the battery case. Some nickel-cadmium batteries now have built-in safety valves to relieve this pressure, but once the valve releases, the battery is ruined.

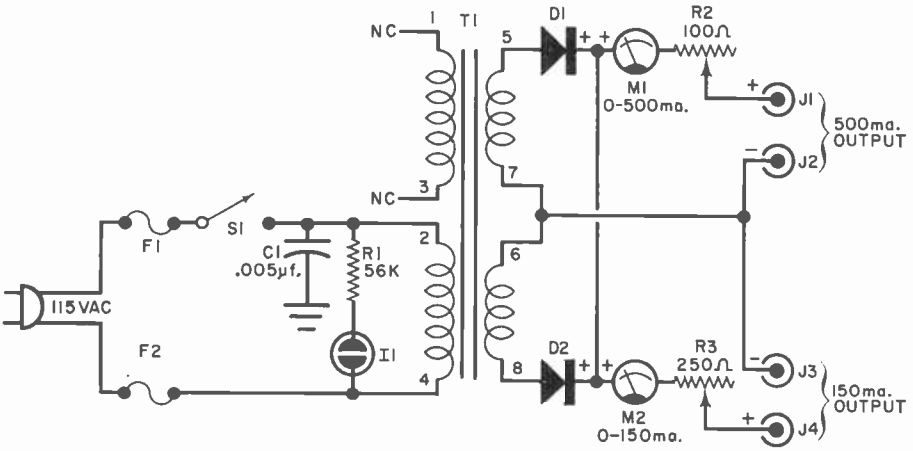
When you've determined the proper charging rate, place the battery, or batteries, in the appropriate holder(s) and connect the charger output leads. The positive lead goes to the positive battery terminal, the negative lead to the negative terminal. If the battery has terminals to which the output leads can be directly connected, as we said before, it's not necessary to use a holder. Groups of batteries to be charged simultaneously should be placed in series, so that each battery gets the same current.

If the charging rate is under 150 ma., use either output (jacks *J1-J2* or *J3-J4*). If it's more than 150 ma., use only *J1-J2*.

Before turning on the charger, set the current-control potentiometer to be used (*R2* and/or *R3*) at minimum current. Then flick on switch *S1* and set the con-

PARTS LIST

C1—0.005-μf., 500-volt ceramic capacitor
D1, D2—Silicon diode, at least 0.75 amp., 100 PIV (Lafayette SP-197 or equivalent)
F1, F2—0.5-amp., 3AG fuse (in line plug)
I1—NE-51 neon lamp
J1, J2, J3, J4—Insulated tip jack (two red, two black)
M1—0-500 ma. panel meter (Shurite Type 850 or equivalent)
M2—0-150 ma. panel meter (Shurite Type 850 or equivalent)
R1—56,000-ohm, ⅓-watt resistor (supplied in pilot light assembly listed at right)
R2—100-ohm wire-wound potentiometer, at least 6 watts (Ohmite Type 0112 or equivalent)
R3—250-ohm wire-wound potentiometer, at least 2 watts (CTS Type 252 or equivalent)
S1—S.p.s.t. toggle switch
T1—Filament transformer; primary, 117 volts; secondary, 24 volts CT @ 1.0 amp. (Triad F-45X or equivalent—see How It Works)
1—Pilot light assembly for I1 (Dialco 95408X-931 or equivalent)
1—8" x 10 1/16" x 8" sloping-panel cabinet (Bud C-1588HG or equivalent)
Misc.—Knobs for R2 and R3, test leads, line cord with fused plug, terminal strips, battery holders, cabinet handles, etc.



Schematic diagram of N-C charger. Two diodes are used as a full-wave rectifier, but T1's center tap, contrary to usual procedure, is not grounded.

HOW IT WORKS

Power transformer *T1*'s secondary is connected to a standard, full-wave rectifier (diodes *D1* and *D2*). The resulting d.c. (12 volts) is available either at jacks *J1* and *J2* (the 500-ma. output) or jacks *J3* and *J4* (the 150-ma. output). Current taken from the former output passes through meter *M1* (0-500 ma.) and potentiometer *R2*; current taken from the latter passes through meter *M2* (0-150 ma.) and potentiometer *R3*.

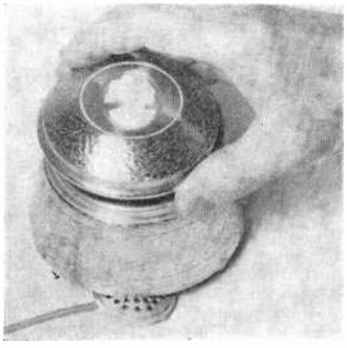
For transformer *T1*, the author used an industrial control model (Stancor P-6377) which he had in his spare-parts box. This transformer has a 115/230-volt primary and two 12-volt secondaries; it was wired (see schematic and pictorial diagram) for a 115-volt input and a 24-volt CT output. Such an elaborate unit is not really necessary, and the simpler, lighter-duty transformer specified in the Parts List will work just as well. It's similar to the P-6377 in style, but has wire leads instead of the numbered terminals shown.

The charger is protected by two fuses (*F1* and *F2*) located in the line plug. Switch *S1* controls the power, and neon bulb *I1* (with limiting resistor *R1*) acts as a pilot light.

trol for the proper charging current. Leave the battery, or batteries, on charge for the recommended amount of time, and that's all there is to it.

To insure maximum life, a nickel-cadmium battery should be recycled three or four times a year. Recycling simply means allowing the battery to become completely discharged before recharging it. This procedure arrests internal "plating," which would reduce the battery's efficiency. -30-

PINT-SIZED CARILLON



The tinkling of a music box will have a carillon-like effect if played through your hi-fi system. All you need to pick up the sound is a low-priced crystal microphone (Lafayette MS-108 or equivalent) placed under the unit. Most hi-fi amplifiers aren't equipped with a mike input, but a magnetic phono or tape-head input will provide plenty of gain. The bass boost from the phono or tape equalization circuit shouldn't affect the essentially high frequency sound of the music box. However, if too much mechanical noise is picked up, try experimenting with the position of the mike.

—Art Trauffer

POOR MAN'S RF POWER INDICATOR

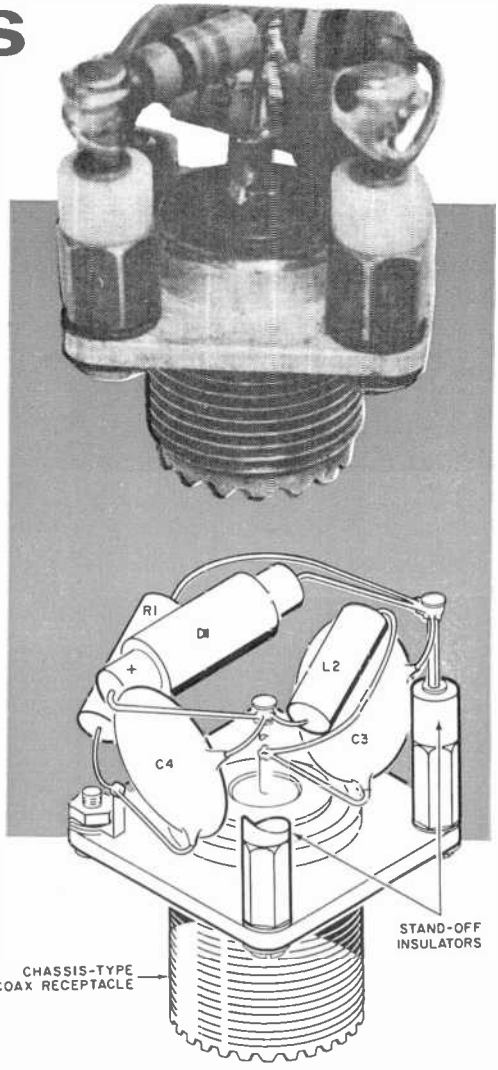
checks transmitter output where it counts the most

By DOROTHY LOUISE ZACHARY

SOMEONE once said "Necessity is the mother of invention," and in my case, this certainly turned out to be true! The "necessity" was a true-reading r.f. power-level indicator for my low-power rig. It had to be inexpensive enough to fit within my grocery allowance.

While r.f. voltmeters are both inexpensive and easy to use, they have a drawback. A poor standing-wave ratio in the transmission line would mean that the r.f. voltage measured at the transmitter might not be a good indication of that actually entering the antenna. Why not, then, I thought, employ an r.f. voltmeter directly at the antenna? This was fine, but I didn't feel like running up to the roof every time I wanted to tune up the rig.

The "invention" that solved this last problem is described here. It consists of a handful of parts mounted on a coax receptacle, and can be put together for just a few dollars. Installed in a coax transmission line via a "T" connector near the antenna, the device samples a small portion of the r.f. voltage and rectifies it. The resulting d.c. voltage appears across the transmission line and can be measured, by means of a properly isolated and bypassed meter, at the operating position. Suitable for both ham and CB bands, the power indicator can be used with rigs running up to about 60 watts output.

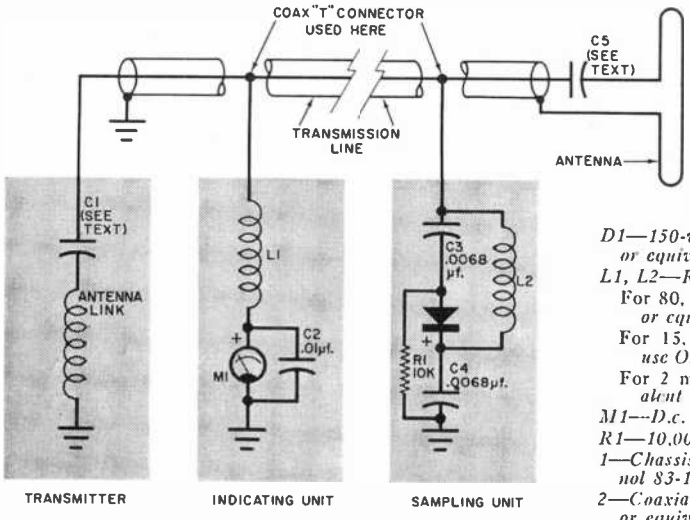


All parts for the sampling unit (see photo and pictorial diagram) are mounted on a coaxial receptacle.

Construction. The complete "sampling" circuit, as mentioned earlier, is mounted on a chassis-type coax receptacle. Install two insulated stand-off insulators and a solder lug, as shown in the pictorial diagram, using the holes provided in the receptacle. Then wire in the five components (*C3, C4, D1, L2,* and *R1*) according to the schematic and pictorial diagrams.

Since the device must be installed near the antenna, it's necessary to weatherproof it. Use your own ingenuity to work out the exact method; one way might be to paint the parts and connections with Glyptal or polystyrene cement.

The indicator used at the operating position is an ordinary d.c. voltmeter (*M1*). Eventually, you'll probably want to mount an individual meter, together with bypass capacitor *C2* and r.f. choke



Schematic diagram of complete system. Sampling unit is located near antenna, indicating unit is placed in shack.

PARTS LIST

C1, C5—500-volt ceramic disc capacitor—see "Installation and Operation" section
C2—0.01-μf., 500-volt ceramic disc capacitor
C3, C4—0.0068-μf., 500-volt ceramic disc capacitor
D1—150-volt general-purpose diode (1N458 or equivalent)
L1, L2—R.f. choke
For 80, 40, and 20 meters, *use Ohmite Z-7 or equivalent*
For 15, 10, and 6 meters, Citizens Band, *use Ohmite Z-28 or equivalent*
For 2 meters, *use Ohmite Z-144 or equivalent*
M1—D.c. voltmeter—see text
R1—10,000-ohm, ½-watt resistor
1—Chassis-type coaxial connector (Amphenol 83-1R or equivalent)
2—Coaxial "T" connectors (Amphenol 83-1T or equivalent)
Misc.—Glyptal or polystyrene cement, meter cabinet, stand-off insulators, etc.

L1 (see schematic) in a small sloping-panel cabinet. It's best, though, to begin with a temporarily wired multimeter so that you can determine the most appropriate scale to use.

Installation and Operation. First see to it that both your transmitter output and antenna input are "open-circuited" with respect to d.c. If this is not the case, install small series capacitors at the transmitter output (*C1*) and/or antenna input (*C5*). The reactance of these capacitors should be about ½% of the antenna load resistance. To calculate the value of a capacitor having such a reactance, use the formula:

$$C = \frac{200}{2\ fR_L}$$

where C is the value of the capacitor (in farads), f is the frequency to which the antenna is tuned (in cycles) and R_L is antenna load resistance (in ohms).

If, for example, you have a 52-ohm antenna tuned to 27 mc. (27,000,000 cycles), the proper capacitor value would be 0.023 μf. (0.000000023 farad). It's not necessary to match this capacitance exactly; just use the closest stock value. But be sure to get ceramic disc units with ratings of at least 500 volts. And don't forget to weatherproof the antenna capacitor, if used.

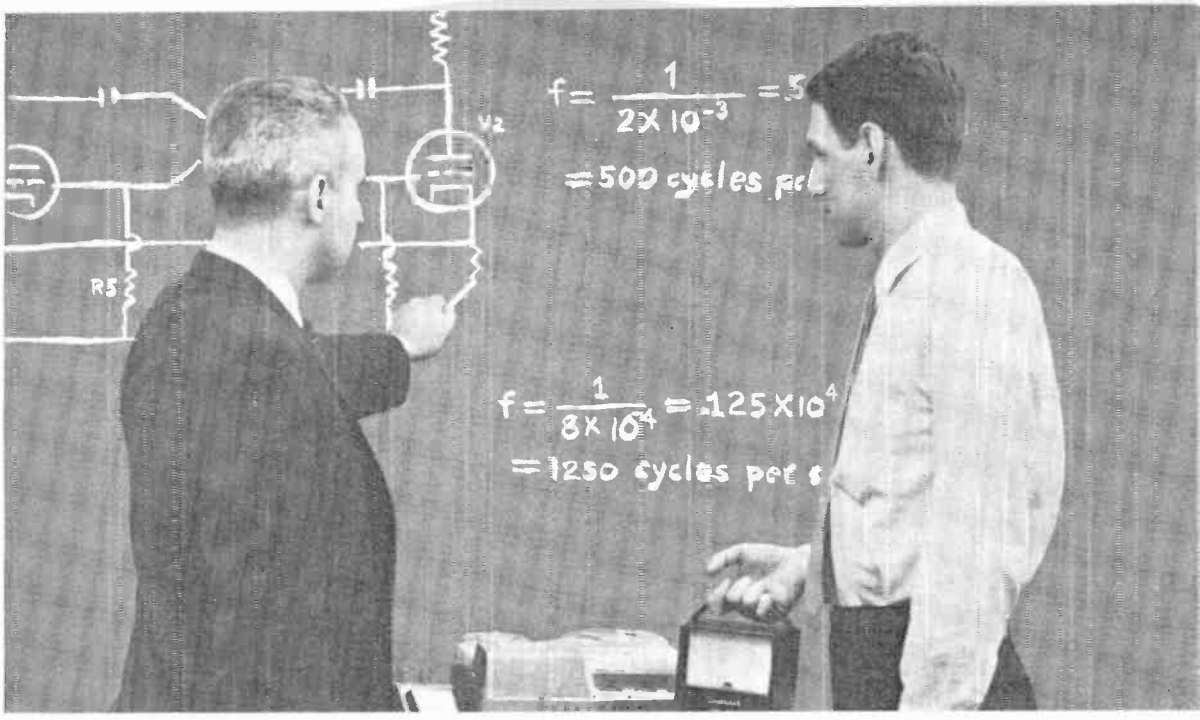
It's now necessary only to install the "sampling" and indicator units (temporarily use a multimeter at *M1*) as shown in the schematic. The former is placed near the antenna, the latter near the transmitter. In making these connections, "T" connectors—such as the Amphenol 83-1T—will prove helpful.

In order for the system to work properly, the sampling unit and the antenna should be as close together as possible. I'd recommend that the distance between the two be no greater than one-tenth of a wavelength. To calculate this maximum recommended distance, the following formula will be helpful:

$$A = \frac{1181.1}{f}$$

where A is one-tenth of a wavelength (in inches), and f is the frequency to which the antenna is tuned (in mc.). Maximum recommended distance between the antenna terminals and the sampling unit at 27 mc., for example, is 43.7 inches.

With the installation completed, all you have to do is turn on your rig and tune for maximum indication on meter *M1*. At this point, you can have full confidence that the maximum amount of r.f. power is being fed to your antenna. Once you have determined the range of readings to be expected on *M1*, a more permanent meter circuit can be constructed, as suggested earlier. —30—



Learning

ELECTRONICS at RESIDENCE SCHOOLS

By JOHN D. and IRENE LENK

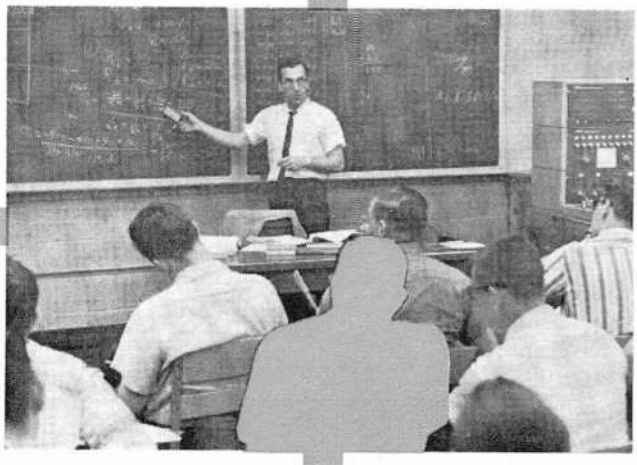
LAST MONTH we took a look at the inner workings of electronics *home-study* schools. We found out what subjects are covered, how these subjects are taught, the approximate cost of the courses, and so on. This month, we will cover the same ground for electronics "*residence*" schools —schools that you attend in person.

As you might expect, the number of hours a week in class, how this time is spent, the amount of homework, the subjects covered, and (most important) the total length of the training will vary with the particular school. Here's what you are likely to encounter.

At most residence schools, you will spend between 20 and 30 hours a week in class as part of a full-time electronics training course. In general, the schools which provide less in-class training make up the differ-

ELECTRONICS SCHOOLS: CONCLUSION

ELECTRONICS RESIDENCE SCHOOLS



ence with additional homework, but some amount of homework will be required with any training course. Usually, the schools expect you to devote a total of about 40 hours a week to your study. Thus, a 6-hour-a-day, 5-day-a-week course will also involve an extra 10 hours a week of home study.

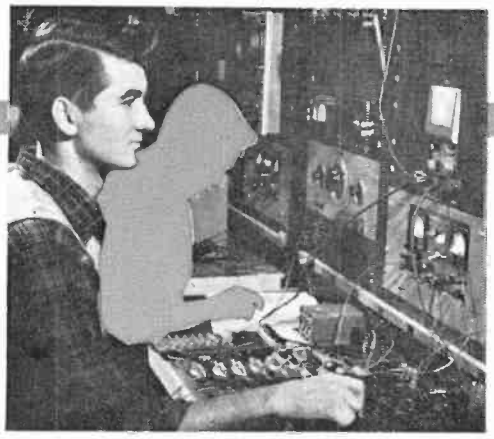
You must put in about 9 hours a week of classroom work for the average part-time or evening course, and you will spend at least 9 hours a week at homework. (Such courses usually operate on a 3-hour-a-night, 3-night-a-week basis).

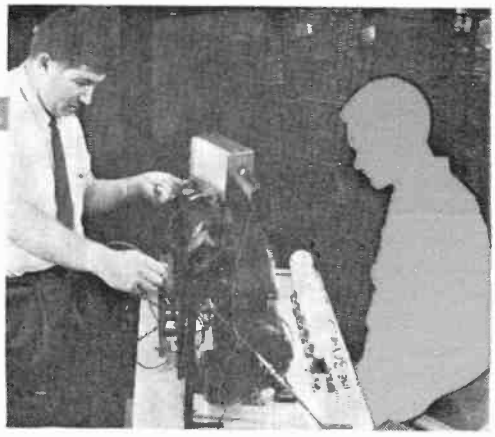
If you take a TV Servicing, Communications, or Advanced Trade School type of course, you will spend about 50% of your time in classroom lectures, the other 50% in the shop or laboratory. The Technical Institutes follow the lead of most Universities, and devote about 2 hours to lectures for each hour of laboratory work. The same proportion holds true for evening classes.

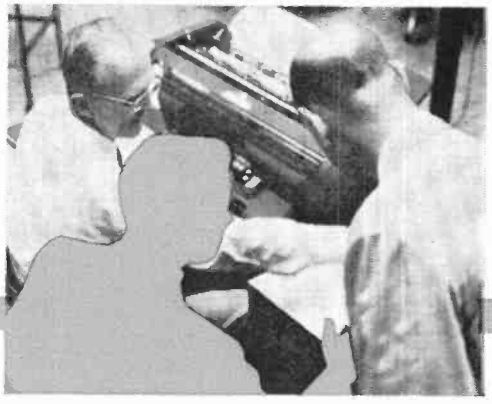
Total Length of Course. The average TV servicing course will run approximately 9 months of full-time day study, while a corresponding communications course will take 9 months to a year for completion. An advanced trade school course, which includes TV servicing and communications as well as specialized study in other fields of electronics, will usually require at least 1½ years of full-time training. The full technical institute courses run from 2 years to 27 months; usually, they are comprised of 8 or 9 quarters, with each quarter being 12 or 13 weeks in length.

In general, those schools which provide equivalent courses for evening classes allow more time for you to complete the training. Thus, an evening course in TV servicing will take at least 1½ years to complete.

Our survey shows that the evening training is identical with that provided for full-time day classes, except in the case of technical institutes and universities. Most evening classes at technical institutes cover about 75% to 90% of the day class material. Then, if you want to go on toward a full B.S.E.E. degree, you must put in 3 to 6 months of residence work.







A comparison of evening and day-time residence courses can be summed up like this. If you want a TV servicing, communications, or advanced trade school course, you can have the training either during the day or in the evening, but evening study will naturally be spread over a much longer period of time. The chief advantage of evening work is that it permits you to complete the course and perhaps obtain a degree without a long interruption in your regular employment.

If you want a technical institute course with a degree, you had best attend "full-time," or at least plan to squeeze in a few months of full-time resident training at the end of the line. And if you are after a B.S.E.E. degree, those few months of study are going to expand into at least a year.

Examinations. Unlike home-study schools, residence schools rarely require an examination at the end of each *lesson*. Instead, you take an examination after completing study of each *subject*.

In general, the TV servicing, communications, and advanced trade schools form a new class every month or 6 weeks. Such a class stays together for the duration of the entire course, and each month or 6 weeks the class moves on to study a new subject. For example, your first month of study might cover applied science; the next month, electricity and magnetism; the third month, radio principles; and so on, through 9 to 18 months.

Each week, you are given a "brush up" or "preview" examination covering the past week's study. If you show any signs of weakness, the instructors bring them to your attention. Then there is a final class examination covering the entire subject. If you pass this final exam satisfactorily, you move on with your class to the next subject.

The technical institutes follow essentially the same plan, except that final

ELECTRONICS RESIDENCE SCHOOLS

examinations are usually given at the end of each quarter, as are university examinations. A few technical institutes also require that you pass a "master" examination before granting a degree.

Each school has its own particular method of presenting examinations. Today, a number of residence schools follow the practice of "open-book" examinations, as in home-study courses. Naturally, the questions are worded so that you can't simply "match up" answers.

In most cases, the questions are problems to be solved, with the answers to be written out in essay form. And you're actually encouraged to read through the reference material as well as your own lecture notes while you're solving the problems. The theory here is that this method tends to duplicate circumstances you will encounter in your future work.

Other schools still hold to the idea that you must understand and *remember* what you have learned. Their examinations are written and presented accordingly.

Checking Your Progress. Since resident training involves considerable shop and laboratory work, your progress in these areas is also carefully monitored. Although the schools usually do not present formal examinations on shop or laboratory work, you must show the instructors that you have learned the practical side of electronics and that you are acquiring the necessary manual skills.

For example, in any course you will learn basic shop practices (wiring, soldering, etc.). And you will probably be expected to construct simple (or even complex) electronic devices.

After you build a device, the instructor will check it out for proper operation and look over your workmanship. If your work is not up to standard (even though the unit operates), the instructor will point out the defects. If you have done an exceptionally sloppy job, you may have to build the entire project over again.

Again, the instructor may want to check your ability to use an oscilloscope. After instruction, you will be assigned to measure various waveforms under the watchful eye of the instructor. If you fail to use the 'scope properly, the instructor will have you repeat the measurements until he is certain that you understand what you are doing.

A Second Try. Now we come to the favorite question, "What happens if I flunk?" If you fail to pass a monthly subject examination in a TV servicing, communications, or advanced trade school, you will usually be asked to repeat the entire month's study.

Sometimes, too, the schools will permit you to take a special examination on the month's work if they feel that you might pass with a second try. They realize that you may have been suffering from "examination jitters," or that there may have been extenuating circumstances, such as absence from class due to illness, personal problems, etc.

But if they feel that you simply don't understand the material, they will probably want you to repeat it in another class. A second failure generally brings a request that you discontinue the course (although some schools have allowed students to repeat a particular subject three or four times, in rare instances).

The technical institutes and universities usually employ the standard grading system for examinations: A, excellent; B, good; C, average; D, poor, but pass-

Literally hundreds of colleges, technical institutes, and other schools offer resident-type training, and it would obviously be impossible for us to include a list of such schools as part of this article. You are probably already familiar with the schools in your own area which provide formal training in electronics. If not, check the yellow pages of your local telephone directory for listings of electronics trade schools, or ask the librarian at your local library for assistance. The superintendent of your local high school will also be able to help you obtain more information.

ing; F, failure. You can pass any given subject with a D, but you must maintain a C average to graduate and receive a degree. As you may know, the policy for granting a degree is usually outside the school's jurisdiction.

Shop and Laboratory Training. Personalized shop and laboratory training is the strong point of in-residence electronics study, whether you go during the day or in the evening. And residence schools pride themselves on the quantity and quality of their laboratory equipment.

A school specializing in TV servicing will have at least one completely equipped TV service shop, while a communications school will duplicate a typical TV and radio broadcasting studio. In all cases, the schools use this laboratory and shop equipment to reproduce actual industrial and commercial situations, giving you the opportunity to "learn by doing."

Although the shop and laboratory programs vary with each school, all schools follow a general pattern of demonstration and lecture on a group or class basis, followed by individual instruction. When your class progresses to a particular shop or laboratory, each item of equipment is fully explained in class lectures and demonstrations. The instructors describe what the equipment is for, how it operates, and how it is used. Sometimes, these lectures are supplemented with various technical films.

After the theoretical discussion and practical demonstration at the class level, each student, or group of two or three students, will perform experiments using the particular item of equipment. This gives each student an opportunity to "get the feel" of test equipment. Once you've completed these courses, you should be able to recognize all standard types of test instruments, and use them without fumbling over the knobs or connecting an ohmmeter across a high-voltage source!

Tools and Equipment. Normally, you will not be required to provide any tools or test equipment for residence training. Most schools lend you a complete kit of tools (and sometimes simple test equipment, such as an ohmmeter) for the duration of the course. There is no additional charge, unless the tools or equipment are damaged or missing when it's time for you to return them.

Some schools recommend that you purchase your own set of tools and will provide tool kits at reduced cost. Other schools make standard test equipment available to students at discount prices. In general, reference texts, slide rules, and similar items are also supplied at reduced cost. Occasionally, a school will recommend that you buy special reference texts.

(*Continued on page* 62)

ADVANTAGES OF RESIDENT SCHOOLS

You have personal contact with your instructors. There are those who say a picture is worth 1000 words, but a demonstration is often worth 10,000 words. If you are one of these people, residence training is your best bet. In other words, if you have difficulty in learning a manual skill (such as soldering, operating test equipment, etc.) until you have seen someone else do it, or if it gives you more confidence to have an expert at your shoulder to check your work, you should definitely choose residence training.

You'll find companionship with others in the same status. At best, a thorough study of electronics is a long, hard road. Some people prefer to make this "trip" with others. You may be able to gain a better understanding of a subject if you can discuss the problems with other students in the same situation. Most residence schools encourage this type of group discussion, as well as group activities outside of class.

You'll see major electronics installations firsthand. Practically all resident-type electronics schools conduct class field trips to local manufacturing concerns, TV shops, broadcast studios, and research laboratories. This gives the students an opportunity to see professional technicians at work and to see today's electronics equipment in use.

A wider range of equipment is available. It's quite obvious that a home-study school is not going to ship you a complete working model of a shipboard or aircraft radar. Nor are they going to install a full-scale electronic computer in your home. But both of these units (or units of the same complexity) are available at the laboratories of various technical institutes. It would even be difficult for a home-study course to supply all of the equipment found in the average TV service type of residence school. So if you want exposure to specialized equipment, it would be best for you to consider resident training.

ELECTRONICS RESIDENCE SCHOOLS

What About Cost? As is the case with home-study courses, all in-residence electronics training courses do not cost the same amount. The best "yardstick" to cost is that you will pay between 75 cents and $1.00 for each classroom hour of residence training. Thus, a 9-month TV servicing course (1080 hours, based on 36 weeks at 30 hours a week) will cost between $750.00 and $1000.00. A full technical institute course could run between $2200.00 and $2500.00.

Except for the length of training, the difference in cost often reflects the quality and scope of the program. Some schools give you more per hour of training in various ways. Their laboratories are more extensive and better equipped, their instructors are more gifted, and their placement services are more elaborate. This does not mean that the less expensive training is "cut rate," but the old rule that "You get what you pay for" still applies.

If you can pay for a course in cash at the beginning of it, you will receive a substantial discount on the overall price. However, the technical institutes and other schools offering long courses do not expect you to plunk down $2000.00 or more. In practically all cases, such schools call for monthly or quarterly payments.

A great number of schools arrange for weekly (about $25.00), monthly (about $100.00), or quarterly (about $250.00) pay-as-you-go installments after you have made an initial down-payment. Usually, this type of plan allows you to discontinue the course at any time, without further obligation. For example, a technical institute may require a $250.00 down-payment for the first quarter, and $250.00 in advance for each quarter thereafter. And you are free to drop the course at the end of any quarter.

A number of schools offer a contract plan in which you make an initial down-payment, and fixed monthly payments until the total price is paid, no matter how long the course takes. They usually offer this as an alternative to the pay-as-you-go plan, and at a substantially reduced cost. But you are under obligation to pay for the course, whether you finish it or not. You can definitely save money this way, but you should understand the contract and make sure of your future plans before you sign it. -30-

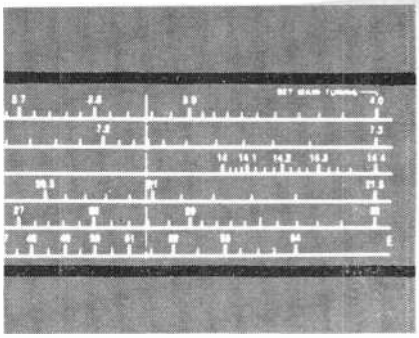
DISADVANTAGES OF RESIDENT SCHOOLS

School is a "full-time job." This is the most obvious drawback to in-residence training. Unless you plan to take an evening course, you must spend about 25 hours a week in class, and devote a few more hours to homework. This routine is extremely difficult when added to another 40 hours on a full-time job. Even if you are working only part time and can get along on the reduced income, you'll find that the strain will show up after a few months.

Schedules must be maintained. Unlike home study, you must keep up with the "class average" in residence-type work. If you're slow in learning or you find the subject difficult, you will always be under pressure. If you're fast, you may become impatient and will probably become bored. Even if you're "average," you will have to scramble to catch up if you happen to miss a few classes.

Study is difficult to interrupt. Because you must keep up with the class, residence schools can't tolerate frequent or long interruptions in training, no matter what the cause. This means that illness or personal problems can easily throw you off. Most residence schools will drop you back a class after a prolonged absence. Or, they could ask you to prove (by special examination) that the interruption did not affect your standing. If these interruptions are frequent, the school may ask you to discontinue the training until you have placed your affairs in order.

Study material is not repeated. Except in very rare cases, lectures, class demonstrations, and examinations cannot be repeated for individual students. If you miss something of importance, you'll just have to get along without it. Even more significant, if you don't understand a particular point, you will have a very limited opportunity to question the instructor on an individual basis. Obviously, an instructor with 20 or 30 students cannot handle more than about one question per student. On the other hand, you can read each home-study lesson as many times as necessary. Likewise, your home-study instructor will answer all questions, and in writing.



Across the Ham Bands

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

A GOOD LOOK AT THE MOSLEY CM-1 RECEIVER

THE new CM-1 amateur communications receiver manufactured by Mosely Electronics, Inc. (4610 N. Lindbergh Blvd., Bridgeton, Mo.) was first mentioned in the January 1962 *Across the Ham Bands*. It looked so interesting that we obtained the first available unit for a more detailed examination and report. Here are the facts.

General Data. Basically, the CM-1 is an 80-meter superheterodyne designed for maximum stability, optimum selectivity, and ease of tuning. It receives phone (AM and SSB) and CW signals with equal facility. To cover the 40-, 20-, 15-, and 10-meter ham bands, a single-tube crystal-controlled converter stage (employing five crystals) is used. The 10-meter band is covered in three overlapping segments, each spread out over the full 12" dial scale, and all bands are calibrated in 5-kc. increments. This design approach makes the receiver as stable and as easy to tune on 10 and 15 meters as it is on 80 meters.

In one respect, the receiver rates as a maintenance man's dream—it employs only a single tube type! Five 6AW8A tubes (each containing a triode and a pentode in the same envelope) serve as the a.f. and i.f. amplifiers, mixers, oscillators, and product detector for CW and SSB reception. Four semiconductor diodes are also used; one is the power supply rectifier, two are in the automatic noise limiter, and the fourth is the AM detector.

Other features include a calibrated S-meter, accessory power socket, and provisions for transmitter relay control and VOX. The set measures 10½" x 7½" x 8" deep in its black-and-gray steel cabinet, and weighs a bit over 12 pounds; the cabinet for the optional matching speaker measures 7½" x 7½" x 8" deep. You can buy a CM-1 for $169.95, the matching speaker for another $16.95 (Model CMS-1).

Stability and Selectivity. The CM-1 drifts less than 500 cycles after a 1-minute warm-up, and a 10% change of line voltage will cause a drift of less than 200

The CM-1 ham-band receiver packs in a lot of value for its low price tag. Basically an 80-meter set, it uses a crystal-controlled converter stage to cover 40, 20, 15, and 10 meters. Rear view of chassis is shown in foreground.

Novice Station of the Month

This month's winning entry in the "Novice Station of the Month" contest, pictures the station of William E. Harris, KN5MIL, 733 Clinton St., Abilene, Texas. Bill uses a Heathkit DX-60 transmitter, running 75 watts, and a Lafayette KT-200 receiver with a Heathkit Q-multiplier. Also in the photo, awaiting the arrival of a Conditional Class license, are a Heathkit HG-10 VFO and a crystal mike. Though Bill's antenna is only 10 feet high, he has already worked hundreds of stations in 24 states.

Bill will be awarded a one-year free subscription to P.E. for his photo. If you would like to try for a similar award, send us a picture of your station—preferably showing you at the controls, and be sure to include with your entry some information about yourself, your equipment, and your activities. You may be one of the lucky winners. Non-prize-winning photos will also be published as space permits. All entries should be sent to Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana.

cycles. An impressive performance for a unit in this price range!

But even more impressive is the mechanical stability. Once a stable CW, AM, or SSB signal is tuned in (a very easy process, incidentally), that signal *stays tuned in* until you turn the receiver dial. You can rap the cabinet, pound on the table, or jump on the floor without causing a quiver in the signal.

A measured 2.5-kc. selectivity at —6 db is attained by the simple method of using a total of 12 tuned circuits in the mixers and i.f. stages. This degree of selectivity is about optimum for amateur AM and SSB phone reception, and quite adequate for CW work.

Sensitivity. Despite the absence of an r.f. stage, the CM-1 has a rated sensitivity, at 10 meters, of ½ microvolt for a 10 db signal-to-noise ratio. Any receiver that meets this rating is a truly sensitive one. Rather than attempting to verify the sensitivity figures, however, we made careful listening tests, as well as comparative measurements with a noise generator and another receiver of known characteristics. These checks established the fact that any greater sensitivity in the CM-1 would be of little practical benefit.

The manufacturer credits the use of a low-noise, triode first mixer for the CM-1's high weak-signal sensitivity. Since there are always at least two tuned circuits between the antenna and the grid of the first mixer, image rejection is equivalent to that produced by a conventional r.f. amplifier.

Though its frequency coverage is limited essentially to the ham bands, the CM-1 is unquestionably a lot of receiver for the money. Hams who are in the market for a set in the under-$200.00 class will do well to take a close look at this imaginatively designed receiver by Mosley.

15-METER GROUND-PLANE ANTENNA

Band conditions were excellent during the weekend, about a year ago, when John, K3GHI, worked 20 countries on 15 meters. It's interesting, though, that his 65-watt transmitter was feeding the inexpensive ground-plane antenna shown on page 65. The results he obtained with it give you an idea of just how effective an "economy" antenna can be. Complete construction details on the K3GHI antenna are presented below, and you should be able to build it for less than five dollars.

Before starting construction, you might give some thought to where you're going to install the antenna. Although a great deal of height is not required, a spot reasonably clear of wires, trees and buildings is highly desirable. Make sure, also, that there's enough space to stretch out the four radial sections (see diagram). John's antenna, as can be seen from the picture, is mounted on a clothes line post,

putting its base approximately six feet from the ground. You might install your version on the roof of a building or on a guyed 10′ or 12′ post.

Mechanical Details. Cut a bamboo pole to a length of 10′ 6″ and wrap it tightly with heavy aluminum foil. The foil can be held in place with windings of plastic tape spaced about six inches apart. Now, using a machine screw and nut, fasten a solder lug to the bottom of the pole so that it's in tight contact with the foil.

The prepared pole is mounted on a wooden support with two pipe clamps, spaced about 10″ apart. For lower losses in wet weather, you should cover the bottom of the pole, where it comes in contact with the pipe clamps and the wooden support, with several layers of "Saran Wrap."

Wiring. Mount a chassis-type coaxial connector (Amphenol 83-1R or equivalent) on a metal L-bracket directly under the base of the pole. Wire the center terminal of the connector to the solder lug previously installed using a short, heavy copper lead. The four 10′ 6″ radials are soldered to four lugs installed under the connector mounting screws.

The radials should be cut from #12 to #16 copper wire. They should be spaced 90° apart; the far ends (which may be 3 or 4 feet lower than the coax connector) are terminated in insulators.

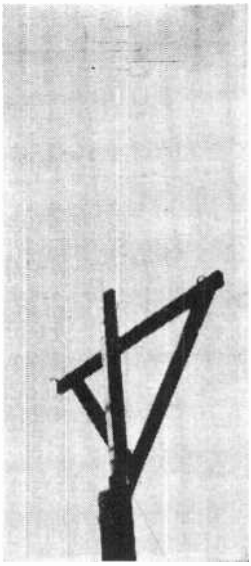
Fasten your 52-ohm antenna cable to the connector and, to take off the strain, tape the cable to the mounting post. Now all you have to do is tune up the transmitter and start working stations.

(*Continued on page* 115)

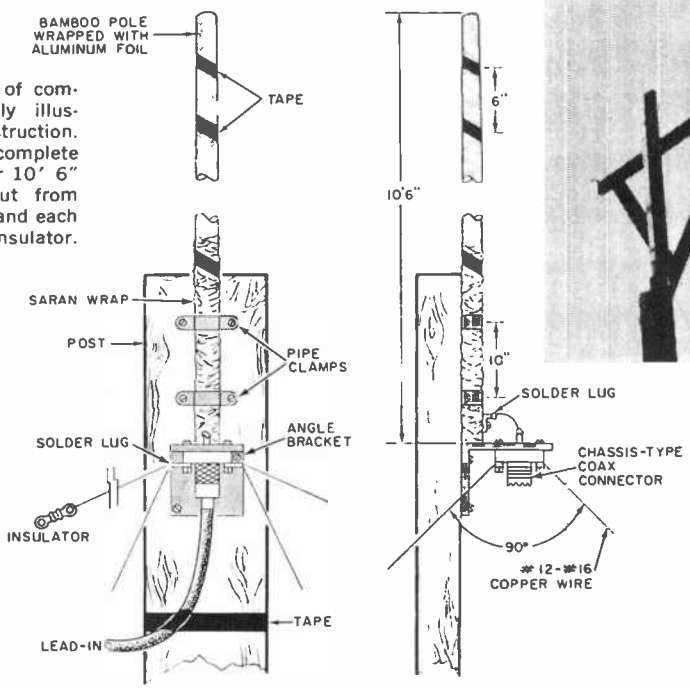
BILL OF MATERIALS

1—Bamboo pole, ¾″ to 1″ diameter at base, cut to a length of 10′6″
1—Roll of 12″-wide heavy aluminum foil
1—Chassis-type u.h.f. coaxial connector (Amphenol 83-1R or equivalent)
4—Antenna insulators
1—45′ length of #12-#16 solid copper wire
Misc.—Machine and wood screws, solder lugs, tape, "L"-bracket, pipe clamps, "Saran Wrap"

Ground-plane antenna is mounted on a clothesline post only 6′ high! The four radials can't be seen in this photo.



Front and side views of completed antenna clearly illustrate the simple construction. After mounting mast, complete the job by adding four 10′ 6″ radials. These are cut from #12-#16 copper wire, and each is terminated in an insulator.



Hobnobbing with Harbaugh

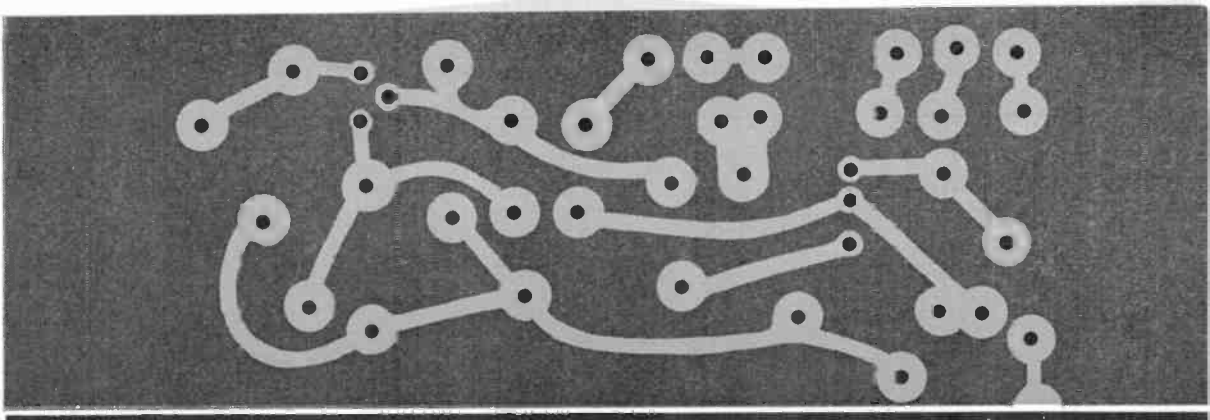
I've Got News for You!

"It's from the FCC in Washington . . . they're comin' to visit."

"It's his latest fad, microminiaturization!"

"This is the last straw!!!"

"That's my ultra-sensitive infrared sprinkling system."



PRINTED-CIRCUIT P.A.

Miniature public-address amplifier operates on either 6 or 12 volts

By **FORREST H. FRANTZ, Sr.**

LOOKING FOR a compact public-address amplifier that will operate from your car battery? Here's one that's fully transistorized, light in weight, and completely portable. Yet it packs punch enough to deliver about 3 watts from a 12-volt battery and about 1 watt from a 6-volt battery. Since it was designed for operation from 12 volts, use of this voltage naturally results in the best performance.

In addition to being battery-operated, this amplifier has several other outstanding features. Due in part to a special printed-circuit board, it's both attractive and professional looking. It measures a compact 3″ x 5″ x 7″ and incorporates separate "mixable" inputs for microphone and phono or tuner. And its output transformer matches any 8-ohm speaker or series/parallel combination of speakers totaling 8 ohms.

The amplifier contains only four transistors and is relatively easy to construct. Once assembled, you'll find that it's ideal for use at pic-

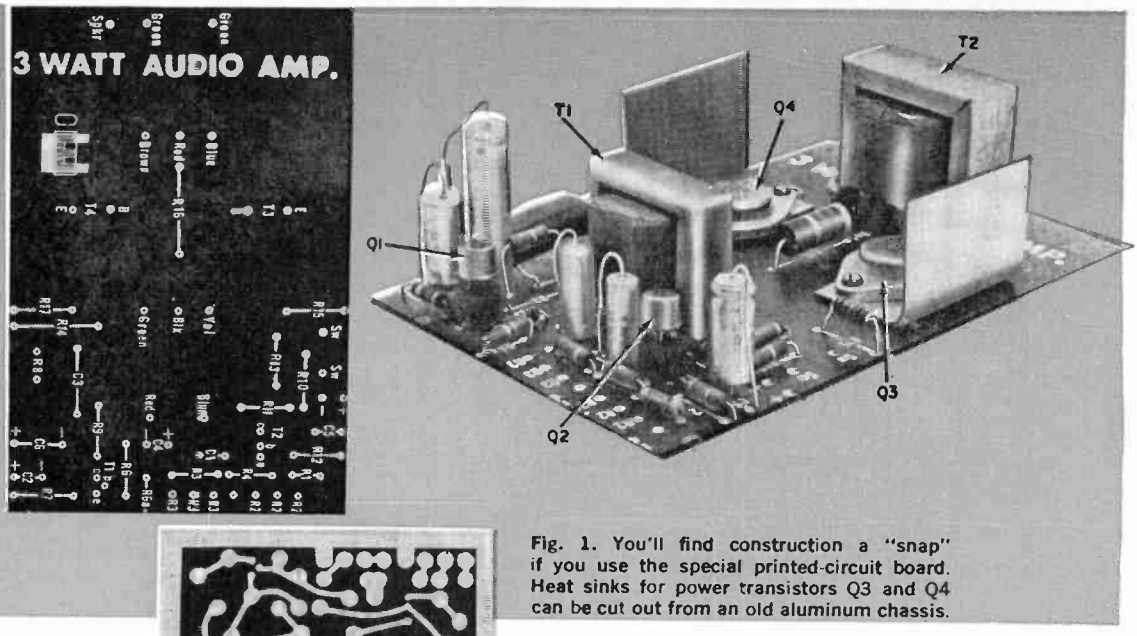
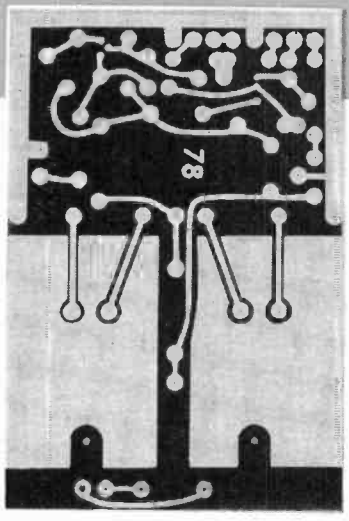


Fig. 1. You'll find construction a "snap" if you use the special printed-circuit board. Heat sinks for power transistors Q3 and Q4 can be cut out from an old aluminum chassis.



nics and other outdoor activities, or it can be permanently installed in an auto or a truck. It can also function indoors with a battery eliminator for a.c. operation, or it can be operated from a spare car battery or even a number of flashlight batteries connected in a series/parallel arrangement.

Construction. The major portion of the circuit is constructed on a printed-circuit board.* This type of construction insures that the components will be held securely in place and makes the amplifier a "toughie" that can take rough treatment. Figures 1 and 3 show the completed circuit-board wiring except for capacitor *C7*, which is connected to the etched side of the board after all other components have been mounted.

Begin construction by cutting and drilling the heat sinks for power transistors *Q3* and *Q4*. Then set the heat sinks aside for the moment, and mount transformers *T1* and *T2* on the circuit board with ½" *6-32* machine screws.

Now proceed with the wiring, cutting component leads to length and soldering connections as you come to them. Use a hot, clean soldering iron or gun and rosin-core solder. Apply heat only for as long a time as necessary, and don't forget to use a heat sink when soldering the transistor leads. As you can see from Fig. 1, all electrolytic capacitors should be mounted vertically.

When you've completed the wiring up to and including the primary of *T1*, you're ready to mount *Q3* and *Q4* on the heat sinks. Be careful not to let the emitter and base leads short to the heat sinks, and mark the respective leads on the sinks to avoid foul-ups with the transistor connections.

Now mount the heat sinks containing the transistors on the circuit board. Note

*A special printed-circuit board has been designed for this amplifier and is available from Irving Electronics Co., P.O. Box 9222, San Antonio 4, Texas. Designated as Catalog No. 78, it sells for $2.75, postpaid. Since illustrations of both sides of the board appear here, you should have no trouble making one of your own if you prefer.

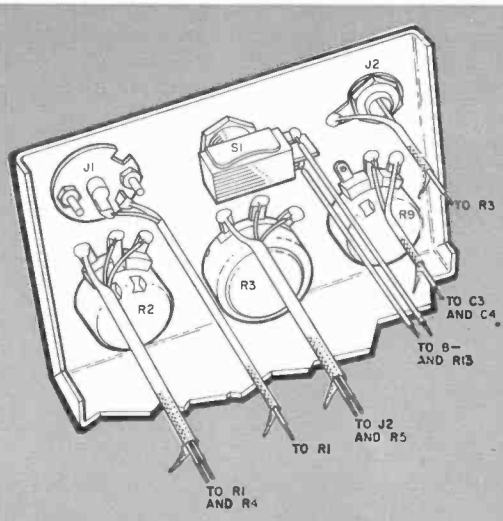


Fig. 2. Jacks and controls are all mounted on front panel, independent of the amplifier chassis. Jack J2 should match the microphone selected.

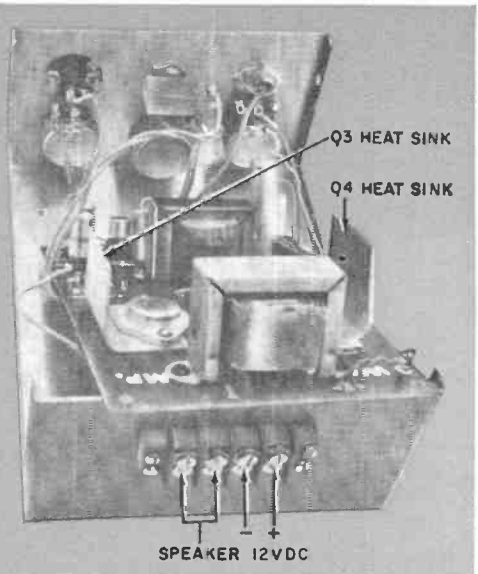


Fig. 3. Completed c rcuit board, ready to be installed in aluminum case.

that the screws should again be about ½" long, since longer screws may short to the case. With this part of the wiring completed, set the circuit board aside for later installation in the metal case.

Next, drill one end of the case for the controls shown in Fig. 2. Mark the hole positions with a punch, then use a $\frac{1}{16}$" drill to make "starter" holes. You can enlarge the holes with a ⅛" drill and cut them to the required size. Place a block of wood under the metal when drilling.

After the drilling is completed, cut the shafts of potentiometers *R2*, *R3*, and *R9* to a length of ⅜" beyond the mounting bushing. (It's best to place the portion of the shaft which is to be discarded in a vise and cut with a hacksaw.) Then mount *R2*, *R3*, *R9*, *J1*, *J2*, and *S1* on the front of the case. Place a lock washer between each of the controls and the case to prevent the controls from slipping.

The position of the hex nut on the mounting bushing of *S1* should be adjusted so that only enough of the bushing protrudes from the front of the case to allow the switch plate and nut to fit on the bushing. The battery and speaker terminal strip (see Fig. 3) can now be mounted on the rear of the case.

Next, wire up the front panel controls (phono jack *J1*, microphone jack *J2*, phono volume control *R2*, microphone volume control *R3*, tone control *R9*, and on/off switch *S1*), exactly as shown in Fig 2. This done, drill four holes in the top of the case to match the four mounting holes at the extreme edges of the circuit board. Four 1" screws and four ½" spacers will be required to mount the circuit board in the case.

Smear Duco cement over each screw to hold the screws and nuts securely in place, and position the circuit board in the case. Fasten the board to the case, then wire in the input cables, grounding the shields to the ground bus which runs around the edge of the board. To complete the wiring, connect *S1* and the battery and speaker terminals.

Testing. Before you test the amplifier, be certain that there are no short circuits between the circuit board and the bottom of the case. Then connect an 8-ohm speaker to the speaker terminals, and a low-impedance microphone (100 to 2000 ohms should be satisfactory) to the mike input (or a crystal phono pickup to the phono jack).

Connect the amplifier to a 12-volt battery or battery eliminator, turn *S1* on, and test. If you don't get satisfactory operation, turn the amplifier off and recheck your wiring. Incidentally, if the microphone and speaker are close enough

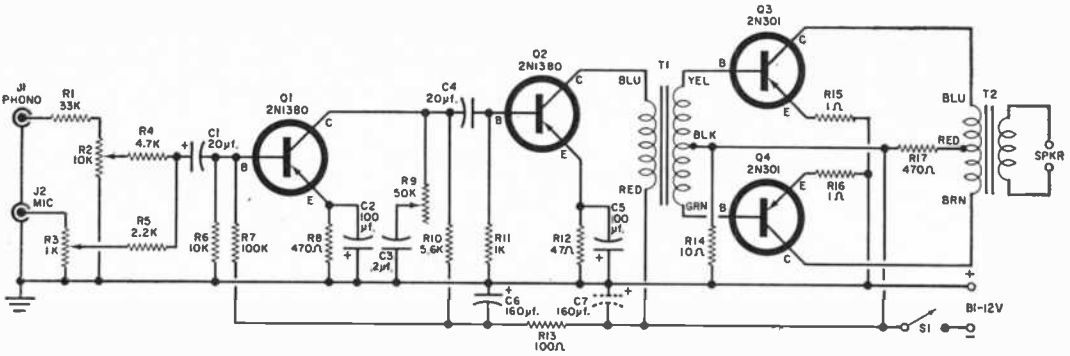
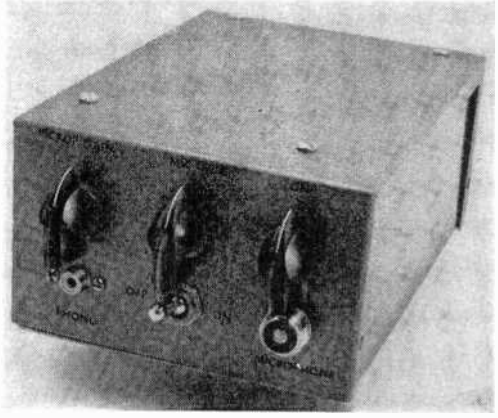


Fig. 4. Schematic diagram of amplifier. Capacitor C7 (shown dotted) mounts on underside of board; like other electrolytics, it should be rated at 15 w.v.d.c.

PARTS LIST

B1—12-volt battery—see text
C1, C4—20-µf., 15-volt miniature electrolytic capacitor
C2, C5—100-µf., 15-volt miniature electrolytic capacitor
C3—0.2-µf. ceramic capacitor (Sprague 5C9 or equivalent)
C6, C7—160-µf., 15-volt miniature electrolytic capacitor
J1—RCA phono jack
J2—Microphone jack (to match microphone used)
Q1, Q2—2N1380 transistor (Texas Instruments)
Q3, Q4—2N301 transistor (RCA)
R1—33,000 ohms
R2—10,000-ohm miniature volume control (Lafayette VC-34 or equivalent)
R3—1000-ohm miniature volume control (Lafayette VC-32 or equivalent)
R4—4700 ohms
R5—2200 ohms (All resistors
R6—10,000 ohms ½ watt unless
R7—100,000 ohms otherwise noted)
R8—470 ohms
R9—50,000-ohm miniature volume control (Lafayette VC-36 or equivalent)
R10—5600 ohms
R11—1000 ohms
R12—47 ohms
R13—100 ohms
R14—10 ohms, 2 watts
R15, R16—1 ohm
R17—470 ohms, 2 watts
S1—S.p.s.t. toggle switch (Cutler-Hammer 8280-K16 or equivalent)
T1—Driver transformer; primary, 100 ohms; secondary, 200 ohms CT (Thordarson TR-65 or equivalent)
T2—Output transformer; primary, 20 ohms CT; secondary, 8 ohms (Stancor TA-12 or equivalent)
1—4" x 5⅞" printed-circuit board—see text
1—7" x 5" x 3" aluminum utility box (Bud CU-2108A or equivalent)
1—4-lug barrier terminal strip (Cinch-Jones 4-140 or equivalent with 4-140 adapter solder terminals)
1—Switch plate (Cutler-Hammer 827-228F3 or equivalent)
2—Transistor heat sinks
Misc.—Knobs, wire, solder, speakers, microphone, nameplates, etc.

Fig. 5. All decked out and rarin' to go, the amplifier needs only a microphone, a speaker, and a power source to operate.

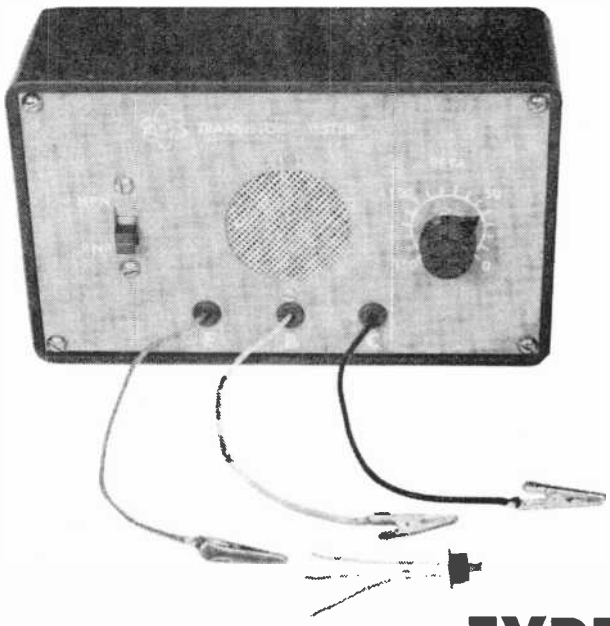


to each other, "squealing" may result. Such acoustic feedback is normal and is not an indication of trouble.

This amplifier is designed to operate with a high-impedance (i.e., crystal) phono pickup and a low-impedance microphone; if desired, a tuner can be connected to the phono input instead.

The Electro-Voice Model 623 microphone (pictured with the amplifier and the E-V Type PA15 paging speaker on page 67) works well, but any other mike with an impedance in the range of 100 to 2000 ohms will suffice. It's also possible to use a crystal microphone if it's plugged into the phono jack, but volume will generally be low with this arrangement.

(*Continued on page* 96)



EXPERIMENTER'S TRANSISTOR TESTER . . .

checks 'em all

By **CHARLES CARINGELLA,** W6NJV

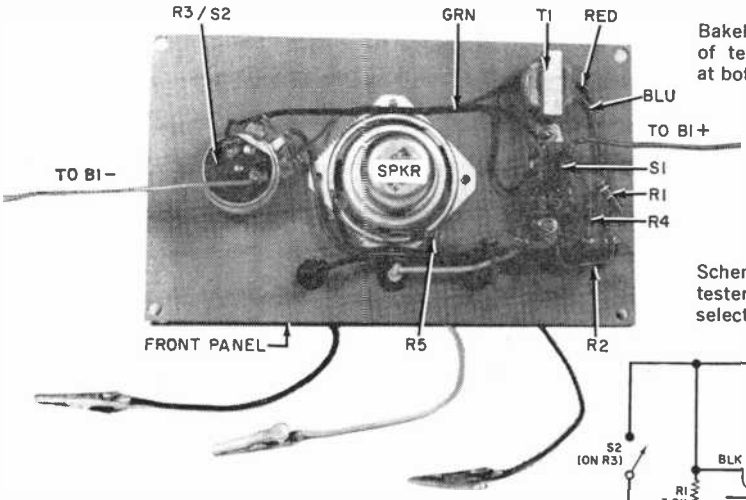
AN inexpensive, yet reliable and accurate transistor tester is something no experimenter should be without. There are plenty of testers on the market, of course—including some sophisticated laboratory models costing hundreds of dollars, but most of them aren't intended for the average experimenter. Why? Because when you're constructing equipment from P.E. articles or even when you're breadboarding an original idea of your own, you usually have only one concern—is your transistor *good* or *bad?*

The tester described here greatly simplifies the testing problem by eliminating most of the tests you probably have no interest in. Furthermore, it offers several distinct advantages of its own. First, and most important, this tester will check transistors *in* as well as *out of* the circuit. What's more, it's capable of testing all types of transistors, including power, low-level audio, and even r.f. types. And finally, it uses only a handful of parts, and can easily be built in a single evening for an outlay of $5.00 or so.

About the Circuit. As you can see from the schematic on p. 72, the transistor under test becomes part of an audio oscillator circuit when it's hooked up to the tester. If your transistor is "good," an audio tone will be heard in the speaker. If your transistor is "bad," no tone will be heard.

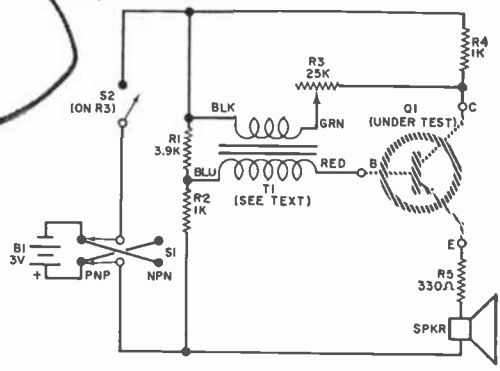
The feedback to produce oscillation is provided between the transistor's collector and base by transformer *T1*, with the amount of feedback determined by the setting of *"Beta"* control *R3*. This control, incidentally, is calibrated from 0 - 150 in units which correspond approximately to the small-signal current gain of the transistor.

In actual operation, the control is ro-



Bakelite front panel holds most of tester's parts. Three leads at bottom connect to transistor.

Schematic diagram of transistor tester. The d.p.d.t. switch (S1) selects either pnp or npn types.



PARTS LIST

B1—3-volt battery (two Burgess Type Z flashlight cells or equivalent in series)
R1—3900 ohms — *All resistors*
R2, R4—1000 ohms — *½ watt*
R3—25,000-ohm potentiometer, linear taper, with switch S2
R5—330 ohms
S1—D.p.d.t. slide switch
S2—S.p.s.t. switch (part of R3)
T1—Transistor output transformer; primary, 5000 ohms; secondary, 100 ohms (Argonne AR-111)
1—1½" PM speaker, 10-ohm voice coil (Lafayette SK-61 or equivalent)
1—6¼" x 3¾" x 2" Bakelite case (Lafayette MS-216 or equivalent)
1—Bakelite front panel for above (Lafayette MS-217 or equivalent)
Misc.—Miniature alligator clips, rubber grommets, grille cloth, knob, wire, solder, etc.

tated from the 150 position toward the zero point until the audio tone is heard. The point at which the oscillation just begins is the approximate transistor *beta* or h_{fe}—probably the most meaningful of the various parameters, since it determines the gain which can be expected from the transistor.

The tester is powered by two penlight cells in series, and switch *S1* reverses battery polarity so that both *pnp* and *npn* types can be tested. If the type of transistor is unknown, it can be quickly determined by switching between the *pnp* and *npn* positions and rotating the *beta* control until oscillation is heard. And regardless of the position of switch *S1*, there's no danger of burning out a transistor, since the voltages are comfortably low and the tester's circuit includes current-limiting resistors.

Putting It Together. The tester is housed in a small Bakelite instrument case, with all components mounted on the front panel. Three short leads of hookup wire are brought out the front panel, and miniature alligator clips are soldered to the ends of the leads for connection to the transistor's emitter, base, and collector leads. This arrangement enables you to check any type of transistor, regardless of its actual mechanical configuration.

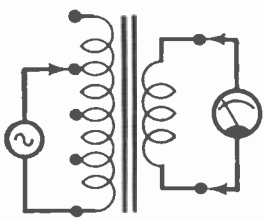
In the author's model, the batteries comprising *B1* were soldered directly into the circuit, having first been inserted into a block of Styrofoam which was notched to the battery size and glued to the case; if you wish, battery holders may be employed instead. Decals were used to label the front panel, and the numerals around the *beta* control were spaced evenly throughout the 270 degrees, with 15 divisions overall.

Incidentally, the phasing of the windings on transformer *T1* must be exactly as indicated for oscillation to occur. Since the transformer leads are identified by colored wires, all you have to do is follow the connections shown in the schematic diagram. —30—

TRANSFORMER QUIZ

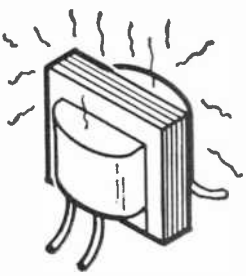
Basically, a transformer is an electrical device in which a magnetic field produced by a primary winding is used to induce a voltage in a secondary winding. But there are as many fine points to transformer theory as there are transformer types. The technician and the hobbyist can review transformer theory and test their knowledge by answering the questions below.

By ROBERT P. BALIN



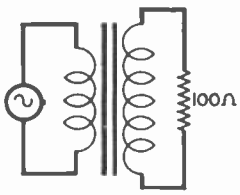
1 "Tapping down" the primary winding of any transformer increases the output voltage of the secondary winding of the transformer.

TRUE FALSE



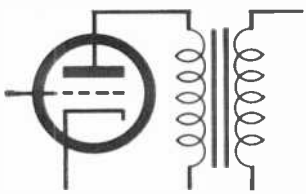
2 If a 50-cps transformer is operated at 60 cps, the transformer will overheat.

TRUE FALSE



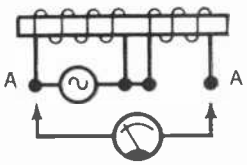
3 A 1:2 primary-to-secondary turns ratio will make 100 ohms across the secondary look like 25 ohms to the primary winding.

TRUE FALSE



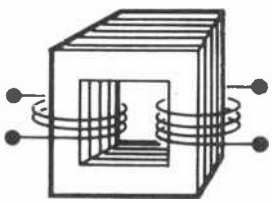
4 The gain of a transformer-coupled audio amplifier stage tends to increase at the low frequencies.

TRUE FALSE



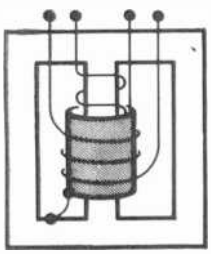
5 With two coils wound in the same direction on a core, as shown above, the voltage across A—A will be the sum of the voltages across each coil.

TRUE FALSE



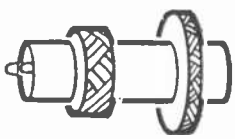
6 Transformer iron cores are laminated in order to reduce the heat generated by induced "eddy currents."

TRUE FALSE



7 A "Faraday screen" is a copper sheet used to reduce inductive coupling between windings.

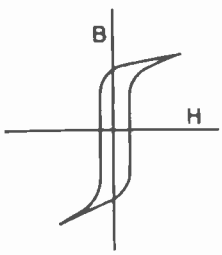
TRUE FALSE



8 The windings of r.f. transformer coils are spiraled back and forth to reduce their distributed capacitance.

TRUE FALSE

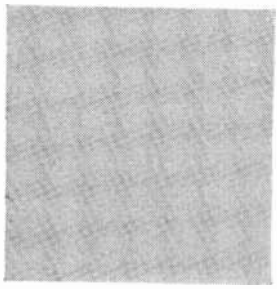
(Answers on page 98)



9 Power transformers are made with a laminated iron core material having a narrow hysteresis loop characteristic.

TRUE FALSE

HYBRID RECEIVER ...for the Locals



Tube meets transistor in this modern adaptation of a decades-old circuit

By MICHAEL S. ROBBINS*

ELECTRONICS ENTHUSIASTS have built countless receivers since station KDKA went on the air 'way back in 1920. Through the years, sets which incorporate grid-leak detectors have always been a favorite with the relative newcomer to this fascinating hobby. And this is one reason why the set described here should be of interest to old- and new-timers alike.

This little receiver also embodies some unusual features. It employs one tube and one transistor in a circuit which delivers room-level volume on local stations. A hybrid, it is a marriage of the old and the new—a one-tube grid-leak detector coupled to a modern transistor audio stage. The output from its 4" PM speaker, although strictly "lo-fi," is louder and more "listenable" than one would expect from such a simple hookup.

About the Circuit. A 12AE6-A tube functions as a grid-leak detector. Since this tube was designed for use as a detector and first-audio stage in "hybrid" auto radios, it works very nicely with a plate potential of about 12 volts. After detection, the audio is amplified by a high-gain 2N321 *pnp* transistor. Power for both tube and transistor is supplied by a filament transformer and a 1N34A diode rectifier circuit.

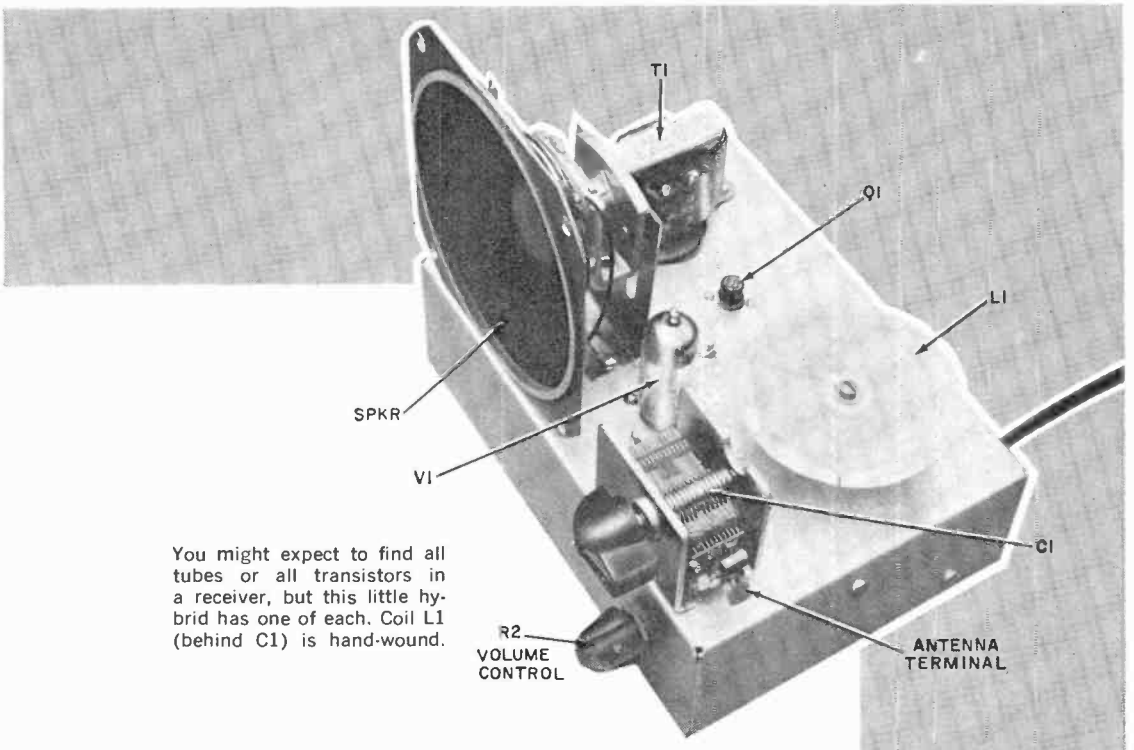
As can be seen from the diagrams and photographs, construction is simple and straightforward—neither parts placement nor component values are critical. Most of the capacitors can be almost any type your spare parts box offers, as long as the values are reasonably correct and voltage ratings are in excess of 15 volts (capacitor *C5*, of course, must be at least a 200-volt unit).

The tuning capacitor, *C1*, can be a single-section type or even a dual-section unit removed from a discarded superhet (use the larger or r.f. section in this case). Output transformer *T1* is a four-watt "universal" type in the author's model, although a 50L6-GT or a 6V6-GT type salvaged from an old radio or television set will do the job. Resistors of

PARTS LIST

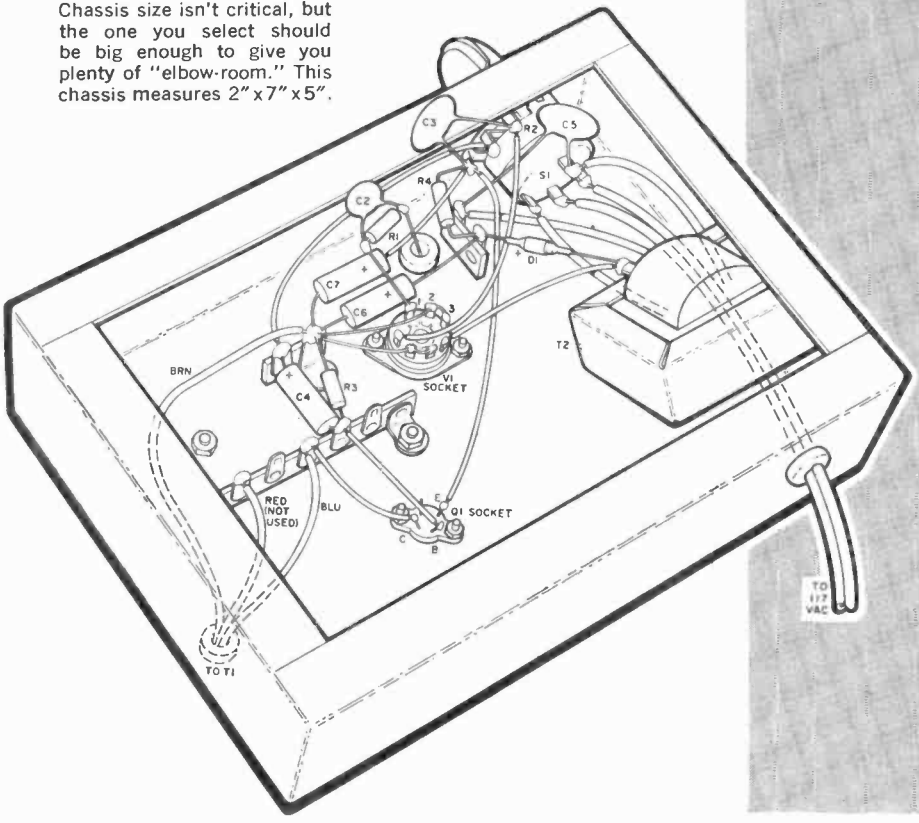
C1—365-μμf. variable capacitor
C2—0.001-μf. capacitor
C3—0.02-μf. capacitor
C4, C6, C7—10-μf., 15-volt electrolytic capacitor
C5—0.01-μf., 200-volt capacitor
D1—1N34A diode
L1—R.f. coil—see text
Q1—2N321 transistor (General Electric)
R1—10-megohm, ½-watt resistor
R2—1000-ohm potentiometer, linear taper
R3—220,000-ohm, ½-watt resistor
R4—1800-ohm, ½-watt resistor
S1—D.p.s.t. switch (on R2)
T1—Output transformer—see text (Stancor A-3856 or equivalent, connected as shown in pictorial, with speaker wired to lugs 1 and 4)
T2—Filament transformer; primary, 117 volts a.c.; secondary, 12.6 volts CT @ 1.5 amp. (Triad F-25X or equivalent)
V1—12AE6-A tube
1—4". 3.2-ohm PM speaker
Misc.—Chassis, line cord and plug, terminal strips, tube and transistor sockets, knobs, hardware, wire, solder, etc.

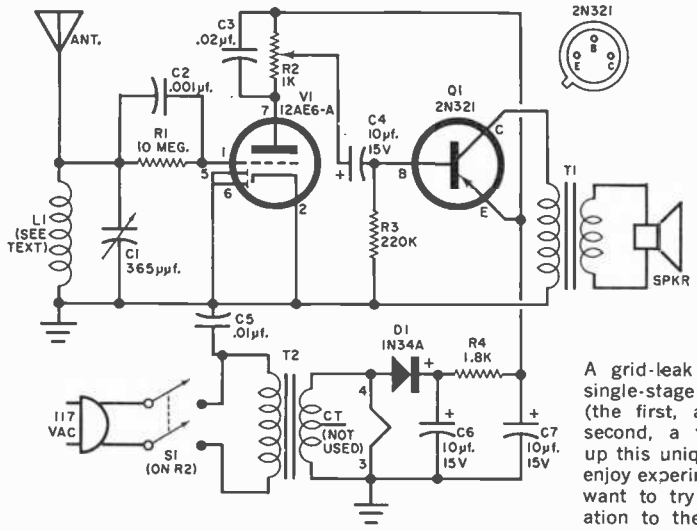
*Project Engineer, Antronic Corporation, Chicago and Los Angeles



You might expect to find all tubes or all transistors in a receiver, but this little hybrid has one of each. Coil L1 (behind C1) is hand-wound.

Chassis size isn't critical, but the one you select should be big enough to give you plenty of "elbow-room." This chassis measures 2"x7"x5".





A grid-leak detector and a single-stage audio amplifier (the first, a tube; and the second, a transistor) make up this unique circuit. If you enjoy experimenting, you may want to try adding regeneration to the detector stage.

the ½-watt, 10% or 20% tolerance variety will be okay.

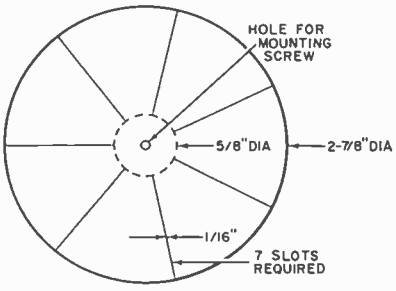
Winding the Coil. The r.f. coil (*L1*) is wound on a form cut from a 3″ x 5″ filing card or other thin piece of cardboard. First, cut out a 2⅞″ diameter disc, then punch a small hole for the mounting screw in the center of the disc and draw a ⅝″ diameter circle around it. Next, cut seven slots, each $\frac{1}{16}$″ wide and spaced equidistant about the circumference, from the outer edge to the ⅝″ inner circle.

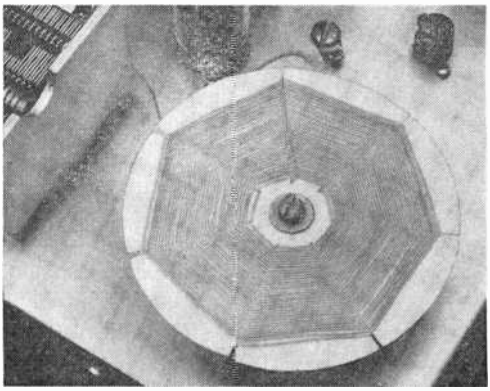
Sixty turns of #30 double-cotton-covered (DCC) wire are then wound interleaved on the form. Numbering the seven segments of the form one through seven, the first turn goes over one, under two, over three, etc., until it is completed. Since there is an uneven number of sections on the form, the second turn goes under segment one, over segment two, and so on; this means that only half the total, or 30 turns, show on one side of any segment. When the winding is completed, the coil should be mounted on the chassis just behind capacitor *C1* with a ¾″ or 1″ spacer.

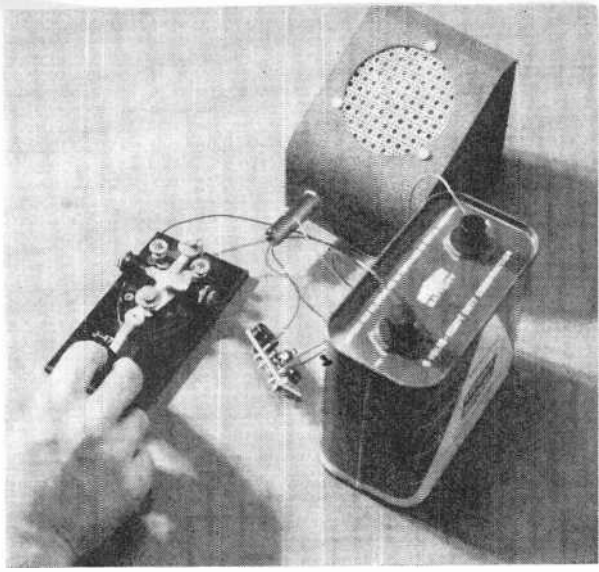
Simple Antenna. An antenna consisting of eight feet of wire dropped behind a bookcase proved satisfactory in the author's case. If an antenna longer than about 15 feet is used, a small ceramic or mica capacitor (about 10 μμf.) should be inserted in series with the antenna at the antenna terminal on the set. No ground is required, incidentally, since the receiver is already grounded for r.f. through the a.c. line.

No adjustment or alignment of any sort is necessary—just plug the set in, turn it on, and enjoy it! -30-

Coil L1 (pictured at right) consists of 60 turns of #30 DCC wire, wound in an "over-and-under" fashion on the form shown below.







Loud-Speaking CPO

By MICHAEL S. ROBBINS

Simple code practice oscillator delivers "really big" sound

CIRCUITS for code-practice oscillators aren't exactly a "dime a dozen," but there are certainly more than enough to go around. The circuit shown here has a number of points in its favor, chief of which is the fact that it's LOUD. And remarkably enough, it supplies room-level volume using only seven components, plus a key and a speaker.

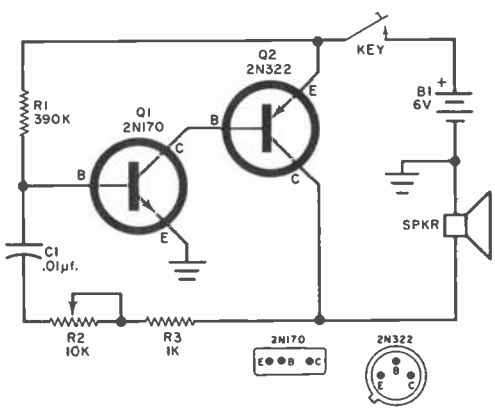
As you can see from the schematic diagram, the circuit is an oscillator/switch similar to that found in many incandescent lamp flashers. Since the 2N322 transistor (*Q2*) functions as a "switch," the audio tone is not a pure sine wave. Nevertheless, the unit *sounds* good, and a sacrifice in waveform is a very small price to pay for the increased volume.

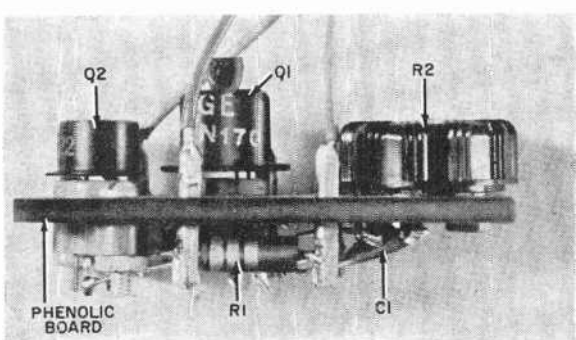
The frequency can be controlled by varying the setting of potentiometer *R2*, and it can also be altered by changing the value of capacitor *C1*. Don't make *C1* too large, though, or transistor *Q2* will draw excessive current.

The author assembled his oscillator on a small piece of perforated "Vectorbord" (see photo below, right). This material is especially easy to work with, since it requires no drilling and permits connections to be made both above and below the "chassis."

Either a 6-volt lattern battery or four flashlight cells in series will power the unit. And while virtually any PM speaker will do, the author obtained best results with a 4", 45-ohm intercom speaker.

No fantastic claims are made for this little device—other than that it's small, inexpensive, and LOUD! -30-





PARTS LIST

B1—6-volt battery—see text
C1—0.01-μf., 200-volt paper capacitor
Q1—2N170 transistor (General Electric)
Q2—2N322 transistor (General Electric)
R1—390,000-ohm, ½-watt resistor
R2—10,000-ohm potentiometer, linear taper
R3—1000-ohm, ½-watt resistor
1—45-ohm PM speaker—see text
Misc.—Transistor sockets, wire, solder, knob, phenolic board, key, etc.

Transistor Topics

By **LOU GARNER,** Semiconductor Editor

THE "MIGHTY MITES" are starting to give the vacuum tube serious competition in still another field. Although transistors are familiar components in battery-operated TV sets, they have not been used extensively in line-operated television receivers. Now, however, the Zenith Radio Corporation has developed a transistorized remote-control system for home TV sets.

Known as the "Space Command '400'," Zenith's new system consists of two units: an ultrasonic transmitter, and a transistorized "receiver" and control chassis (see Fig. 1). Using this new remote-control arrangement, the set owner can turn his TV set on; change channels; adjust volume; shut off or "mute" the sound; or turn the set off—all by simply pressing the appropriate button on the hand-held transmitter.

The ultrasonic transmitter (see inset in Fig. 1) is essentially a mechanical device. Control signals are developed by the vibration of resonant metal rods which, in turn, are excited whenever one of the four push buttons is depressed. The signals, incidentally, are in the 40-kc. range.

Eight transistors are used in the control "receiver;" a block diagram of this unit, which is mounted in the cabinet with the TV chassis, appears in Fig. 2.

In operation, the 40-kc. control signals sent out by the transmitter are picked up by a low-impedance ceramic microphone located on the front of the TV set; the output of the mike is fed to a three-stage, broadly tuned amplifier consisting of *Q1, Q2,* and *Q3*. Since the microphone may pick up other ultrasonic signals as well as the desired control signal, an amplitude limiter stage (*Q4*) is used to cut off extraneous noise pulses. This insures proper control under an extreme range of input signal levels.

After limiting, the control signal is applied to four sharply tuned amplifier/detectors (*Q5, Q6, Q7,* and *Q8*), which drive appropriate control relays. Two relays are used to operate the tuning motor —one for tuning to higher and one for tuning to lower channels. A third relay is used for "muting" sound without affecting the picture—when answering the telephone or during commercials, for instance.

Fig. 1. Transistorized remote control is now simple as 1-2-3 on many new TV sets. Press a button on the "transmitter" (inset) and a transistorized "receiver" in the TV set does all the rest.

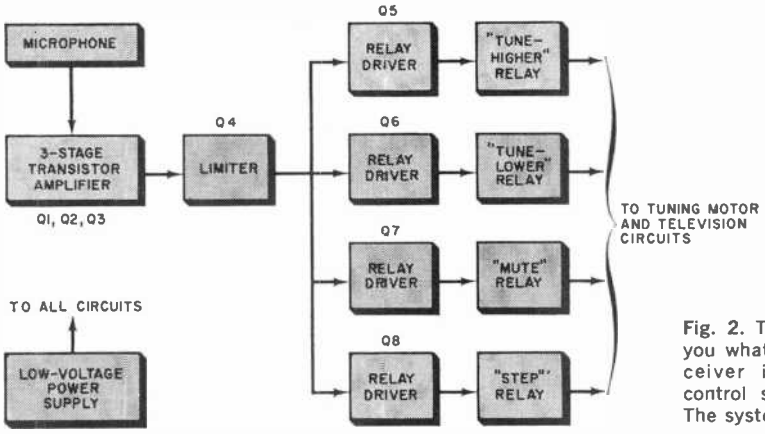


Fig. 2. This block diagram shows you what goes on inside the "receiver in the Zenith remote-control setup for home TV sets. The system uses eight transistors.

A four-position stepping relay, controlled by *Q8,* is used to turn the TV set "on" and "off," as well as to adjust the audio volume to one of three fixed levels. Special filters provide a proper time constant for relay control and prevent noise pulses from causing false operation. Different frequencies are used for each control function, of course.

The control receiver's operating power is furnished by a conventional line-operated, low-voltage power supply, consisting of a step-down transformer, a selenium rectifier, and *RC* filters.

Eight basic models in Zenith's 1962 TV line are equipped with the new "400" remote-control system. With each one, "skip-channel tabs" are provided. These can be adjusted through an access hole in the back of the cabinet so that the channel selector stops only on local "live" channels.

Readers' Circuits. Our correspondence indicates that many readers enjoy experimenting with circuits for one- and two-transistor receivers. We get more requests for these circuits than for any others, even though we've featured literally dozens of such circuits in past columns. So here's another single-transistor AM receiver, and a light-sensitive multivibrator as well.

The *receiver circuit* in Fig. 3 was submitted by reader Gregory Surma (7338 Auburn, Detroit 28, Mich.) It's similar

Need a battery for a Japanese transistor portable? Table below lists standard Japanese transistor batteries and equivalent units made by major U.S. producers.

TRANSISTOR BATTERY EQUIVALENTS

TYPE	1.5 Volt					9 Volt		
	"N"	"AAA"	"AA"	"C"	"D"			
Japanese	UM-5	UM-4	UM-3	UM-2	UM-1	006P	W06P	006
Burgess	N	7	Z 930	1 130	2 210 230	2U6	YL-6	P6M P6
Eveready	904	912	915 1015	953 635	950 D-99 100	216	E177	226
Ray-O-Vac	716	400	7R	1LP	2LP 3LP	—	—	—
RCA	—	—	—	—	—	VS312	VS309A	VS323 VS300A

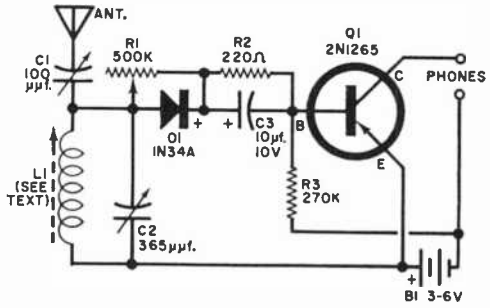


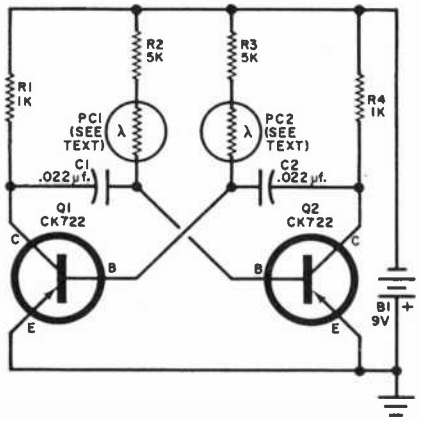
Fig. 3. Reader George Surma designed this little one-transistor receiver. Note the use of forward bias on the 1N34A diode.

to simple receivers shown in the past except for one interesting variation. A fixed base bias is applied to the transistor (*Q1*) through resistor *R3,* and a small forward bias is placed on the diode detector (*D1*) by resistor *R2*. This latter bias may tend to increase the detector's sensitivity under some conditions.

In operation, r.f. signals picked up by the external antenna are coupled through antenna trimmer *C1* to tuned circuit *L1/C2*. The selected signal is detected by the crystal diode, *D1,* and applied through capacitor *C3* to a *pnp* transistor, *Q1,* used as a common-emitter amplifier. The amplified output from *Q1* is developed across the magnetic headphones serving as a collector load.

Standard components are used. Capacitor *C1* is a small, 100-$\mu\mu$f. trimmer; *C2* a conventional 365-$\mu\mu$f. tuning capacitor; and *C3* an 8- to 16-μf., 6- to 12-volt electrolytic. Coil *L1* is a ferrite loopstick similar to Lafayette's MS-299, potentiometer *R1* has a value of 500,000 ohms, while *R2* and *R3* are ½-watt resistors.

Fig. 4. This light-sensitive multivibrator originated with reader Dennis Rathbun. Light controls operating frequency.



Any of several diodes can be used for *D1,* with types 1N34A and 1N48 both good bets. Transistor *Q1* can be almost any small *pnp* unit; Gregory writes that he has used types 2N299 and 2N1265 with good results. Battery *B1* should supply from 3 to 6 volts, and almost any standard (1000- to 4000-ohm) magnetic headphones are satisfactory.

Dennis Rathbun (366 So. Columbia, Los Angeles 17, Calif.) submitted the light-sensitive *multivibrator circuit* shown in Fig. 4. This, of course, is another variation of a familiar circuit; some readers, for example, may remember the "Transistorized Audio Photometer" article which appeared in the March 1957 issue.

Referring to the schematic diagram, we see that *pnp* transistors *Q1* and *Q2* are connected in the common-emitter arrangement as in a conventional collector-coupled multivibrator. In such a circuit, you may recall, the *RC* time constants in the base and collector circuits affect frequency and waveshape. Dennis achieved sensitivity to light in his circuit by replacing the base resistors with networks made up of Clairex CL-3 photocells (*PC1* and *PC2*) in series with 4700- or 5000-ohm, ½-watt resistors (*R2* and *R3*).

In operation, light falling on both photocells changes the *RC* time constants, causing a corresponding shift in operating frequency. If unequal amounts of light fall on the two photocells, the "symmetry" of the output waveshape changes. The output signal can be observed by connecting an oscilloscope to either of the two collectors . . . or heard by connecting a crystal earphone between either collector and circuit ground (or, if preferred, between the two collectors).

The circuit can be duplicated quite easily for experimental tests. Resistors *R1, R2, R3,* and *R4* are all ½-watt units; *C1* and *C2* are ceramic or paper capacitors. Transistors *Q1* and *Q2* are *pnp* types similar to Raytheon's CK722; the power supply, *B1,* is a standard 9-volt battery—a Burgess 2N6, for example.

Short-Wave Receiver. Allied Radio Corporation (100 N. Western Ave., Chicago 80, Ill.) has introduced a new Knight-

(*Continued on page* 100)

On the Citizens Band

with **DICK STRIPPEL,** 2W1452, CB Editor

NOT TOO LONG AGO we attended a CB meeting at which the subject of the FCC came up (and when doesn't it?). This time, the complaint was that the FCC never does anything to get rid of the jokers who are ruining CB for serious users.

Actually, this is far from the truth. Almost every week one or more (mostly more) "show cause" notices are issued. And such a notice is *not* a simple "pink ticket." A "show cause" notice requires the recipient to inform the FCC if there is any valid reason why his station license should not be revoked. Such notices are sent to licensees who have disregarded "pink tickets" in the past.

We at POPULAR ELECTRONICS receive regular bulletins listing all "show cause" notices. Here are some examples of pertinent cases compiled over the past few months:

● The Commission required a Fresno, Calif., CB'er to "show cause," charging him with transmitting "messages not necessary to the exchange of substantive communications related to the business or personal affairs of the persons concerned," using his station "for the purpose of uttering obscene, indecent or profane language" and transmitting messages "not directed to a specific person or station within the ground-wave range of the station being operated." This really covered a lot of ground.

● "Show cause" notices went to CB'ers in Washington, D. C., Bell Gardens, Calif., Falls Church, Va., and to dozens of others because they did not pause at five-minute intervals for two-minute periods of non-transmission.

● Several licensees, including a 13W in Portland, Ore., received "show cause" notices for not maintaining the carrier frequencies of their stations within the required tolerance. The Portland CB'er had received no less than nine "pink tickets" during the previous eight months, none of which were answered.

The most frequent violation seems to

CQ DX 11

By David Moore

"Okay, fine," said the CB fan.
"Thanks a lot for the call, ol' man.
Real good signal; S-9 plus;
And by the way, the handle's Gus.

"The QTH is Maplewood,
And the elevation's pretty good.
The height's just right for long-range calls,
And our logbook shows some DX hauls.

"The entire station here's home-brew,
With VOX, and key, and a phone patch, too!
Certainly think this band is swell,
And by the way, please QSL.

"Well, guess I'll turn it back to you.
Please tie the ribbons on this chew.
It's 1800 GMT,
And I have a sked with a VE 3 . . . ."

So the QSO finished here.
Gus comes out some time next year.
No more will ol' Gus chew the fat—
The FCC has seen to that.

Poems are made by fools like me,
But only YOU can save CB.

be using a station for trivial gossip, or "ham-type" operations. This is closely followed by violations of the "five-minute rule." We're happy to note that CB'ers at least appear to be careful in their choice of words—very few notices were given for using profane language on the air.

"Hot-Shot" Walkie Talkie. Harry Bangle, 5Q2880, Unit 1, of Lincolnton, N. C., is all set if he ever needs a high-power portable rig. He owns a Cadre transceiver running a CB "gallon" (transistorized) and uses it with a small "hot-shot" six-volt dry battery. His "receive" current is slight, and on "transmit" he can work over a ten-mile range. By the way, Harry is Secretary-Treasurer of the Lincolnton CB Club.

Tech Topics. Looking for high-quality coils for field strength meters or "roll-your-own" receivers and converters? Lafayette Radio, 111 Jericho Turnpike, Syosset, L. I., N. Y., is selling replacement parts for its famous series of transceivers; write them for their complete catalog if you don't already have it. Incidentally, replacement TV i.f. coils in the 25 - 29 mc. range might work in your rig if exact replacements aren't available; your local distributor will be able to help you choose the ones you want.

Need a simple signal source for setting your receiver on channel after an "expert" has played with all those alignment slugs? Here's one of the quickest you can make. Obtain a door buzzer from your hardware store and examine its construction. You'll note that it has a pair of switch contacts, one of which is attached to a movable armature. Solder a 0.25-μf., 600-volt capacitor across the contacts, making sure not to restrict the movement of the armature. The modified buzzer should then be wired to a battery. Now, *using very short leads,* connect a transmitting crystal for the channel you want between a point on the operating buzzer and the set's antenna jack. Connect the crystal onto the buzzer at different spots (the frame may work) until you hear a loud tone from the speaker. You should pick up a tone even if your set is badly out of alignment. Then tune your receiver until the tone drops in volume, and your set will be exactly on the crystal frequency. This is an old Army trick which works well with both overtone and fundamental crystals.

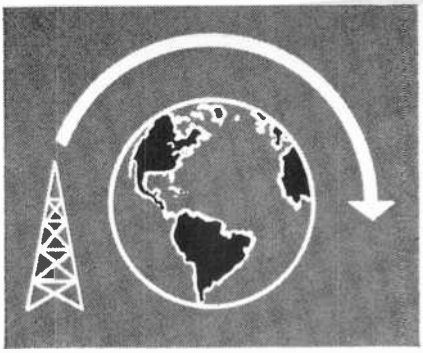
While on the subject of CB set alignment, we've found that with most units we have examined, a quarter of a turn on any of the front-end coil slugs can mean the difference between a "hot" set and one which won't pick up the guy next door. We don't recommend playing with adjustments, though, unless you have the necessary training and test equipment; even then, make all adjustments SLOWLY and CAREFULLY!

Operating Hints. If you really want to run your station like the "pros," and get the message through in the shortest possible time, warm up your short-wave receiver and listen in on the long-range Air Force frequencies. Try either 6738 kc. or 11,228 kc.

While there's a lot of drama on these channels, the technique of the operators is polished and unhurried, even in emergencies. Now and then these frequencies will sound like Channel 11 on a summer Sunday, and the tricks used to clear up the mess can easily be applied to CB. Give 'em a listen.

Club Notes. The Nassau County (Long Island, N. Y.) CB Club will hold its second Annual Jamboree on April 8 at the Bethpage Bowling Alley, on Hempstead Turnpike in Bethpage. If it's anything like last year's, when more than 300 persons attended, it should be a gala affair. Additional activities are planned for this year's event, and at press time, 15 distributors had agreed to show their

(*Continued on page* 99)



Monthly Short-Wave Report

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

STATIONS BEHIND THE IRON CURTAIN

IN PRACTICALLY every mail, your Short-Wave Editor receives a number of reception reports on the larger Iron Curtain stations, namely, those in Moscow, Budapest, Bucharest, Sofia, Peking, and (if you wish to include Cuba as an Iron Curtain satellite) Havana. It seems as though everyone has been hearing these stations, and no wonder, for they are broadcasting with tremendous power and on many different frequencies. It's nearly impossible NOT to hear them.

Many of our readers have asked why we don't publish more reports on the stations behind the Iron Curtain. There are two good reasons:

(1) A great many reporters send in material on these stations. We might be able to devote, say, four lines to program content in a particular item, but we would have to use ten lines or more to list the contributors, thereby cutting down on the overall amount of space available for the listing of other items. After all, it is the prime purpose of this column to give you news items rather than the names of reporters.

(2) Because the Iron Curtain stations are apt to change their schedules and/or frequencies at all-too-frequent intervals, we do not often have a chance to print the material before it goes out of date, due to the time which necessarily elapses between our receipt of the reports and their actual publication in this column.

We don't want to *discourage* you from sending in reception reports on these stations—quite the contrary. But we would like to suggest that you try to log more of the harder-to-hear stations; don't worry about the easy ones. Go after schedule or frequency changes, and search for new stations or for stations that have returned to the air after being off for some period of time. Those are the reports that are most likely to be

Steve Newman, WPE3CUS, of Kingston, Pa., operates a Hallicrafters S-40 receiver, with a Hammarlund "S"-meter on top of it. A Heath AA-191 amplifier and 3A FM tuner, and a 75'-long antenna round out the station. To date, Steve has 34 countries logged, and 22 verifications.

The listening post of Derrick Marston, WPE1DDY, Stamford, Conn. Derrick's receiver is a Heath AR-3, his antenna a 175' long-wire. Located above the AR-3 is a Heath QF-1 Q-multiplier and a preamplifier; a homemade "S"-meter is still in the construction stage. Derrick has accumulated 40 veries from 12 countries.

used; those are the ones that are really news!

WRH—1962 Edition. The 1962 edition of the *World Radio TV Handbook* is now available. As in years past, this valuable book is a must for everyone's listening post. For one thing, it lists the short-wave stations all over the world, by country, as well as many of the medium-wave stations. Frequencies, call-signs (where used), power, addresses, interval signals, and names of leading station personalities are also listed. In addition, many other worthwhile features are included, such as DX programs, abbreviations, world time, call-sign allocations, television listings, and world charts. The 1962 edition can be obtained from Gilfer Associates, Box 239, Park Ridge, N. J., for $3.00.

The booklet "How to Listen" has been enlarged and retitled "New Guide for Shortwave Listening." This, too, is available from Gilfer Associates, at the above address, for $1.50.

(*Continued on page* 109)

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1 Fill out the form below. (You must be a short-wave listener presently active in the hobby to be eligible for a Short-Wave Certificate.)

2 Send us 10 cents in coin to cover the cost of the certificate as well as the handling and registration costs. If you live outside the United States and cannot obtain U. S. coins, send either 15 cents in Canadian currency or two International Reply Coupons (IRC's).

3 Insert the application form, coins (or IRC's) and a stamped, self-addressed envelope in another envelope and mail it to:
Monitor Registration, POPULAR ELECTRONICS
One Park Avenue, New York 16, N. Y.

(Please Print)

Name ..... Ham Call-Area Prefix .....

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

Receivers — Make ..... Model .....

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

Principal SW Bands Monitored ..... Number of QSL Cards Received .....

Type of Antenna Used .....

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

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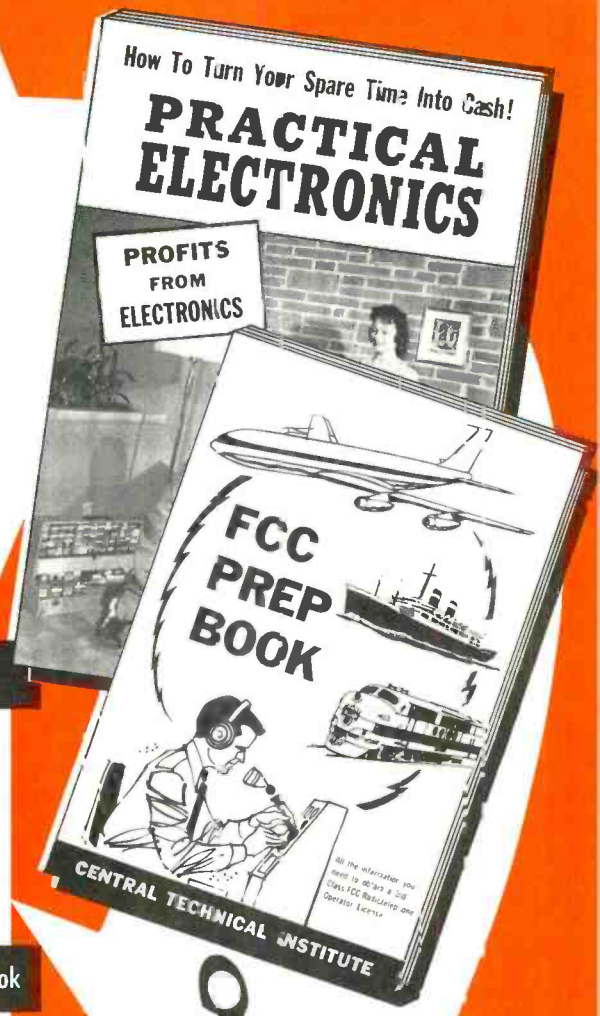

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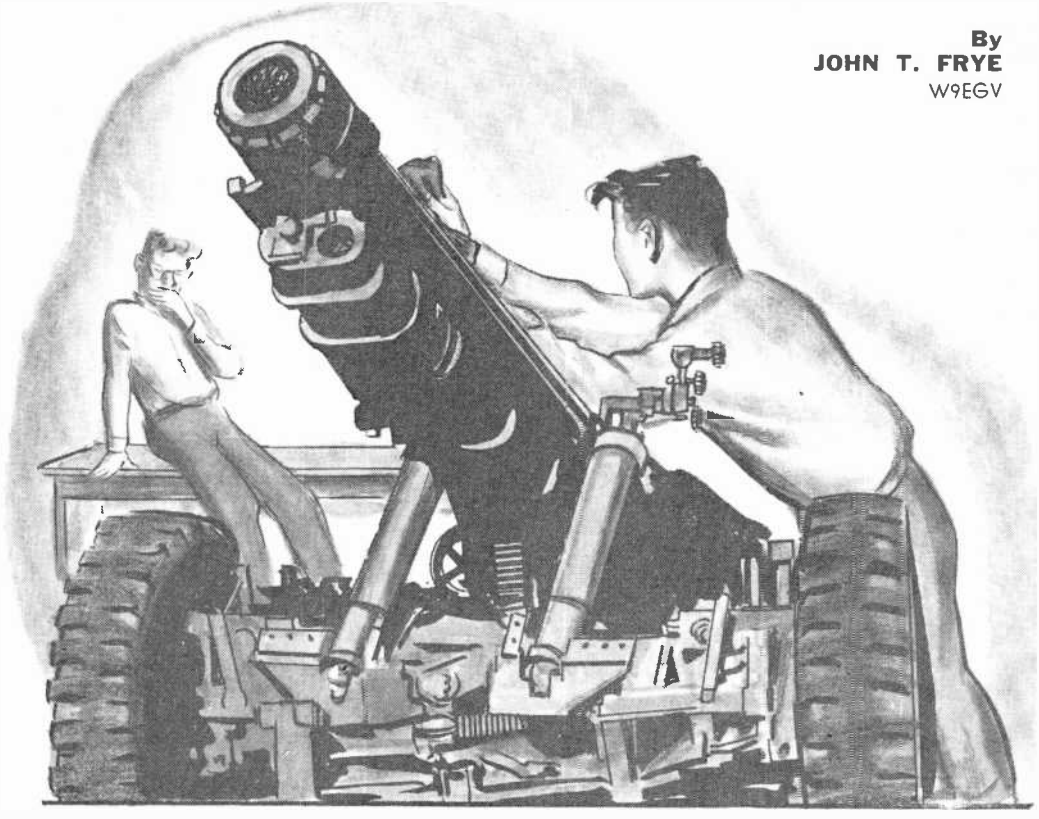
ROTC RIOT

a Carl and Jerry Adventure

By
JOHN T. FRYE
W9EGV



CARL AND JERRY were alone in the big armory building on the campus of Parvoo University. Under the Morrill Act, all physically-fit male undergraduate students attending the land-grant institution were required to enroll in some form of military training during their freshman and sophomore years. Both boys belonged to the Army's Reserve Officer Training Corps, familiarly known on the campus as "rot-see," and that is why they were in the armory. Strictly speaking, that is why *Jerry* was in the armory. At the suggestion of his lieutenant, he was working off three demerits by polishing the howitzer. Carl was keeping his buddy company and providing some dubious moral support.

"You missed a spot there by the breech," he pointed out critically from where he lolled lazily on a bench. "How did you goof up this time and give old Zimmie a chance to gig you?"

"My shoulder brass was a little tarnished—or so dear Lieutenant Zimmerman complained," Jerry answered. "I don't see how it could be with all the rubbing I've done, but I'll have to admit my brass doesn't shine the way yours does. Yet I never see you making with the Brasso and Blitz-cloth. How come?"

"Oh, didn't I tell you?" Carl asked, affectedly smothering a yawn. "I take my hat and shoulder brass to chem lab with me and dunk them in a weak solution of sulfuric acid. Works fine. Polishing is for peasants."

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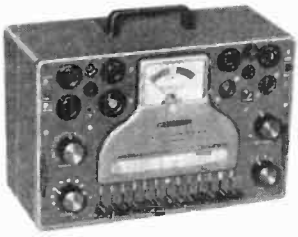

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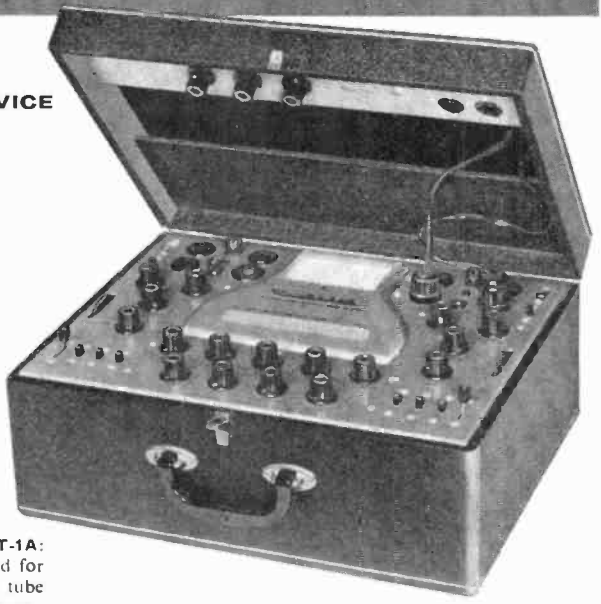

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ITEM	MODEL NO.	PRICE

Carl and Jerry

(*Continued from page 87*)

you, who needs enemies? But Lt. Zimmerman is a real clown, and I'll bet his grandpappy was in the Prussian Army. He really loves to ride me. 'Mr. Bishop,' he says in that nasty-nice voice of his, 'since you can't seem to clean little things, suppose we see what you can do with something bigger. I expect that howitzer to sparkle!' Have you heard his latest?"

"Nope."

"As you know, he's drilling us for Corps Day. He's taped a whole drill he intends to feed into the armory p.a. system so he 'may better observe the reaction time of the troops to spoken orders.' Get a load of this," Jerry said, as he walked to a table at the end of the armory and switched on a tape recorder. In a few seconds the voice of Lt. Zimmerman could be heard barking out occasional commands against the steady beat of a metronome. Music was playing very faintly in the background.

"I notice the local broadcast station is getting into that playback amplifier a bit," Jerry observed. "Zimmie was over here this afternoon checking to make sure the commands were given at the right time so that the squad wouldn't run into the armory walls when they started at the right spot and were pointed in the right direction. You'd think he was bucking for general instead of being just a Parvoo senior in rot-see. If I dared, I'd like to put a few commands of my own on that tape just to foul him up—"

Jerry's voice trailed off and his eyes took on the glassy look they always wore when he was in the throes of electronic inspiration. "Say, Carl," he said eagerly, "do you still have that little battery-operated two-meter transmitter in your locker?"

"Sure. I was checking it out last night, and it works fine; but why?"

"Be a good Joe and go get it while I keep burnishing the loudenboomer. I want to try something."

Carl went with alacrity, for he knew that when Jerry got that look interesting things usually happened. It was only three blocks from the armory to the resi-

dence hall; so he was soon back carrying a compact little u.h.f. transmitter no larger than a cigar box.

Jerry started the recorder again and placed the transmitter on the wooden table beside it. He flipped on the transmitter, and anything he said into the transmitter microphone blotted out and rode over the top of anything playing from the tape.

"Fine, fine!" he exulted. "Now let the tape play all the way through and write down the exact time that elapses from the start to the end of each order and the nature of the order. I'll finish polishing; and then back to our room! We have work to do tonight."

AFTER they had supper, Carl and Jerry locked the door of their room in H-3 and started on their project.

"What I have in mind," Jerry explained, "is to put some commands of my own on the tape of this miniature, battery-operated tape recorder and feed the output into the two-meter transmitter. As you saw this afternoon, any time that transmitter is turned on in the vicinity of the tape recorder in the armory, the very strong r.f. field overloads the first amplifier tube in the recorder and forces it to make like a detector. Under those conditions, any modulation on the transmitter carrier feeds right through the amplifier in the recorder."

"Why does r.f. do that?"

"A strong r.f. signal that reaches the grid of this amplifier tube swings that grid positive on positive half-cycles of the r.f. During these swings, the grid attracts electrons from the cathode which must flow to ground through the grid resistor, often several megohms in value. Trapped electrons piling up on the grid will bias the tube negatively to the knee of its characteristic curve, and it becomes a grid-leak detector instead of an audio amplifier.

"That's why ham rigs are often heard on tape recorders, hi-fi amplifiers, p.a. systems, electric organs, broadcast radios, and TV sets, even though the ham transmitters are functioning perfectly and legally. Police and taxicab radios do the same thing. For this to happen, the r.f. field must be intense, which means that it only occurs near the transmitter. The condition is often aggravated when

the transmitter frequency is high and wavelength is short, because then it is more likely that standing waves will appear on the amplifier wiring and put a maximum signal on the grid of a high-gain amplifier tube."

"Aw, sure! I remember now. The ARRL *Handbook* explains how the condition can usually be corrected by installing a simple resistance/capacitance filter in the grid circuit and lowering the value of the grid resistor. We did that to this little recorder. But are you going to let the transmitter run all the time the tapes are playing? The r.f. will blank out the other tape."

"I know, and I don't want to do that. I want to use some of Zimmie's orders and some of my own. We'll rectify part of the audio output from my tape recorder with a silicon diode and use the developed d.c. to operate a little relay that turns on the plate supply to the transmitter. We'll put enough capacitance across the relay coil so that the stored current will hold the relay closed between words. That way the transmitter will turn on every time one of my orders starts and will cut off a second or so after the order is given."

Actually marrying the tape recorder to the transmitter was an easy job for Carl and Jerry, and it was still early in

the evening when they slipped into the still-empty armory carrying a small box that housed both the transmitter and miniature recorder. This box was concealed in the space behind a desk drawer, and a tiny Micro-switch was mounted so that when this drawer was shoved in the last sixteenth of an inch the tape recorder and transmitter heaters were turned on.

They turned on both recorders and were delighted to discover the timing on the tape Jerry had made was perfect.

The few orders he gave substituted perfectly for those of the lieutenant that were covered up. When the volume control of the battery-operated recorder was carefully adjusted, it was very difficult to tell who was giving the command. Jerry was an excellent mimic.

Satisfied, they carefully rewound both tapes, pulled out the desk drawer a fraction of an inch, and went back to H-3 and to bed. It would be nice to report that their consciences kept them awake, but they slept like cherubim.

DRILL for the boys did not come until late in the afternoon of the next day. Anticipating the discomfit of their thoroughly disliked upper classman, they looked forward eagerly to the event, and finally it arrived. Carl managed to stand close to the desk until the lieutenant switched on the tape recorder. At the precise moment the officer pushed the "Play" button, Carl nudged the drawer shut with his knee and went to join Jerry in the drill squad. He had been so intent on performing this critically-timed operation that he did not notice a man, smartly dressed in a regular Army uniform, who had entered the hall and was now standing quietly by the door.

"You didn't start the thing—I hope!" Jerry whispered fervently out of the corner of his mouth. "See that silver star on the uniform of the stranger? He's a Brigadier General. Must be doing a little inspection between planes. You didn't start it, did you?"

"It's off and running," Carl whispered back. "Stand by for court-martial!"

At this moment Lt. Zimmerman noticed the distinguished visitor; and, after

a shocked double-take, he threw him a snappy salute. The general returned the salute and waved for him to carry on.

The tape had already started delivering a little sermon from Lt. Zimmerman on military obedience: "A good soldier obeys every order of his commanding officer instantly, resolutely, and unquestioningly, no matter how foolish the command may seem at the moment. That is the basis of our drill today. Until the tape recorder says otherwise, *it* is your commanding officer. No matter how much any other person—including the sergeant or myself—may try to dissuade you, you shall carry out your orders unflinchingly. Fall in!"

As the squad started to go through the maneuvers dictated by the tape, Lt. Zimmerman sauntered over and shook hands with the general, who was still standing near the door, close to a wall. Carl and Jerry were sweating copiously, and not from the April warmth, as they marched the length of the armory, made a left turn, marched across the end, made another left turn, and started back. Both boys were trying desperately to recall the orders Jerry had put on their tape and to picture the probable result when these orders started coming through the speakers. They were not left in doubt for long.

The squad marched smartly past the two officers. Then the first of the spurious orders barked from the speakers. The squad turned to the left. In a few seconds a command in Lt. Zimmerman's voice turned the men left again. Then, when they were squarely opposite the two officers, another of the false commands turned them left once more and they started marching straight at the general and the lieutenant.

The face of the lieutenant, as he watched his men march toward him, wore a look of mingled puzzlement and

anger; but as they came relentlessly closer, the look changed to something similar to horror.

"Stop! Company halt! Aw, cut it out, fellows!" his voice trailed off in a most unmilitary wail; but not a man even hesitated. They marched straight against the two officers, forcing them backward, and pinned them against the wall while the soldierly legs still pumped up and down in a rhythmic one-two one-two one-two.

Mercifully, the tape recorder finally gave an order to about-face, and the freed lieutenant ran over and stopped the tape recorder. Serious as the situation was, Carl and Jerry could hardly keep from grinning as they saw him lift it off the desk and run his hand all around it in a vain search for hidden wires.

"Lieutenant," the red-faced general said sternly, as he tried to restore a crease to his trouser legs that had been rumpled and soiled by the scraping shoes of the squad, "may I suggest that you dismiss the company? I think we should go into the office and have a little talk about the danger of allowing your command to leave your control, even for a few minutes."

AS SOON AS the door closed behind the angry general and the sheepish-looking lieutenant, the rest of the boys filed out of the armory, still chattering excitedly about the strange happenings. Carl and Jerry stayed only long enough to retrieve the little box from its hiding place behind the drawer.

"Whew, that was close!" Jerry said as they started at a quick trot back to their own quarters. "I only wanted to march the squad into a wall and let Zimmie see how it feels to be made to look foolish in front of everybody. I actually felt sorry for him when the general was chewing him out, but maybe he'll be a little more tolerant from now on."

"Okay, but let's hurry," Carl said, looking back over his shoulder. "I'm not going to rest easy until we've dismantled this handy-dandy little electronic sergeant and erased the tape. That general had firing-squad eyes if I ever saw them!" -30-

Printed-Circuit P.A.

(Continued from page 70)

Installation Tips. The appearance of the amplifier can be improved by placing suitable nameplates on the front and back panels. Since the on/off switch is already identified, placing *Phono* and *Mike* on the respective jacks and volume controls and *Tone* on the tone control will take care of labeling the front panel. *Plus* and *Minus* as well as *Speaker* labels may be fastened to the back of the amplifier to identify the respective terminals.

If the amplifier is to be installed permanently or semi-permanently in a car or truck, some additional fittings will have to be fastened to the amplifier case. Since the requirements will vary considerably with each individual installation, you're pretty much on your own. However, a few tips may be helpful.

For a semi-permanent installation, power can be secured from the cigarette lighter outlet, and the amplifier can be placed in the glove compartment. For a permanent installation, a set of angle brackets (available at most hardware stores) attached to the case will permit easy under-the-dash mounting.

If you want to use the amplifier inside or move it about a good bit, attach rubber feet to minimize chances of scratching table tops. —30—

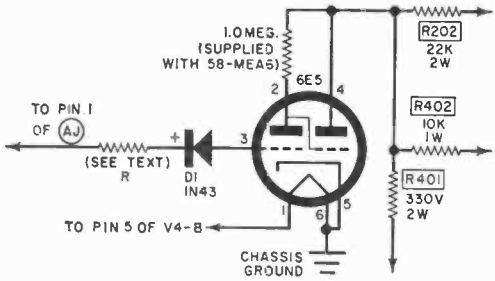
"Is this EICO? I think I've found an error . . ."

Cat's Eye for CB-1

You can improve the appearance of your Heathkit CB-1 transceiver through the addition of a 6E5 tuning indicator tube mounted on an Amphenol 58-MEA6 tuning eye assembly. The "magic-eye" tube's green glow will also be a more accurate tune-up indicator than the neon bulb in the CB-1. The Amphenol assembly and the 6E5 tube will cost about $3.50.

Use a 58-MEA8 assembly and a 1629 magic-eye tube if your CB-1 is wired for 12-volt operation. The 1629 is identical to the 6E5 except that the former has a 12-volt filament and an octal base.

Mount the tuning eye assembly in a convenient spot on the CB-1 panel—the necessary hardware is supplied by the manufacturer. You'll have to make just four solder connections to the CB-1. Take B-plus voltage either from the power supply (as shown in the diagram) or from pin 2 of the send-receive switch. If the voltage is taken from the switch, the magic eye will glow only when you are transmitting.



You will probably find it necessary to experiment with the value of the resistor (*R*) which is inserted between diode *D1* and the antenna jack, terminal 1; it might range anywhere from 2700 to 270,000 ohms. If the eye closes too much, increase the value of *R*; if it doesn't close enough, decrease the resistance. Strive for a ¼"-wide shadow when the CB-1 is tuned up and the antenna loaded. Modulation peaks should further decrease the shadow width.

—*Richard Newton and Dick Barnett*

Transformer Quiz Answers

(*Questions on page* 73)

1 TRUE. Decreasing the number of turns used in the primary winding will increase the turns ratio of the windings. Hence, the voltage ratio will be increased.

2 FALSE. As the frequency of the supply voltage is increased, the inductive reactance of the transformer windings increases and less heat due to loss currents is produced by the same amount of input voltage.

3 TRUE. The impedance ratio of a transformer varies directly as the square of the turns ratio and is therefore 1:4, or 25 ohms in this instance.

4 FALSE. The transformer primary winding impedance decreases as the signal frequency is reduced. Since the primary winding is the plate load for the vacuum tube stage, the resulting lowered plate load impedance causes a reduced output.

5 TRUE. Both coils will act as the secondary winding and develop an output voltage which will be the sum of the voltages across each coil. However, the output voltage will be 180° out of phase with the input voltage.

6 TRUE. Eddy currents exist in the iron core due to the alternating magnetic field. Assembling a core made of thin sheets insulated from each other tends to keep these loss currents and the resulting heat to a minimum.

7 FALSE. The Faraday screen is used to prevent the transfer of electrical energy between the windings by capacitive coupling.

8 TRUE. A "universal" winding prevents the adjacent turns in a coil from running parallel to one another. The capacitance between turns is thereby kept to a minimum, and a more uniform coil Q for a wide band of frequencies is obtained.

9 TRUE. The area enclosed by the hysteresis loop is a measure of the electrical energy lost as heat when the atoms of the core material are rearranged because of the cyclical magnetization of the core. Hence, the narrower the sides or the smaller the area within the loop, the less the losses in a core material. Remember, losses can never be completely eliminated.

On the Citizens Band

(*Continued from page* 82)

latest CB equipment. You can write or phone the Bethpage Bowling Alley for more information. By the way, this up-and-coming organization meets at 8 p.m. on the first Sunday of each month at the bowling alley and welcomes visitors. The club also sponsors electronics classes consisting of lectures and films. . . . The Greater Dallas (Tex.) CB Club has formed a TVI committee to help in the investigation of complaints. They also boast an extensive monitoring service. . . . The Mid Hudson CB Club, (Robert Simmons, Secy., 85 Mansion St., Poughkeepsie, N. Y.) recently elected a new slate of officers. Installation was conducted during a dinner at Talbot's Hotel. . . . A newly-formed club is the Northwest Five-Watters (Ed Fiedler, Pres., 7 North Ridge, Mt. Prospect, Ill.) which is interested in boosting its membership. Several projects are being planned. . . . The Niagara Frontier CB Club recently saw a New York Telephone Co. film on the American Telephone and Telegraph Company's proposed earth-satellite communications system. The club has also set up a "Sunshine Committee" to send cards to members who are ill. . . . The Citizens Radio Service Club of Washington Court House, Ohio, (John Williams 19A5006, Pres.) has been working closely with local civil defense officials during emergency drills.

Keep the club news coming in. If your club puts out a newsletter, please place us on your mailing list. Address all material directly to Dick Strippel, CB Editor, POPULAR ELECTRONICS, One Park Ave., New York 16, N. Y.

We're still interested in enlarging our directory of CB clubs, which we hope to publish in this column shortly. Send us the name of your club, *its address*, and a list of the officers—on the back of a post card, please.

Flash! Hot off Channel 9! There's an outside chance that many CB'ers will be able to obtain call-sign auto license plates. One state, Wisconsin, already has approved several CB applications for the special plates. —30—

Transistor Topics

(*Continued from page* 80)

Kit which should be of real interest to home builders and experimenters (see Fig. 5). Dubbed the "DX'er," it assembles into a three-transistor, two-band receiver tuning the standard AM broadcast band (550 - 1500 kc.) and the short-wave band from 7.5 to 17.5 mc.

Designed for use with an external antenna, the "DX'er" is equipped with an adjustable antenna trimmer for peak

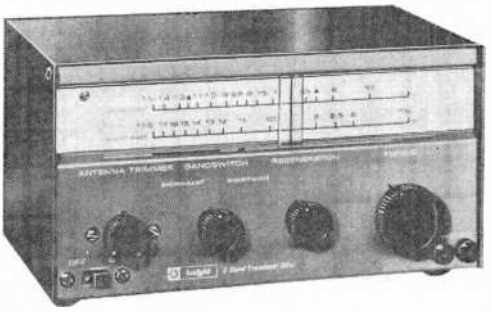


Fig. 5. All-transistor Knight-Kit "DX'er" tunes both the broadcast band and from 7.5 to 17.5 mc.

performance. A regenerative r.f. amplifier/detector stage insures good sensitivity and also serves as a BFO for reception of code signals. The detected signal is transformer-coupled to a two-stage *RC*-coupled audio amplifier designed to drive standard magnetic headphones; operating power is supplied by a built-in power pack made up of four penlight cells connected in series to supply six volts.

The set's construction is rather unique —a single "L"-shaped sheet serves both as the basic chassis and as the receiver's front panel. A separate "U"-shaped cover slips over this chassis when the wiring is completed, forming an attractive all-metal cabinet; wiring is point-to-point. Featuring a large, slide-rule dial, the "DX'er" is priced at $19.95, plus postage; headphones are available as an accessory item.

Product News. The International Rectifier Corporation (233 Kansas St., El Segundo, Calif.) has released a series of experimenter's solar cells and photocells. Included are the B2M and B3M selenium photocells, the S1M silicon solar cell, and the CS120M6 cadmium sulphide photocell. The B2M is a bracket-mounted unit, while the other three devices are assembled in rugged plastic cases with reticular lens for optimum light absorption. Prices range from approximately $1.50 to $2.35.

This new series of units is "blister"-packaged on the front covers of 24-page "project" booklets (see Fig. 6) containing circuits for a variety of experiments. Available separately at 50 cents each, the booklets are free with the purchase of the photocells.

General Electric (W. Genesee St., Auburn, N. Y.) is marketing a subminiature silicon *pnpn* diode switch that can be triggered with light. Five types are in production, with voltage ratings from 50 to 400 volts. These units can handle average currents of 0.25 amp. and peak surge currents as high as 5 amperes. Experimenters will find them valuable for control circuit applications. Prices range from $5.00 for the 50-volt units to $25.00 for the 400-volt types.

Motorola, Inc. (4501 W. Augusta Blvd., Chicago 51, Ill.) has developed an electronic ignition system which eliminates the need for conventional breaker-points. Transistorized, the system uses a small

Fig. 6. International Rectifier's photocells and "project" booklets are supplied packaged together.

magnetic pickup device for timing. In operation, a small spoked or toothed wheel is rotated past a tiny magnet without touching it. Since there is no physical contact, there is no wear.

That does it for now. *Hasta luego, muchachos . . .*

—Lou

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MAY 14-16
National Aerospace Electronics Conference
Dayton Biltmore Hotel and Memorial Hall, Dayton, Ohio

MAY 21-24
Electronic Parts Distributors Show & Conference
Conrad Hilton Hotel, Chicago, Ill.

MAY 24-27
Southwest Air, Space & Electronic Exposition
Market Hall, Dallas, Texas

JUNE 1-3
Southwestern Division ARRL Convention
Disneyland Hotel, Anaheim, Calif.

JUNE 12-14
Armed Forces Communications & Electronics Show
Sheraton Park & Shoreham Hotels, Washington, D. C.

JUNE 24-28
Music Industry Trade Show
New York Trade Show Building and Hotel New Yorker, New York, N. Y.

AUG. 21-24
WESCOM
Ambassador Hotel & Memorial Sports Arena, Los Angeles, Calif.

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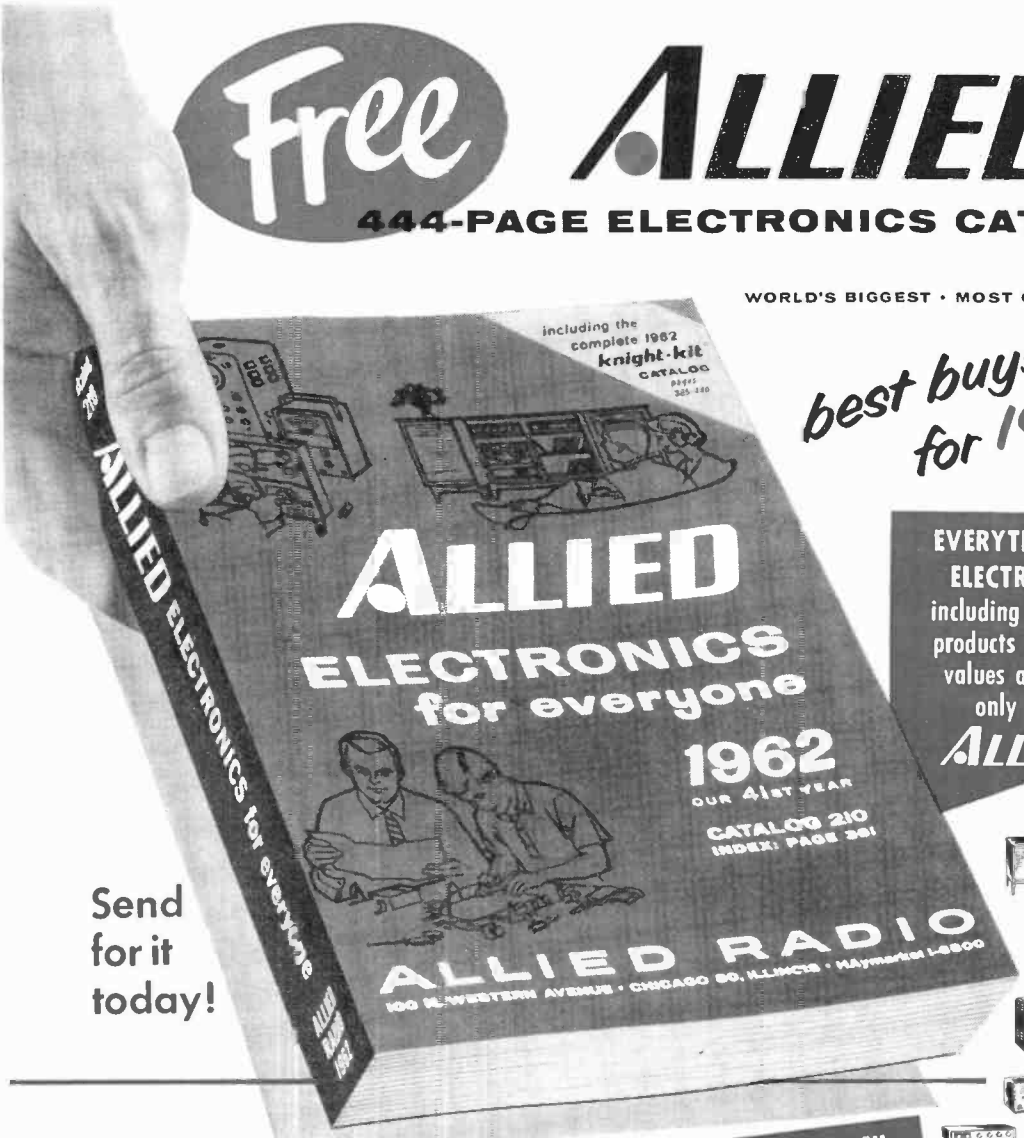

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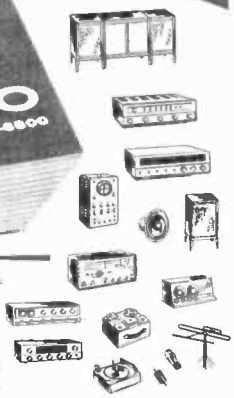

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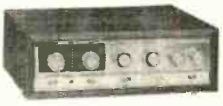

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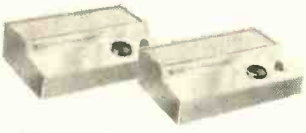

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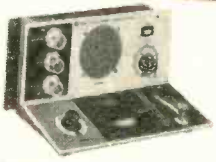

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THE GABBLE KILLER (*Continued from page 45*)

HOW THE SYSTEM WORKS

The tone generator connects to the mobile transceiver's mike input jack via plug *P101*, and the mike plugs into jack *J101*. When switch *S101* is in the normal position (shown), the transceiver operates as usual. With *S101* depressed, however, power from battery *B101* is applied to the tone generating circuit, the output of the circuit is fed (via coupling capacitor *C107* and voltage-dropping resistors *R106* and *R107*) to the input of the transceiver, and the transceiver's "push-to-talk" circuit is activated. The net result is that a 345-cycle tone is broadcast by the transceiver.

A modified Colpitts oscillator, the tone-generating circuit is designed around transistor *Q101*. Base bias for *Q101* is taken from the junction of voltage-dividing resistors *R104* and *R103*, and the oscillator's output is developed across emitter-load resistor *R105*. The feedback necessary to maintain oscillation is provided by a network consisting of resistor *R102*, the tuned circuit formed by *C102-C105* and choke *L101*, and coupling capacitor *C106*. Capacitors *C102* and *C103*, as well as *C104* and *C105*, are in parallel because it is difficult to obtain stock capacitors having exactly the required values. Potentiometer *R101*, with its series capacitor *(C101)*, is used to make small adjustments in the frequency of the generated tone.

An audio-actuated relay circuit is connected to the base station transceiver via the leads marked with circled numbers (see schematic of relay circuit and sample schematics of transceiver audio output stages). When a call from the mobile unit is expected, the transceiver is turned on and set to receive on the proper frequency. Though the receiver is operating, no sound is heard because one of the leads from the speaker to the output transformer is disconnected.

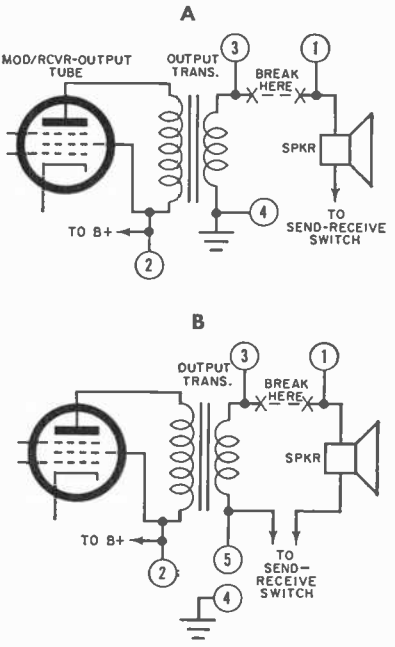
The mobile operator activates the base station receiver by holding the tone generator button *(S101)* closed for about four seconds. The resulting 345-cycle tone is picked up by the receiver and fed, via leads *3* and *4* (or *3* and *5*—see "Installation" section), to the coil of resonant-reed relay *K201*. A vigorous vibration is then set up in a small metal reed, tuned to 345 cycles and located in the relay. This closes a circuit which allows B+ voltage to flow, via lead *2*, from the transceiver to a delay network (resistors *R201* and *R203* and capacitors *C201* and *C202*). After an interval of about three seconds (necessary to prevent activation of the receiver by a random tone), capacitors *C201* and *C202* charge enough to close relay *K202*. One set of *K202*'s contacts restores the broken speaker-output transformer connection via leads *1* and *3*; the other set holds *K202* closed by bypassing the contacts of *K201*, allowing B+ voltage to flow (through dropping resistor *R202*) directly to *K202*'s coil.

When communication with the mobile unit is ended, the base station operator presses push-button switch *S202*. This action breaks the holding-current path to relay *K202*, the relay contacts open, the receiver is silenced, and capacitors *C201* and *C202* are discharged (through resistor *R204* and the coil of *K202*) to await the next signal. For manual activation of the receiver in the absence of a tone signal, push-button switch *S201* is wired in parallel with *K202*'s "holding" contacts. It's necessary only to press the button momentarily to lock *K202* in a closed position.

this schematic and to output stage schematic "B."

Whether you use a 4- or a 5-wire cable, run it through a ventilation louver or other convenient opening in the transceiver cabinet before making the connections.

Adjustment. Switch on the base station transceiver, setting the volume control to its normal level and disabling the squelch. After a 1-minute warmup, push



Sample schematics of wiring you may encounter in audio output stage of base transceiver. Type "A" requires only four wires to the relay circuit; "B" needs five.

switch *S201*. Relay *K202* should now snap closed, and the usual background hiss should come from the speaker. If the relay fails to operate, try reducing the spring tension on its armature. Should the transceiver power supply furnish less than 200 volts to lead *2* of the interconnecting cable, you may also have to reduce the value of *R202* to about 10,000 ohms.

With the relay closed, push switch *S202*; this should open it, silencing the speaker, in about half a second (the time

required to discharge *C201* and *C202*). Now switch on the speaker by pushing *S201*, and you're ready to proceed with the next step.

Temporarily set up the mobile rig next to the base station transceiver, switching it to the base station's channel. Next, depress *S101* on the tone generator (if your mobile unit has no push-to-talk circuit, you'll also have to flip its "Transmit-Receive" switch to "Transmit.") You should now hear a tone in the base station speaker.

Vary the frequency of the tone, using potentiometer *R101*. At the same time, keep your eye on *K201*'s 345-cycle reed. It should be possible to find a setting of *R101* which will throw the reed into lively vibration. If not, the tone generator's frequency range isn't quite right; adding an 0.068-μf. capacitor (Mylar!) in parallel with *C104* and *C105* will probably clear up the trouble. Once you obtain the proper vibration, permanently solder *C104*, *C105*, and the extra capacitor (if used) in place.

At this point, push *S202* to release *K202*. Now push *S101* again; the 345-cycle reed should vibrate and, after a 2- or 3-second delay, *K202* should snap closed. You'll again be able to hear the audio tone in the base station speaker. When you let go of *S101*, the tone should stop and the receiver should continue to function normally until *S202* is actuated.

If *K202* closes less than 2 seconds after *K201* starts to buzz, increase the value of *R201;* if the delay is greater than 3 seconds, reduce the value. Some delay is necessary in order to keep heterodynes and other spurious noises from accidentally switching on the receiver speaker.

As a final check, have an assistant drive the mobile unit 4 or 5 miles away from your base. Try out the system again, making sure that it still functions dependably. It might be necessary to touch up the setting of *R101*.

The tone generator can now be fastened permanently on or near the mobile transceiver. But if the generator, over a period of time, drifts so far off frequency that *K101* fails to operate, try another 2N1381 transistor at *Q101*. Now and then, one encounters a transistor which is extremely sensitive to temperature variations.

The selective calling system, as de-

FREQUENCY CONVERSION CHART

Reed Frequency	Capacitor Values Required	
	C102, C104	C103, C105
315 cps*	.22 μf.	.047 μf.
345 cps	.22 μf.	.015 μf.
375 cps	.1 μf.	.1 μf.
405 cps**	.15 μf.	.022 μf.

**Longest reed* ***Shortest reed*

scribed, works only from mobile to base station. The average CB'er enjoys listening to activity on the band as he drives along the highway, so there is no need to immunize his receiver against signals not meant for him. Any reader who wants selective calling in both directions, however, can readily combine a tone generator and relay circuit in a single package. He can then install one of these dual units at each end of the line.

Changing the Signaling Tone. As CB interference increases and more selective calling systems are installed, you may discover that a nearby station is using a signaling tone identical in frequency with yours. If this happens, you can readily shift to one of the three other reeds on *K201*.

It will be necessary also, of course, to change the frequency of the tone generator. This can be done by changing the values of *C102-C105*; a table of values for these capacitors, corresponding to each of the four reeds, will be found at the top of this page. As before, you may have to make slight variations in capacitance to produce exactly the right frequency. -30-

PHOTO CREDITS

58 (right).....RCA Institutes

59 (top, left and right)....RCA Institutes

59 (center, left).....NRI

59 (center, right).....CREI

Short-Wave Report

(*Continued from page 84*)

Current Station Reports

The following is a resume of current station reports. All times shown are Eastern Standard and the 24-hour system is used. At time of compilation all reports are as accurate as possible, but stations may change schedule and/or frequency with no advance notice.

Austria—Vienna has been noted at 1200 on 7105 kc. with announcements in French and a program of music announced in German. Another xmsn was noted on 17,850 kc. from 0930 in English. *(WPE1JI, BB)*

Bahrein—One of the very few ways to log this country is through 2AE. the Bahrein Aeradio, on 8845 kc. Try for this one during mid and late afternoons. *(VE7PE2M)*

Brazil—*R. Nacional*, Brasilia, is again active on 11,720 kc. from around 1700, dual with 9665 kc. *(WPE4FI)*

ZYN37, *R. Soc. Feira de Santana*, has been logged at 1800 on 4765 kc. *(BB)*

R. Mayrinck Veiga, Rio de Janeiro, 11,775 kc. (to 2235 s/off), and *R. Guaiba*, Porto Alegre, 11,785 kc. (to 2300 s/off) are heard well most evenings with orchestra music and newscasts in Portuguese. *(WPE8ANI)*

British Honduras—Belize has returned to the air on 3300 kc. and is heard well at 1900-2315 in English; reports are requested. This station had been off the air since late last summer due to hurricane damage. *(WPE2FGX, WPE4BQ, WPE4JO, WPE5AG, WPE9CQC, WPE9CVE)*

Central African Republic—*R. Bangui*, 7220 kc., is noted from 0022 with dance music. News at 0030 follows the French ID. *(WPEØVB)*

Czechoslovakia—Prague has moved up to 7345 kc. (from 7340 kc.) for the N.A. program at 2200-2300, dual to 5935, 9550, 9795, and 11,990 kc. *(WPE2FGX)*

Dahomey—A recent QSL from Cotonou lists the following schedule: Mondays, Tuesdays, Wednesdays, and Fridays at 0015-0115, 0615-0715, and 1200-1630; Thursdays at 0015-0115, 0615-0815, and 1200-1630; Saturdays at 0015-0115 and 0700-1800; Sundays at 0200-1700 on 4870 and 7190 kc. *(VE3PE1LA)*

Denmark—According to the new schedule, *The Voice of Denmark*, Copenhagen, now broadcasts to Greenland at 1230-1320 on 15,165 kc. Other broadcasts: to N.A. daily on 9520 kc. at 2030-2130 and 2200-2300, with a DX bulletin on Wednesdays at 2100-2110; to S. America on 15,165 kc. on Mondays, Wednesdays, and Fridays at 1730-1830; to Far East, Australia, and New Zealand on 15,165 kc. on Tuesdays, Thursdays, and Saturdays at 0400-0500. *(WPE8BUV, SCDX)*

Dominican Republic—What is possibly a new station has been noted on 9700 kc. at 2130-2200 in Spanish with music. *(WPE4EFQ)*

R. Santiago, HI4F, is reported to be on 3360 kc. from 1901 with ads, pop music and Sp. anmts. Another report claims that HI8Z,

R. Santiago, has moved from 6313 to 3405 kc. where it has been noted at 1900-2000, but this is not confirmed. *(WPE2GES)*

Ecuador—*R. Cariamanga,* listed for 6035 kc., is actually on 6232 kc. and strong around 2130-2200 with "Ritmos Interamericanos" in Spanish. *(PY2PE1C/TG9)*

Egypt—Cairo is now on 9505 kc. in Arabic at 1600-1630; abrupt s/off. English dictation-speed news is given at 0130-0200 on 7050 kc. *(WPE2FGX, WPE9NY)*

France—Paris broadcasts to the Far East at 0800-1000 (Eng. to 0845) on 21,620, 17,775, and 15,245 kc., and at 1800-1830 on 11,920 and 9560 kc. Lessons in French beamed to Eng.-speaking countries are aired at 2145-2200 on 7160 kc. *(WPE2FHU, WPE2GMG, WPE9AXT, WPE9CGQ, VE1PE3L)*

Gabon—*R. Gabon,* Libreville, has been noted on 7270 kc. from 0104 with Fr. news; ID and native music from 0118 to 0130 s/off. *(WPEØVB)*

Ghana—The latest schedule from Accra for the Eng. External Service reads: 21,545 kc. at 0915-1045; 17,740, 15,210, and 9545 kc. at 1000-1045; 9545 kc. at 1200-1245; 11,800 kc. at 1330-1415; 15,287 kc. at 1500-1545; 11,800 kc. at 1550-1635; and 9545 and 6070 kc. at 1630-1715. All xmtrs are 100 kw. except the one on 15,210 kc., which is 10 kw. Other xmsns in native language are noted on 21,545 kc. at 1240-1300 and 1350-1414. *(WPE2CTS, WPE4BC, WPE4EFQ, WPE7AHX, WPE8ANI, WPE8CNX, WPE8CUS, WPE9BTA, WPE9CQN, WPE9CVE, WPEØVB, VE3PE1MM)*

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Gilbert & Ellice Islands—VTW2, Tarawa, is a new call on 6050 kc. The power is 2000 watts. It was noted in New Zealand on a Friday until 0530. *(SCDX)*

Honduras—HRRH, *La Voz de Occidente,* Santa Rosa de Copan, 5960 kc., is apparently testing, for they have very few commercials; all-Spanish, it was noted at 0846-0902 and later. *R. Onda Musical Tricolor,* La Ceiba, 6190 kc., is good at 1042 with a children's program in Spanish. *(PY2PE1C/TG9)*

Hungary—Budapest operates to N.A. at 1900-2000 and 2230-2330 on 5960, 9833, and 7220 kc., and to Great Britain and Europe at 1500-1530 and 1700-1730 on 9833, 7220, and 6236 kc. All Eng., the programs contain home and foreign news, commentaries, music, sports, amateur news, and "mailbags." *(WPE2FUI, WPE2GDS, WPE9CLI)*

India—*All India Radio,* Delhi, is noted on the previously unreported frequency of 7105 kc. with an Indonesian program ending at 1800. *(BB)*

Iraq—Baghdad is now on 6030 kc. from 1730 to 1750 s/off with news, music, and an anthem. This is in English. *(WPE2GOQ, WPE4DMX)*

Israel—*The Voice of Zion*, Tel-Aviv, 9009 kc., carries Hebrew at 1415-1445, French to 1515, Eng. to 1545 with news, talks, and some re-

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John Pinn *(VE3PE1MM)*, Port Arthur, Ont.
Richard Laviolette *(VE7PE2M)*, Richmond, B. C.
Jack Perolo *(PY2PE1C/TG9)*, Guatemala City, Guatemala
Bernard Brown *(BB)*, Derby, England
Sweden Calling DXers (SCDX)
World Radio Handbook (WRH)

corded music. The s/off is usually rather abrupt. *(WPE3CTB)*

Japan—*R. Japan*, Tokyo, can be noted broadcasting to N.A. in Eng. and Japanese at 1930-2030 on 15,135, 17,725, and 21,520 kc., and to N.A. and Latin America at 2300-0000

SHORT-WAVE ABBREVIATIONS

anmt.—Announcement
Eng.—English
Fr.—French
ID—Identification
IS—Interval signal
kc.—Kilocycles
kw.—Kilowatts
N.A.—North America
Port.—Portuguese
QRM—Station interference
QSL—Verification; confirmation
R.—Radio
s/off—Sign-off
Sp.—Spanish
xmsn—Transmission
xmtr—Transmitter

in Eng., Sp., and Japanese on 11,800, 15,235, 17,725, and 21,520 kc. *(WPE2GOY, WPE5BOX, WPE7IK, WPE8ANI, WPE8BUV, WPE8QT, WPE9DKF)*

Jordan—Amman has been noted on 9560 kc., during the 2015-2215 scheduled program, with Eng. news at 2025; a "mailbag" is given on Mondays and Fridays at 2030-2050. The Arabic program runs from 2045 (it varies) to 2215/close. *(WPE2EPC, WPE2GOQ, WPE4BUJ, WPE4FI, WPE4JO, WPE5AG)*

Katanga—Leopoldville has sent the following schedule: 1200-1500 to Africa in French; 1530-1830 to Europe, Asia, and Oceania in French; 1900-2200 to the Western Hemisphere in Eng.; all on 11,755 kc. Newscasts are aired at 1330, 1715, and 2045 in French, 1430 in Port., 1545 in German, 1745 and 2000 in Sp., 1800 in Italian, and 1630 and 2130 in English. *(WPE2EOL, WPE3CEH)*

Mauritius—Forest Side has been tuned at 2200 in Eng. on 6101 kc. This is an extremely fine DX catch but it may require many hours of careful tuning to log it. Does anyone know if this is a daily service? *(VE7PE2M)*

Mozambique—Lourenco Marques is now on 15,300 kc. and is noted at fair level at 1200-1530 in Portuguese. *(WPE4FI)*

Netherlands—Hilversum has moved up to 5985 kc. for the 2030-2120 N.A. xmsn and the 2130-2220 Sp. xmsn. Other changes include "DX Juke Box" switching from Tuesdays to Thursdays and "By-Request" from Thursdays to Tuesdays. A Dutch language program is planned. Interested readers may obtain full details by writing to *R. Nederland,* Box 222, Hilversum. *(WPE1DCF, WPE1DS, WPE2BAT, WPE2FHZ, WPE2FNU, WPE2FUI, WPE4EFQ, WPE4FI, WPE8QT)*

Peru—A new station is OAX9D, *R. Tropical,* Tarapoto, 9710 kc., noted at fair level at 0630-0800. Also new is OAZ4C, *R. Andina,* Huancayo, 4995 kc., 1000 watts, with a schedule of 0600-0000. The latter verifies by letter. Rarely noted is OCX4T, *R. Cultural,* Huancayo, 4870 kc., 500 watts. *(WPE4FI, WRH)*

Philippines—The National Civil Defense Administration, Manila, operates on 6015 kc., and was heard from 0738 with pop music and Eng. anmts; ID at 0800. *(WPEØVB)*

Portugal—A new frequency for Lisbon is 6185 kc., used at 1900-2300 to N.A., parallel with 6025 kc. There is considerable QRM from Bogota (Colombia) on 6183 kc. *(WPE1DAR, WPE4FI)*

English to W. Africa can be heard daily on 17,895 kc. at 1315-1430, with a newscast at 1330-1345. *(WPE1CE, WPE8QT)*

Rumania—Daily Eng. broadcasts from Bucharest read: to Europe at 1430-1500 on

9510, 7195, and 6190 kc., at 1600-1630 and 1730-1800 on 7195 and 5990 kc.; to N.A. at 2030-2130 on 11,810, 9510, 7225, 7195, 6190, and 5980 kc., and at 2200-2230 and 2330-0000 on 15,380, 11,810, 9570, 9510, 7225, 7195, and 6190 kc.; to the Near and Middle East at 1400-1430 on 9510, 7195, and 6190 kc.; to India at 1000-1030 on 11,940 kc.; and to Africa at 1000-1030 on 15,250 and 11,810 kc. *(WPE2DPR, WPE2FFC, WPE2FMH, WPE2FVU, WPE2FXQ, WPE2GKZ, WPE4DAO, WPE7ARF, WPE8DYR, WPE9CHO, WPE9CZQ)*

Spanish Guinea—*R. Santa Isabella*, Fernando Poo, has been heard under heavy QRM on 6240 kc. from 2030 to 2052/fade-out with talks in Spanish and a little music. *(WPE8CUS)*

Turkey—TAM, Ankara, 7240 kc., was noted at 1505 with pop records and Turkish (?) anmts; ID/IS given at 1515, followed by news in French. *(WPE1BD)*

TAR8, Erzerum, has been heard on 7651 kc. at 1340-1359 with native music; ID at 1400; music to 1430. This station has a good signal for only 1000 watts! *(WPE1HC)*

Uruguay—CXA19, *R. El Espectador*, Montevideo, is noted on 11,835 kc. at 2030-2230 with news, music, and many ID's, all Spanish. *(WPE4DMX)*

Clandestine. *La Voix de Revolucion* (reported in Conakry, Guinea Republic) has been noted on 11,964 kc. from about 1647 to 1915 s/off; all French, but no newscasts. Programs consist of African "jazz" (not religious chanting). A partial ID was given at 1741 and the only complete ID at s/off. *(WPE4CBI)*

R. Free Russia has again been heard after an absence of some months on approximately 12,000 kc. Reported located in or near Sprendlingen, near Frankfurt, Germany, it is said to transmit from a mobile unit which may be anywhere in Central Europe. It operates 10 hours daily on 6424, 6787, and 10,714 kc., according to a Norwegian publication. *(SCDX)*

The Algerian *Radio Medea* now operates at 0600-0815 on 8665 and 11,485 kc., and at 1700-1830 on 11,194. *(SCDX)* —30—

"Ahh, I've been at it a full eight hours now and have yet to fix a TV set!"

Transistor Controls Temperature

(*Continued from page* 49)

Allow the oven temperature to stabilize for five or six on/off cycles and then note and record the temperatures at which the light goes on and off. The difference in readings at these two points represents the circuit's maximum operating range.

Now, all that remains to be done is to calibrate the dial of temperature control potentiometer *R1*. Turn *R1* counterclockwise (i.e., toward a lower temperature) a few degrees at a time and allow the oven temperature to stabilize each time you change the control position. The dial should be marked for the temperature midway between the minimum and maximum readings (lights on, lights off) for each setting of the control. Lower than ambient room temperature can be achieved by placing ice cubes (in a plastic container) inside the oven.

If less than maximum circuit sensitivity is desired, turn *R1* fully clockwise and allow the oven to stabilize at the highest temperature; then rotate sensitivity control *R4* counterclockwise a few degrees at a time. Allow the oven temperature to stabilize, and record the temperatures at which the light goes on and off.

The difference in temperature readings indicates the sensitivity for the setting of *R4*. Continue to vary *R4* until the desired sensitivity is obtained, then calibrate the control for *R1* as directed above.

Installation. If the thermostat is to control the heating unit of a house, the contact terminals of relay *K1* should be connected directly to the mercury-switch leads of a commercial thermostat. As a result, the transistor thermostat will "take over" whenever the commercial thermostat is set for a room temperature which is lower than desired.

In a permanent installation, the control circuit can be located in the basement with the sensing transistor and temperature-control potentiometer mounted at a convenient location in the house. If you make *R1* a subminiature potentiometer, you'll be able to house the "upstairs" unit in a "package" as small as or perhaps even smaller than conventional thermostats. -30-

Across the Ham Bands

(*Continued from page* 65)

News and Views

Harry N. Kokinakis, KN7POZ, 116 N. 3rd St., Tooele, Utah, rates Guam (KG6) on 40 meters as his best DX. But his Hallicrafters HT-40 transmitter and SX-110 receiver have also worked 41 states including Alaska (39 confirmed), and Japan. When he isn't on 40, Harry works 15 meters. . . . **John Furlow, WN4BMG,** P.O. Box 85, Winter Park, Fla., is another 40- and 15-meter man. On 40 meters, he uses a doublet antenna; on 15, he sports a two-element beam. A Heathkit DX-20 transmitter and a Hallicrafters SX-99 complete the station. John possesses QSL cards from 35 states and is waiting for promised cards from 10 more. An antenna experimenter *par excellence,* he has had 25 diffcrent ones!. . . . **Mervin Cripe, KN8ZQU,** 8150 N. Riverview Dr., Kalamazoo, Mich., runs a Heathkit DX-40 transmitter and a Knight-Kit R-100 receiver, both of which he assembled himself. Merv operates on 40 and 80 meters with a 2-band antenna 20′ high. He has worked 25 states and is a member of the Ragchewers' Club.

Ted Lester, WV2VVB, 141 Main St., Keyport, N.J., has worked all the Novice bands in the six weeks he has been on the air, but 15 meters is his favorite. "Although it's only open in the daytime," he says, "and even then sometimes just barely, when it does start to perk up you never can tell who will come back to your CQ. Usually, it's quite a pleasant surprise." Ted transmits on a Heathkit DX-60 and receives on a Knight-Kit R-100. His antennas are an 80- and 40-meter dipole and an "all-direction" V-beam for 40 and 15 meters. Contacts with 36 states, Canada, and England indicate that everything in the shack works well. Ted offers to help prospective hams get their Novice licenses. . . . **Tim Lovatt, WV6UIN,** 202 S. San Gabriel, Azusa, Calif., feeds a 40-meter dipole with an EICO 723 transmitter running 60 watts and receives on a Philmore CR5-AC. Eight states worked and three confirmed is his record after a short time on the air. . . . **Wayne Barstow, KN7OJY,** 9548 S. 200th, Kent, Wash., reports that his station cost him only $40.00. His receiver is a converted, war-surplus BC-454; and his transmitter—another war surplus job—runs the full 75-watt Novice power. The antenna is a 135′ doublet. Although Wayne has worked "only" 5 states and two Canadian provinces, he has a lot of fun rag-chewing with the locals on 80 meters.

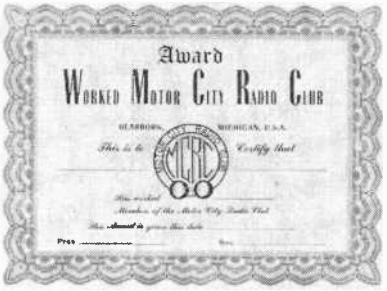
Ewell "Bub" Pendergrass, WN5AER, 2804 S. Eye St., Fort Smith, Ark., keeps Arkansas on the air on the 80-, 40-, and 15-meter Novice bands. In four and a half months he has made over 200 contacts (in 29 states and Canada) with his Johnson Challenger transmitter and Hammarlund HQ-150 receiver. A 15-meter beam 35′ high and a dipole for 80 and 40 meters bounce his signals off the ionosphere. . . . **Dick Reynolds, KNØHLQ,** 6420 18th

POPULAR ELECTRONICS

April 1962 Advertisers' Index

Ave., S., Minneapolis, 23, Minn., joins KN7OJY in operating a $40.00 station. He operates on 80 meters with a converted BC-696 "Command" transmitter running 65 watts into a folded dipole; a BC-454 "Command" receiver handles the incoming signals. So far, he has worked 60 stations in 10 states. . . . **Larry Shelton, WN5AZP,** 4610 Bluffview Blvd., Dallas 9, Texas, reports how surprised he was to read, in the December column, about the prospective Novice who was learning the code on a Hammond electronic organ. Larry passed his Novice code test on a Hammond organ! In four weeks on the air, Larry's Johnson Adventurer transmitter, Hallicrafters S-76 receiver, and dipole antenna have proved that Hertz's theories were correct—he contacted eight states.

James C. Alley, WN4CAJ, P.O. Box 122, Troutman, N.C., really doesn't like to do things the hard way; it's strictly accidental that he has



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the positions of the director and the reflector reversed on his 3-el, 15-meter, Hy-Gain beam antenna. In spite of this slight error, however, he has worked three Canadian provinces, South Africa, Nicaragua, Venezuela, and Puerto Rico on the beam. An EICO 720 transmitter and a Knight-Kit R-100 receiver (both of which are put together correctly) do the huffing and puffing; on 80 and 40 meters, they tie into a dipole antenna. Of 45 states worked, 44 have QSL'ed so far. If you need a North Carolina card, look for Jim. . . . **Al Salmi, K8TNZ,** Box 250, Gries Hall, Northern Michigan College, Marquette, Mich., spent seven months on 3728 kc. as a Novice, working 39 states—all confirmed. His transmitter is a Heathkit DX-40, his antenna a folded dipole, and the receiver a secret. Al's brother Robert, WN8ASJ, keeps the equipment hot while Al is at school.

That does it for another month. Let's hear from *you* soon. Write to: Herb S. Brier, W9EGQ, c/o POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana. 73,

Herb, W9EGQ

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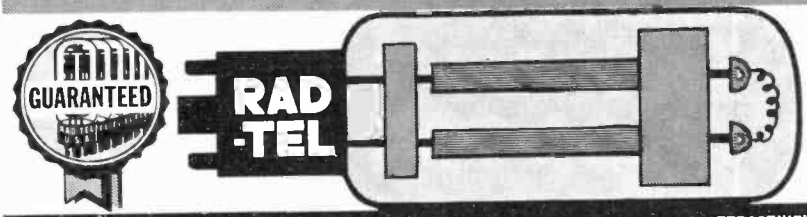

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	12SQ7	.78
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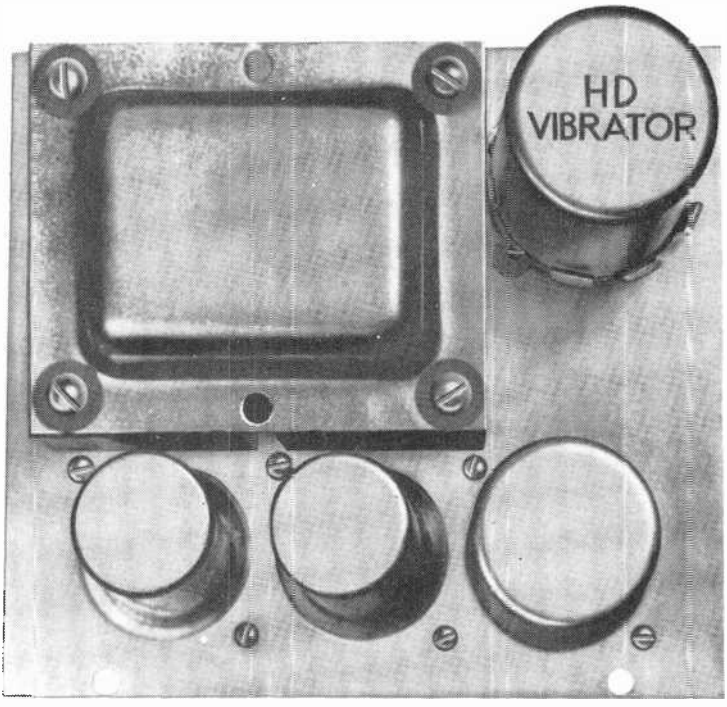

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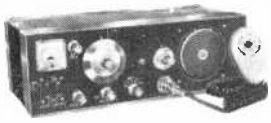

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