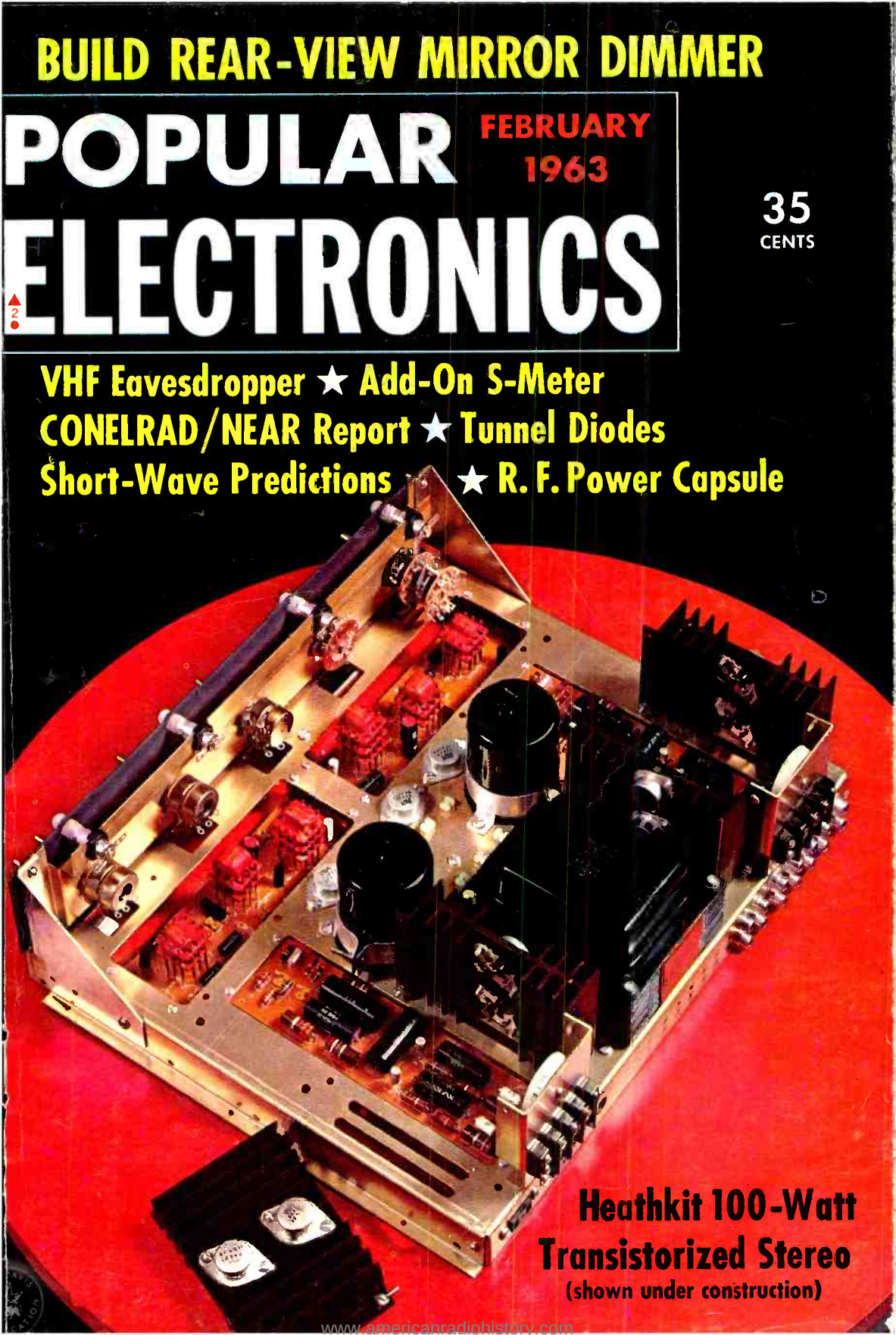
BUILD REAR-VIEW MIRROR DIMMER

POPULAR ELECTRONICS

FEBRUARY 1963

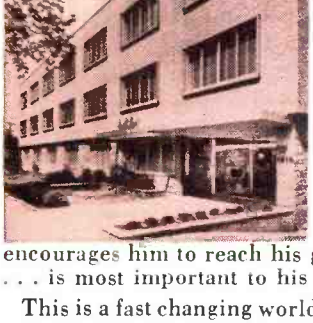
35 CENTS

VHF Eavesdropper ★ Add-On S-Meter
CONELRAD/NEAR Report ★ Tunnel Diodes
Short-Wave Predictions ★ R. F. Power Capsule



Heathkit 100-Watt Transistorized Stereo
(shown under construction)

Where You Train Is As Important As Your Decision To Train



Electronics is a growing and expanding industry. That's why so many ambitious men are deciding to train for careers in this exciting field. They recognize the opportunities to advance and prosper. But, *where* a man trains and *how* the school of his choice teaches Electronics . . . how it encourages him to reach his goals and realize his ambitions . . . is most important to his success.

This is a fast changing world. A school offering Electronics courses must keep pace. That's why NRI—with nearly 50 years of specialized experience—now offers *nine* choices of training within the one field of Electronics. Select the course of most interest to you and receive the kind of home-study training that prepares you for a *specialized* career. NRI's large staff of specialists is always on the job keeping course material up-to-date . . . helping you earn your way while training . . . assisting you with job placement when ready. In short, whatever branch of Electronics you select, NRI is qualified through knowledge and experience to help you grow.

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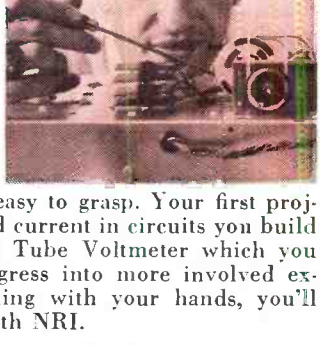

NRI "learn by practice" method is the time-proved way to learn easier, faster, better. Most NRI courses include—*at no extra cost*—special training equipment to give shop and laboratory experience in your own home. All equipment is yours to keep.

Projects you build, experiments you perform, make NRI lessons come to life. Complex subjects become interesting, easy to grasp. Your first projects are measuring voltage and current in circuits you build yourself. You use a Vacuum Tube Voltmeter which you construct. Later on, you progress into more involved experiments. If you like working with your hands, you'll enjoy learning Electronics with NRI.

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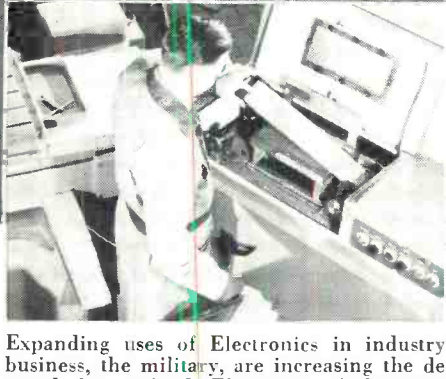
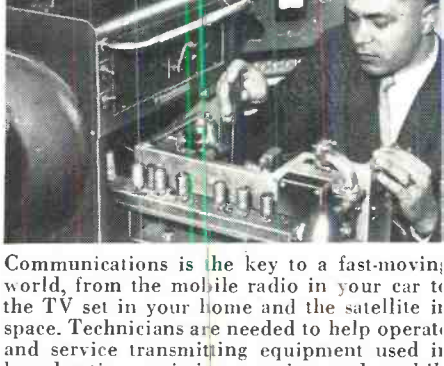


Expanding uses of Electronics in industry, business, the military, are increasing the demand for trained Electronic Technicians. Electronics needs more Technicians than engineers—from four to seven times more. Electronics is changing our world, creating interesting and important career opportunities for those who qualify. NRI training prepares you.



Communications is the key to a fast-moving world, from the mobile radio in your car to the TV set in your home and the satellite in space. Technicians are needed to help operate and service transmitting equipment used in broadcasting, aviation, marine and mobile communications. Even a service Technician needs an FCC License today to work on C-Band and other Radio equipment. NRI trains you for your choice of Communications fields.

Television and Radio are bigger than ever. Color Television, after years of experimenting, is now moving ahead fast. Hi-fi stereo, PA systems, FM all mean money-making opportunities for you as a Service Technician in your own spare-time or full-time business, or working for someone else. NRI's time-tested training not only teaches you to fix sets, but shows you how to earn spare-time money soon after enrolling. Mail postage-free card

JOIN THE THOUSANDS WHO TRAINED FOR NEW CAREERS WITH NRI

"I want to thank NRI for making it all possible," says Robert L. L'Heureux of Needham, Mass., who sought our job consultant's advice in making applications and is now an Assistant Field Engineer in the DATAmatic Div. of Minneapolis-Honeywell, working on data processing systems.

"I have gone ahead financially ever since I enrolled with NRI," writes Gerald W. Kallies, now a Chief Instrument Technician of Rio Algom Nordic cerenium mines and part-time TV engineer for CKSO-TV, Elliott Lake, Ont. He enrolled with NRI on finishing high school.

His own full-time Radio-TV shop has brought steadily rising income to Harlin C. Robertson of Oroville, Calif. In addition to employing a full-time technician, two NRI students work for him part-time. He remarks about NRI training, "I think it's tops!"

"I can recommend the NRI course to anyone who has a desire to get ahead," states Gerald L. Roberts, whose Communications training helped him become an Electronics Technician at the Coordinated Science Laboratory, U. of Illinois, working on naval research projects. He also holds a First Class FCC License with Radar Endorsement.

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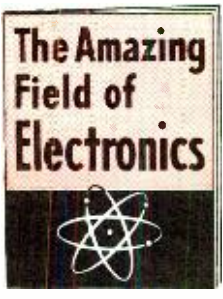

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This month's cover photo by Bruce Pendleton

VOLUME 18 FEBRUARY 1963 NUMBER 2

Special Construction Feature

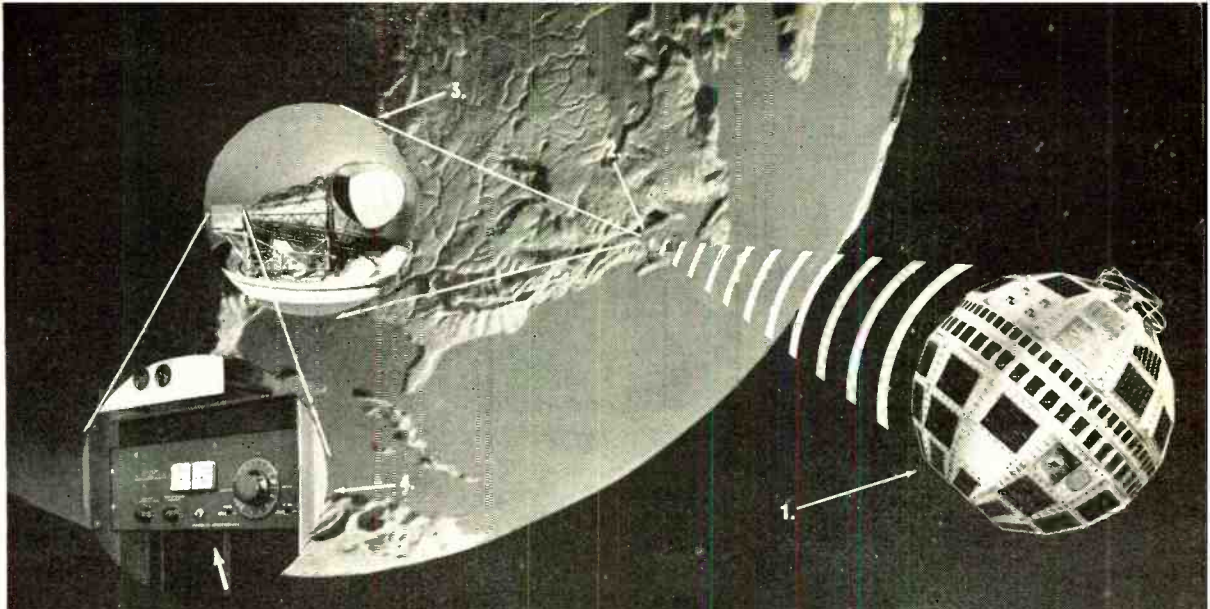
Electronic Construction Projects

Audio and High Fidelity

Amateur, CB, and SWL

Electronic Features and New Developments

Departments



SPECIAL REPORT ON A HISTORIC EXPERIMENT WITH THE EARTH STATION AT ANDOVER, MAINE

Scott® tuner used for Telstar tests...

Bell System engineers wanted to test FM reception from the Telstar Satellite orbiting in outer space. They used the sensitive Scott 310-D broadcast monitor tuner (rack mounted) for this unique experiment. FM signals were sent to Telstar where they were rebroadcast to the earth station for Communicating by Satellite at Andover, Maine. The Scott FM tuner was successfully used on this project.

Scott congratulates the Bell System on their spectacular achievement and is proud to be part of this historic project.

The Scott 310-D was a logical choice. Like all Scott tuners it offers exceptional sensitivity and selectivity. Scott pioneered Wide-Band FM circuitry. Scott engineers perfected "Time Switching" multiplex circuitry for high fidelity reception. Only Scott silver-plates FM front-ends for highest sensitivity. Scott invented the first foolproof FM Stereo signaling device — the Sonic Monitor*.

350B FM Stereo Tuner

If you want the very best FM Stereo reception choose the tuners selected by professionals . . . choose Scott, America's most reliable name in FM Stereo. *Patent Pending

These superb Scott FM Stereo Tuners are proud products of the same engineering laboratories that developed the 310-D used in Telstar.

If you seek perfection choose one of these superb Scott tuners: 4310 Broadcast Monitor FM Stereo Tuner, $475*; 350B FM Stereo Tuner, $219.95*, 333 AM/FM Stereo Tuner, $259.95*; 370 FM Stereo Tuner, $169.95*; LT-110 FM Stereo Tuner Kit, $159.95*; 340 FM Stereo Tuner/70 Watt Stereo Amplifier, $379.95*; 355/208 AM/FM Stereo/80 Watt Stereo Tuner Amplifier, $469.90*. *Slightly higher west of Rockies.

Here's how the "Telstar" experiment worked

1. FM signals were relayed from Bell Telephone System Telstar satellite orbiting the earth at 16,000 M.P.H. at heights varying from 500 to 3,000 nautical miles. **2.** Signals were beamed to the "Earth Station for Communicating by Satellite" at Andover, Maine, where **3.** a giant horn antenna 180-feet long and 95-feet high received the signals. **4.** Installation of Scott 310-D Broadcast Monitor Tuner (Rack Mounted) at Andover, Maine.

Write today for new 1963 Hi-Fi Guide including complete details on Scott FM Stereo tuners and kits and complete "Telstar" report.

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The easiest FM Multiplex tuner kit to build...

is the one you would choose for performance alone!

The Fisher KM-60 StrataKit is the inevitable choice of the kit builder who has considered the pros and cons of every FM Stereo Multiplex tuner available in kit form today. The KM-60 is by far the easiest to build—because it is a StrataKit. It is by far the finest performer – because it is a Fisher.

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

The front-end and Multiplex stages are assembled and pre-aligned. The other stages are already aligned and require a simple 'touch-up' adjustment by means of the tuner's laboratory-type d'Arsonval signal-strength meter.

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

Another outstanding feature of the Multiplex section is the exclusive STEREO BEAM, the Fisher invention that shows instantly whether or not an FM station is broadcasting in stereo. It is in operation at all times and is completely independent of the tuning meter.

The Fisher KM-60 StrataKit is very close to the finest FM Stereo Multiplex tuner that money can buy and by far the finest that you can build. Price, **$169.50***.

FREE! $1.00 VALUE! write for The Kit Builder's Manual, a new, illustrated guide to high fidelity kit construction.

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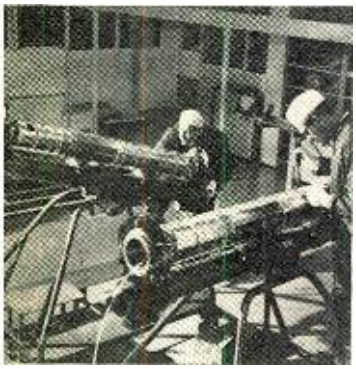
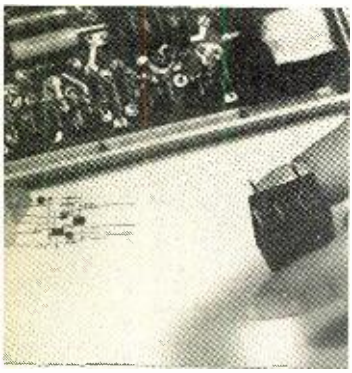
POP'tronics

NEWS SCOPE

A TRANSPARENT PHANTOM, shaped like a human head, tests the effectiveness of scanning devices in detecting brain tumors. Developed by Picker X-Ray Corporation, White Plains, N.Y., the unbreakable plastic noggin has two swivel-jointed openings in the top through which "tumor simulators," loaded with desired amounts of radioactive material, can be placed anywhere within the "brain" area. When the phantom is filled with water, the resulting "mock-up" skull provides a close simulation of the radiation absorption and scattering characteristics experienced with an actual human head. Tests have shown that the background counting rate resulting from scatter of radiation from the simulated tumors in the water-filled skull is at least as great as that observed clinically in actual brain scanning.



UNDERWATER ARTILLERY that will "shoot" telephone conversations across the bed of the Pacific Ocean undergoes final stages of assembly and inspection at the plant of a British affiliate of International Telephone and Telegraph Corporation. Known technically as submarine telephone repeaters, these gold-plated "guns" will amplify the signals as they become weaker in traveling along a transpacific telephone cable between Australia and Canada. The cable, which is expected to carry up to 80 two-way telephone calls simultaneously, will supplement the interference-prone high-frequency radio links now in use.



BYE-BYE, SOLDER—Ultrasonic bonding, or "sound soldering," is a new, unique metal bonding process that can lop 40% from the cost of manufacturing complete microminiature electronic circuits. It will be used by the Sperry Electronic Tube Division in Gainesville, Florida, to fabricate micromodules. Photo shows printed circuit board (at top) redesigned into compact wired circuit (far left) which is packaged in a "butter-pat" sized container (left). The new package design will allow circuits to throw off more heat and will extend their life, besides reducing the space they take up.

FIRE ONE! If only a fraction of the thousands of Polaris missiles "fired" during recent simulated launchings at the U.S. Navy Submarine School, New London, Conn., were armed with nuclear war heads, any enemy or combination of enemies would have been "wiped from the face of the earth." Training Polaris crews in the intricate launch procedures of this powerful weapon is an electronic maritime device developed and built by Curtiss-Wright Corporation. As sophisticated as a nuclear submarine, the device simulates oceanic operating conditions as well as the complicated tasks of launching missiles from anywhere under the "seven seas."

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DX'ing the Satellites

■ Just recently I finished building the "NASA-136 Converter" (June, 1962), and it works fine. I did encounter some difficulty in obtaining the coil forms, but it was well worth the effort. How about an article on DX'ing the satellites?

STEPHEN C. WILKAS, WPE6AAM
Lakeside, Calif.

We're glad to hear that your NASA-136 is "A-OK," Steve. And you'll find the article you're looking for on page 52.

VHF Receiver—Extended Range

■ A few months ago I completed the "Compactron VHF Receiver" (September, 1961), but I made a modification that other P. E. readers might be interested in. Instead of soldering coil *L2* into the circuit, I hooked up a small crystal socket across tuning capacitor *C3*. This allows different coils (different values of *L2*) to be inserted for changing frequencies. So far, I've been able to extend the

P. E.'s Available

From time to time, readers write and tell us that they are forced to part with their P.E. collections—due to lack of storage space. Rather than print one letter at a time—as they come in—we decided to hold them and print a list of the collections available, along with the prices asked, and the persons to contact. Here, then, are the most recent of these offers.

Vol. 1, No. 1, to present (complete set); price, $25.00—express collect. Contact:
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Vol. 1, No. 1, to present (complete set); price, open for bids. Contact:
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2901 Golden Ave.
Long Beach 6, Calif.

Vol. 1, No. 1, through Vol. 6, No. 3; price, $10.00. Contact:
Pete Rickmers
7326 E. Vernon Ave.
Scottsdale, Ariz.

Vol. 3, No. 4, to present (minus one or two issues); free—telephone and make arrangements.
Sheldon J. Einhorn
7325 Ruskin Rd.
Philadelphia 51, Pa.

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Grantham training is **Specialized Training,** endorsed and recommended by many electronics firms throughout the nation, and accredited by the National Home Study Council. We teach you the **how** and **why** of basic electronics, with the necessary math taught as an integral part of the lessons. The course is thorough, easy to understand, and lays a solid foundation for all types of electronics work—communications electronics, military electronics, computer electronics, automation electronics, broadcasting electronics, and many more.

The time required to prepare for your first class FCC license, an important step toward your goal, is cut to a minimum through quality instruction—**either by home study or in resident classes.** You learn more electronics in less time because the Grantham Method is engineered with the student in mind. Complete details concerning Grantham training are available free for the asking. Now, it's up to you—**it's your move!**

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Gentlemen:

Please send me your free booklet telling how I can get my commercial F.C.C. license quickly. I understand there is no obligation and no salesman will call.

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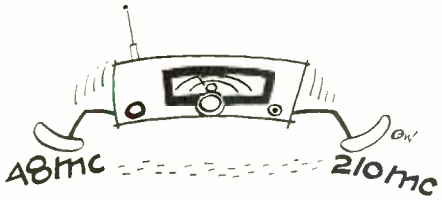
Letter Tray

(*Continued from page 8*)

frequency coverage down to 48 mc. on the "low" end, and up to 210 mc. on the "high" end. At the higher frequencies, *L2* is ½ turn of wire, while at



the lower frequencies the coil varies from 10 to 15¼ turns and from 1" to 2" in length.

JOHN W. OTEY
Tulsa, Okla.

A job well done, John! We're sure that many of our readers who built the "Compactron VHF Receiver" will want to modify it to extend its range as you did.

CQ WPE5's!

■ I would like to get a WPE5 SWL club started and was wondering if P.E. could be of some help. Will you publish a letter asking all WPE5's who would be interested in such a club to send me their names, addresses, WPE call-signs, the types of equipment they have, and their ideas about the club?

CHRIS MAHER, WPE5CEV
1846 St. Ann
Jackson 2, Miss.

There's your letter, Chris! Best of luck with the club, and we hope you wind up with 100% membership.

Diagram Wanted!

■ For the last several months I have been trying desperately to obtain a schematic diagram for my short-wave receiver. It is an E. H. Scott CZC-46209, originally built for the U. S. Navy during World War II. Can you help me?

SAMUEL GOLD, WPE6DXA
1222 41st Ave.
San Francisco, Calif.

Sorry, Sam, we weren't able to locate a source for the Scott schematic, but perhaps one of P.E.'s SWL readers can be of assistance to you.

Where Did the Ham Go?

■ As a steady reader of P.E. for a number of years, I have noticed a new trend in recent months which alarms me. Lately, I find the magazine filled with CB articles of a semi- or non-technical nature that lends little if anything to the electronics "state of the art." I agree that CB has its

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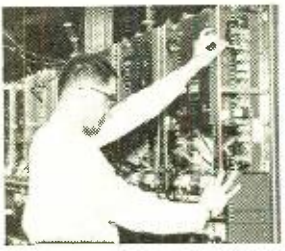

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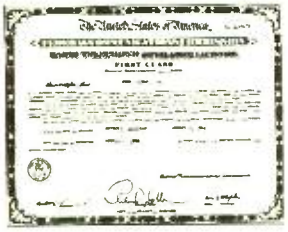

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Letter Tray

(*Continued from page* 10)

place, but it would seem that this place is being made at the cost of shoving the amateur aside. Is it right to push the technical-minded amateur away because his ranks do not fill up as rapidly as those of the talk-minded citizen?

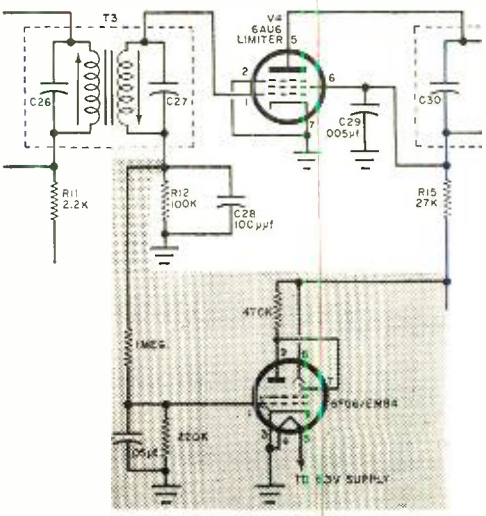
FREDD GLAZNER, K4OOE
University, Alabama

With the exception of our annual CB Equipment Directory, Fredd, P.E. has devoted much more editorial space in the past year to ham radio, and even to SWL'ing, than to CB. The Directory is published each August as a service to CB buyers. The fact is that P.E. has never condoned the excessive "hamming" on CB channels and has repeatedly urged CB'ers to become hams.

Out of Tune

Hi-Fi Lab Check (*November,* 1962, *page* 73). If you had trouble making sense out of the caption for the graph at the top of page 73, you'll be glad to know that the first sentence should have read, "Power response for the left channel showed a maximum output of 47 watts."

Electronic Tuning Indicator (*December,* 1962, *page* 55). The color which was intended to cover the added components and wiring in the diagram was inadvertently omitted. The entire diagram is reprinted below, with the additions appearing in gray.



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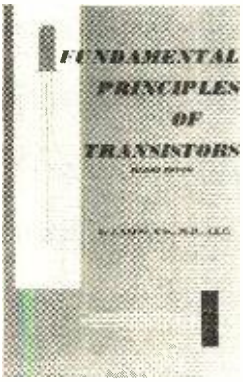
34

POP'tronics Bookshelf

FUNDAMENTAL PRINCIPLES OF TRANSISTORS (Second Edition)

by J. Evans



This second edition of *Fundamental Principles of Transistors,* like the first, is based both in content and in level on the author's experiences in lecturing to post-graduate students. It was designed to meet the needs of young graduates entering the field of transistors, enabling them to use the rapidly expanding fund of knowledge being built up. The volume is devoted almost entirely to transistor theory, since the author feels that circuitry and applications are quite adequately covered elsewhere. Because of the tremendous recent advances in the field, the material in the first edition has been expanded and completely revised. For example, a new chapter (on diffuse base transistors) has been added and the book is longer by a third.

Published by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. 332 pages. Hard cover. $8.50.

HOW TO SOLVE PROBLEMS IN ELECTRICITY AND ELECTRONICS

by Henry Jacobowitz

This book is devoted to the solution of typical problems that arise in the study of electricity and electronics. Beginning with elementary d.c. circuits, it progresses through more complicated problems of a.c. circuits, including those associated with tubes and transistors. Many different types of problems are presented on each subject, with their solutions worked out in clear, step-by-step fashion. In addition, the book

(*Continued on page* 20)

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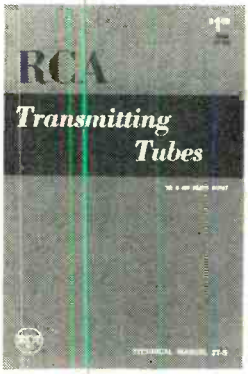
(*Continued from page* 14)

offers a review of the principles and laws upon which the solutions are based.

Published by John F. Rider Publisher, Inc., 116 W. 14th St., New York 11, N.Y. 152 pages. Soft cover. $3.50.

RCA TRANSMITTING TUBE MANUAL
(Revised Edition)

Every experimenter—ham or not—should have a copy of RCA's latest transmitting tube manual (TT-5), compiled by the Electron Tube Division. The first revision since 1956, this manual is chock-full of valuable information and includes 23 typical circuits using power tubes. Among these circuits are a Class B linear r.f. amplifier for single sideband; a 120-watt, 50-mc. transmitter; and a 10- to 80-meter transmitter. More than 180 types of transmitting tubes—to 4 kw. plate input—and related rectifier tubes are listed in the technical data section, with their maximum ratings, typical operating conditions, and other characteristics. The fully illustrated text material, written in easy-to-understand style, covers all phases of power tube technology.



Published by Electron Tube Division, Radio Corporation of America, Harrison, N.J. 320 pages. Soft cover. $1.00

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Over 1000 up-to-date entries of words, phrases, terms, and abbreviations used in all phases of computer technology are offered in this compact volume which was compiled by the Howard W. Sams technical staff. Anyone who is somewhat confused by the jargon of the computer field will find it an invaluable reference source. All types of general- and special-purpose computers —analog, digital, and hybrid—are repre-

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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."

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(*Continued from page 20*)

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TECHNICAL TELEVISION

by A. V. J. Martin

This volume strikes a happy medium between books written for engineers and those for technicians; in fact, the approach used in discussing the basic principles underlying television theory is so straightforward that it should reach both the technician and the engineer. Mathematics is kept to elementary algebra, except for a few complex calculations (and skipping them won't detract from the continuity or usefulness of the text). Some of the drawings in the section dealing with color television are presented in full color to help the reader understand this aspect of the subject. In addition, there are fold-out schematics for ease in following the complex circuitry discussed.

Published by Prentice Hall, Inc., Englewood Cliffs, N.J. 547 pages. Hard cover. $14.65.

New Literature

National Radio has released a new catalog covering its complete line of amateur and short-wave receivers. A description of each receiver is given, along with its specifications, in this 12-page, 8½" x 11" brochure. To get your free copy, write to National Radio Co., Inc., Melrose 76, Mass.

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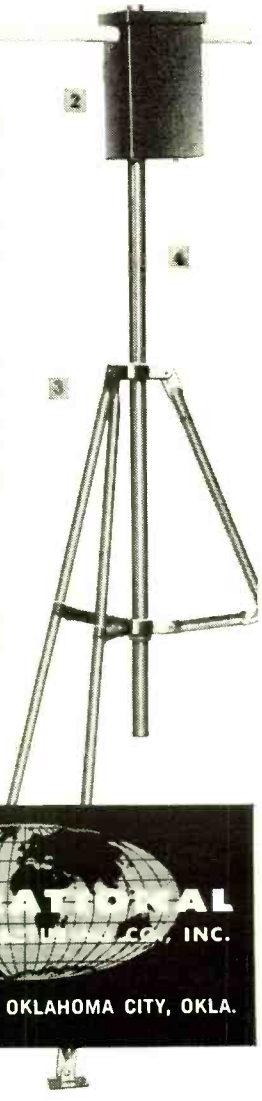

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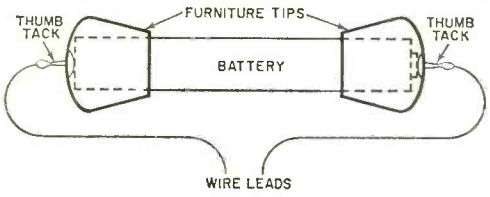
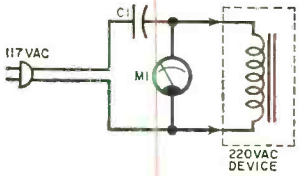


in another circuit. All you need are two rubber tips (the type used on furniture legs) and a couple of unpainted metal thumbtacks. Insert a thumbtack—from the inside—through the bottom of each rubber tip and solder a wire lead to the protruding pin. After you push the caps over each end of the battery and connect the leads to the circuit, you're in business. These rubber tips come in various internal diameters, so you can make caps for a number of battery sizes. —*John A. Comstock*

CAPACITOR BOOSTS 117 VOLTS A.C. TO 220

Next time you come across some really inexpensive, surplus 220-volt relays, timers, etc., don't pass them up. You can—very simply—boost a 117-volt a.c. source to operate these low-power, 220-volt devices. The trick is to form a series resonant circuit by connecting a capacitor (*C1*)



—a 0.1-μf., 400- to 600-volt unit is a good value to start with—in series with the coil of the device to be used. With the capacitor connected and 117 volts applied, attach the leads of an a.c. voltmeter (*M1*) across the

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STEREOTABLES

with *Hysteresis-Synchronous Motor* for perfect rotational accuracy even when there are current fluctuations.

R-320A—Rondine 2—Combines the superiority of the single-play turntable with Rek-O-Kut's remarkable new tonearm. Auto-Poise* . . . gives you the world's only *true* turntable with fully automatic operation. Minus 57db rumble . . . even at full amplification.

R-320A with AP-320 Automatic Tonearm (illustrated) $169.95
R-320 with S-320 Tonearm ... 129.95
R Stereotable only 79.95
R Base (oiled walnut finish) 14.95

N-34H. 2-speed stereotable. (33 & 45 rpm) Minimum noise and rumble level ever achieved in a 2-speed machine. Driven by cushion-soft Rekothane belt ..... $89.95 (Walnut base, Model BW-1, $14.95)

B-12GH. 3-speed stereotable. Oil-grooved turntable shaft turned to extremes of precision tolerance. Provides unparalleled playback performance. Has single selector knob, neon pilot light $109.95

B-12H (not shown). 3-speed stereotable for the professional or dedicated audiophile. Features special, massive, custom-built hysteresis-synchronous motor, ideal for heavy-duty applications ..... $149.95 (Walnut base for above: Model BW-1, $16.95)

B-16H—3-speed professional 16" stereotable. Self-lubricating, custom-built hysteresis-synchronous motor. At 33⅓ & 45 rpm, reaches full operating speed in ¼ turn. Permanently affixed Strobe Disc permits instantaneous checking of all speeds. $275.00

EASY-TO-ASSEMBLE

STEREOTABLE KITS

You save the cost of factory-assembly, get the same quality Rek-O-Kut features throughout. Same hysteresis-synchronous motor and Rekothane belt drive system.
K-34H—33 and 45 rpm stereotable in kit form. Similar to Model N34H $69.95
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S-320 Tonearm

with exclusive omni-balance*

- Acoustically isolated counterweight for static balance
- Micropoise for micro-adjustment of cartridge tracking pressure
- Omni-Balance for optimum bearing loads and lateral balance

Only with the S-320 tonearm can you adjust to perfect balance with any cartridge. The result is equalized output from both walls of the stereophonic groove, total elimination of "skating," reduction of distortion to an absolute minimum . . . increased life for records and stylus. $34.95

Build your own speaker system

with these REK-O-KUT High-efficiency, Patented PARAFLEX* Component Speakers

A-80D 8" EXTENDED RANGE SPEAKER
Ideal for small enclosures and will deliver a surprising amount of clean bass in cabinets of the bookshelf type. *Specs:*
Frequency response: 45-13,000 cps.
Power handling: 20 watts maximum.
Impedance: 8 ohms. $29.95

A12-DX 12" CO-AXIAL SPEAKER
Designed for the highest quality reproduction, this co-axial is a woofer-tweeter combination which also incorporates a mid-range diffuser for "impact" presence. *Specs:*
Frequency response: 35-18,000 cps.
Power handling: 25 watts of program.
Impedance: 8 ohms. $49.95

A 150-X 15" 3-WAY SPEAKER
One of the finest "big" three-way speakers on the market. Capable of undistorted reproduction, this speaker is a *must* for the audiophile who prefers to build his own systems. *Specs:*
Frequency response: 20-18,000 cps.
Power handling: 35 watts integrated program.
Impedance: 8 ohms. $109.95
Model A150-SV (same as above with volume control) $119.95

FREE! Colorful 8-page booklet of "Construction Plans for Speaker Enclosures." Informative, valuable yet available without charge. Use coupon below.

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*Name*_____
*Address*_____
*City*_____ *Zone*____ *State*____

*Pat. Pending

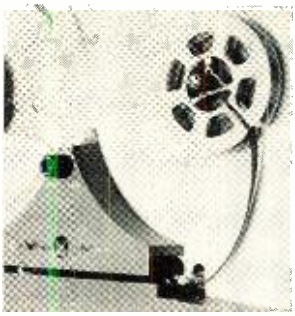
Tips

(*Continued from page 24*)

relay, timer, etc., and observe the reading. Then, if you still need more voltage, increase the capacity in steps of 0.02 - 0.05 μf. until the voltage stops rising or starts to fall. (Note: the 220-volt device must possess some inductance for the above method to work.) —*G. N. Dugonis, W3COZ*

8-MM. FILM REELS HOLD RECORDING TAPE

Did you know that plastic 8-mm. film reels are ideal for storing small quantities of magnetic recording tape? They will fit the spindles of almost any tape recorder, and a 50-foot reel will hold up to 200 feet of standard, 1½-mil tape. Don't try to use a metal reel, however; if it is made of ferrous material, it may demagnetize the tape. —*Glen F. Stillwell*



TOOL HOLDER FROM ADHESIVE BANDAGE CONTAINER

An adhesive bandage container makes a good tool holder. Just tack the lid of the container on the wall of your workshop, and it will accommodate screwdrivers, pliers, wrenches, etc. Since these containers come in various sizes, the size tools they will hold also varies. Another use for such containers is in storing small parts. —*Wayne Floyd*

RED PAINT SPOT IS BATTERY SAVER

Sometimes batteries in portable equipment go dead because the power is left on when the equipment isn't being used. This won't happen if you can see at a glance that the power's on when you think it's off. Get some red paint (your wife's nail polish will do, too) and apply some to the portion of

The new RCA MARK VIII 27-Mc 2-WAY RADIO

More Features · Improved Performance · AT A LOWER PRICE

Here is THE outstanding bargain today in a 2-way Citizens' Band radio: THE NEW RCA MARK VIII. Compact, dependable, simple to operate, it outperforms and offers more features than even the famous RCA Mark VII.

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- Operates from standard 117-volt AC; separate DC power supply (optional) for mobile installations (you don't pay for unnecessary power supplies)
- Electronic switching—no relay noise or chatter
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- Light and compact—only 3½ inches high, weighs only 8 pounds with mike; fits easily under the dashboard of even a compact car
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plus many more features to increase its usefulness and efficiency.

The new low Mark VIII price $149.50**
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City_____ Zone_____ State_____

*Maximum plate input power to final radio-frequency amplifier stages as defined by FCC regulations

**Optional list price

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Tips

(*Continued from page 26*)

the slide-switch that's visible when the switch is in the "ON" position. With a bright red paint spot on the switch, you can't help noticing it—even with a passing glance. —*Stanley E. Bammel*

RETAINERS FOR SHEET METAL SCREWS

If you ever have the problem of a sheet metal screw not holding in place, here's a good solution. You can secure the screw with an easy-to-make retainer. Cut a strip of metal ½" wide and drill holes for the size screw to be used at ½" intervals. This done, cut the strip apart between the holes with a pair of snippers. A greater number of these retainers can be made at one time by stacking the strips of metal. —*Joseph Noonan*

COMING NEXT MONTH

What strange sounds lie in that portion of the spectrum just above the range of the human ear? Build this transistorized "Ultra-Sonic Sniffer," and you're in for a world of surprises—including a sampling of sounds that only your dog can hear!

ON SALE
FEBRUARY 26

- **MICROMINIATURIZATION**
  Miniaturization in electronics is not new. But today's microminiaturization techniques promise to be the catalyst that will make even the most liberal prophet's predictions seem incredibly tame.

- **THE BLINKER MINDER**
  No chance of inadvertently leaving your turn-signal "blinkers" on, once you've constructed this transistorized signaling device.

- **GRID DIP MODULATOR**
  Add a small, battery-powered modulator, and your grid dip meter becomes an r.f. signal generator.

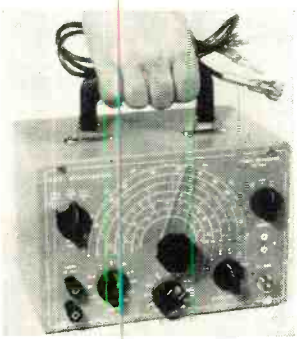
New Products

LAMP MAGNIFIER

With electronic components getting smaller every day, working on equipment for long periods at a time can easily cause eye strain. The Haas magnifier will help prevent such strain. Clipped onto your workbench- or desk-lamp, its 2-power magnification is excellent for working on tiny electronic parts. And, because its plastic-framed $2\frac{3}{4}$" x $2\frac{9}{16}$" lens is hung on pivot hinges, you can tilt the magnifier to the most convenient angle. Tension springs and hooks are provided for easy attachment to any lampshade without tools. *(Haas Corp.,* Mendon, Mich.)

PORTABLE SIGNAL GENERATOR

A transistorized circuit in the Pel SG-101 signal generator makes the 3-lb. unit truly portable — allowing it to be operated *anywhere* without warm-up. A front panel socket enables you to test CB crystals, and the unit can also be used as a crystal-controlled r.f. test source. The SG-101 has a frequency range of 135 kc. to 120 mc. on fundamentals—in six overlapping bands—and 70 to 240 mc. on harmonics. Internal modulation is 400 cycles, and external modulation is possible within the audio frequency range. Available in either kit or factory-wired form, the SG-101 provides three extra bandswitch positions for special



(Continued on page 32)

bzzzz

When a very small boy has his hair cut, the clippers make a harsh buzz—a nervous, exciting sound. Yet the same machine gives off only a dull hum when it's used on a man.

The unfortunate part is that once you've heard the dull hum, you never get to hear that exciting buzz again. No matter what. Even Audiotape can't record it.

Audiotape can (and does) take care of everything else that adds to listening enjoyment. It gives you clarity and range, freedom from noise and distortion and unequaled uniformity, reel after reel. All you have to supply is the point of view. Audiotape does the rest, and does it superbly.

Whether you're taping a barbershop quartet or a hundred-voice choir, there's an Audiotape exactly suited to your needs. From Audio Devices, for 25 years a leader in the manufacture of sound recording media—Audiodiscs*, Audiofilm* and . . .

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*TRADE MARK

Products

(*Continued from page* 30)

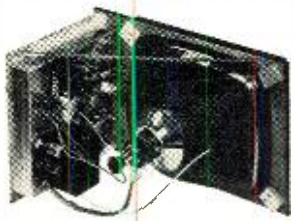
coils, crystals, etc. Price, $34.90 in kit form; $54.90 assembled. (*Pel Electronics,* 214 Main St., Hackensack, N.J.)

VARIABLE POWER SUPPLY

Available from GC Electronics, the Model 36-562 combination power supply and battery eliminator is variable from 0 to 24 volts. The supply is suited for extended operation of transistor units without their batteries, or as a test-bench power source. Two heavy-duty silicon rectifiers provide full-wave rectification, and ripple is held to less than 1%; a large meter on the front of the supply is automatically disconnected when the power is turned off. In addition to the common and B+ leads on the front panel, there is a separate 1½-volt lead; the three leads are 18" long and are equipped with mini-gator clips and slip-on insulators. Price, $19.95. (*GC Electronics Co.,* 400 S. Wyman St., Rockford, Ill.)

23" TV KIT

Now you can build your own TV set for only a little more than what you'd have to pay for the tubes alone. The Heathkit GR-22 boasts a 23" picture tube, and it comes with all critical circuits—including a wide-band, three-stage i.f. strip—fully wired and tested, ready for mounting on the sturdy, 16-gauge steel chassis. The GR-22's two-watt hi-fi audio output can be fed to an 8-ohm integrated speaker, and there's also a cathode-follower so you can use the GR-22 with your present hi-fi system. The kit sells for $169.95; an optional UHF tuner for internal mounting is available for an addi-



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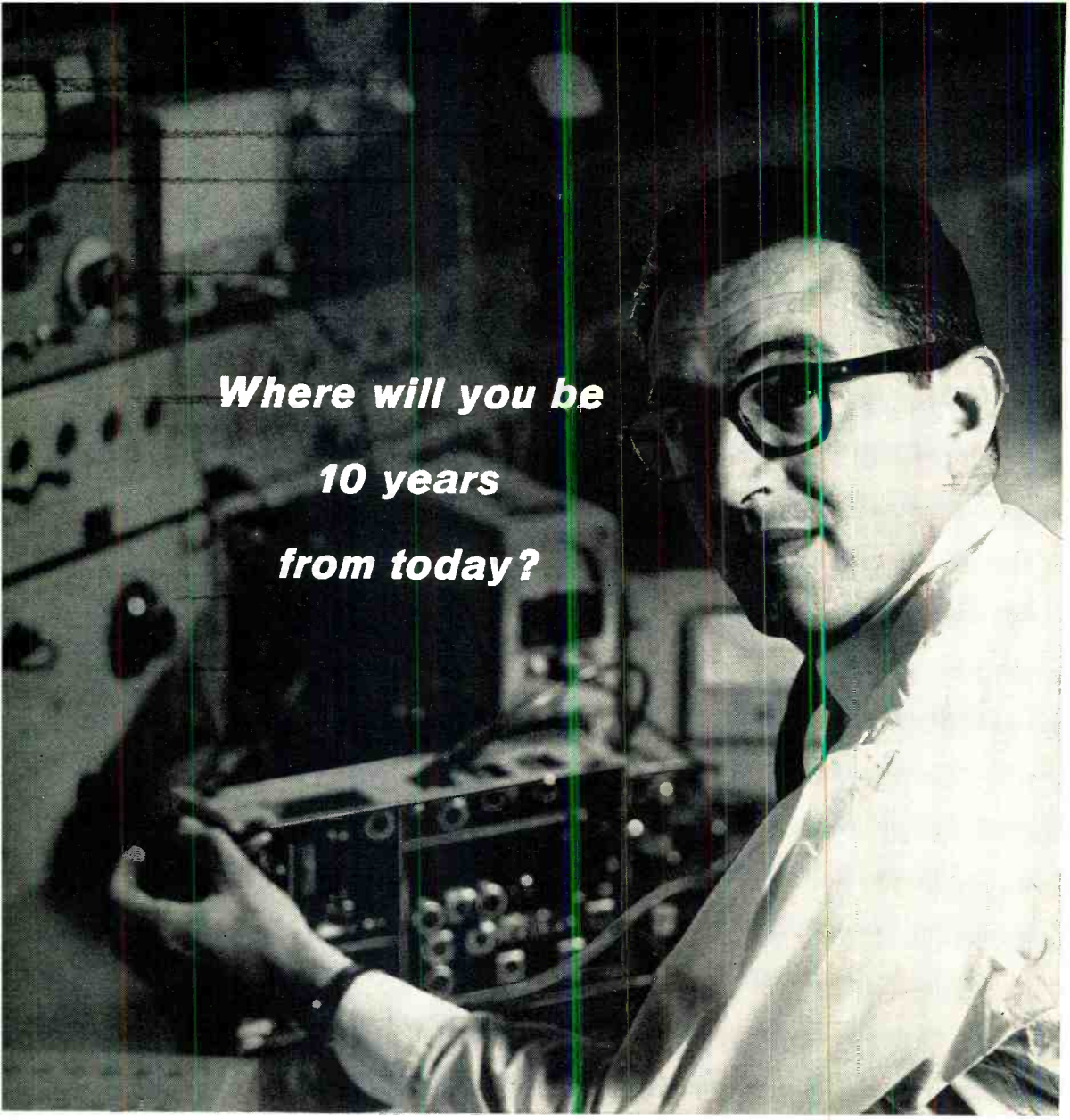

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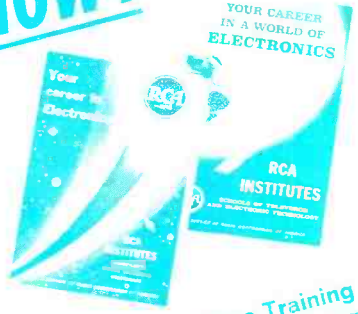

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Electronic Technician, Field Technician, Computer Technician, Broadcasting Technician, Customer Service Engineer, Instrument Technician	Industrial and Communications Electronics (V-7)	2 yrs. High School with Algebra, Physics or Science
TV Serviceman, Electronic Tester	Electronics and Television Receivers (V-3)	2 yrs. High School with Algebra, Physics or Science
Transistor Circuits Specialist	Transistors	Radio background
Junior & Senior Detail Draftsman	Electronic Drafting (V-11, V-12)	2 yrs. High School with Algebra, Physics or Science
Color TV Service Technician	Color Television	Television background
Industrial Electronic Technician	Automation Electronics (V-14)	Radio and Transistor Background
Technical Writer	Technical Writing	Electronics background
Computer Service Technician	Digital Computer Electronics (V-15)	Radio and Transistor Background
Console Operator, Junior Programmer	Computer Programming (C-1)	College Grad or Industry sponsored
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Preparatory	Preparatory Mathematics (P-OA)	1 yr. High School

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Note: 3 additional locations. RCA Technical Institutes offers a limited selection of basic resident school courses in Electronics in Chicago, Philadelphia, and Cherry Hill, N. J. (near Camden). For complete information write the name of the city of your choice on the attached postcard.

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Automation Technician	Automation Electronics	Radio or Electronics Fundamentals
Transistor Circuits Specialist	Transistors	Radio or Electronics Fundamentals
Transmitter Technician, Communications Specialist	Communications Electronics	Radio or Electronics Fundamentals
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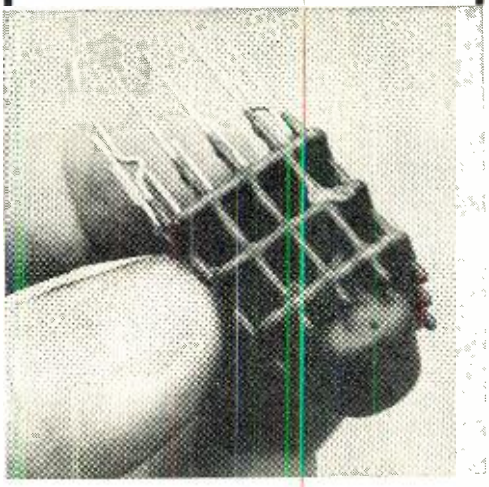
Transistorized Stereo Amplifier

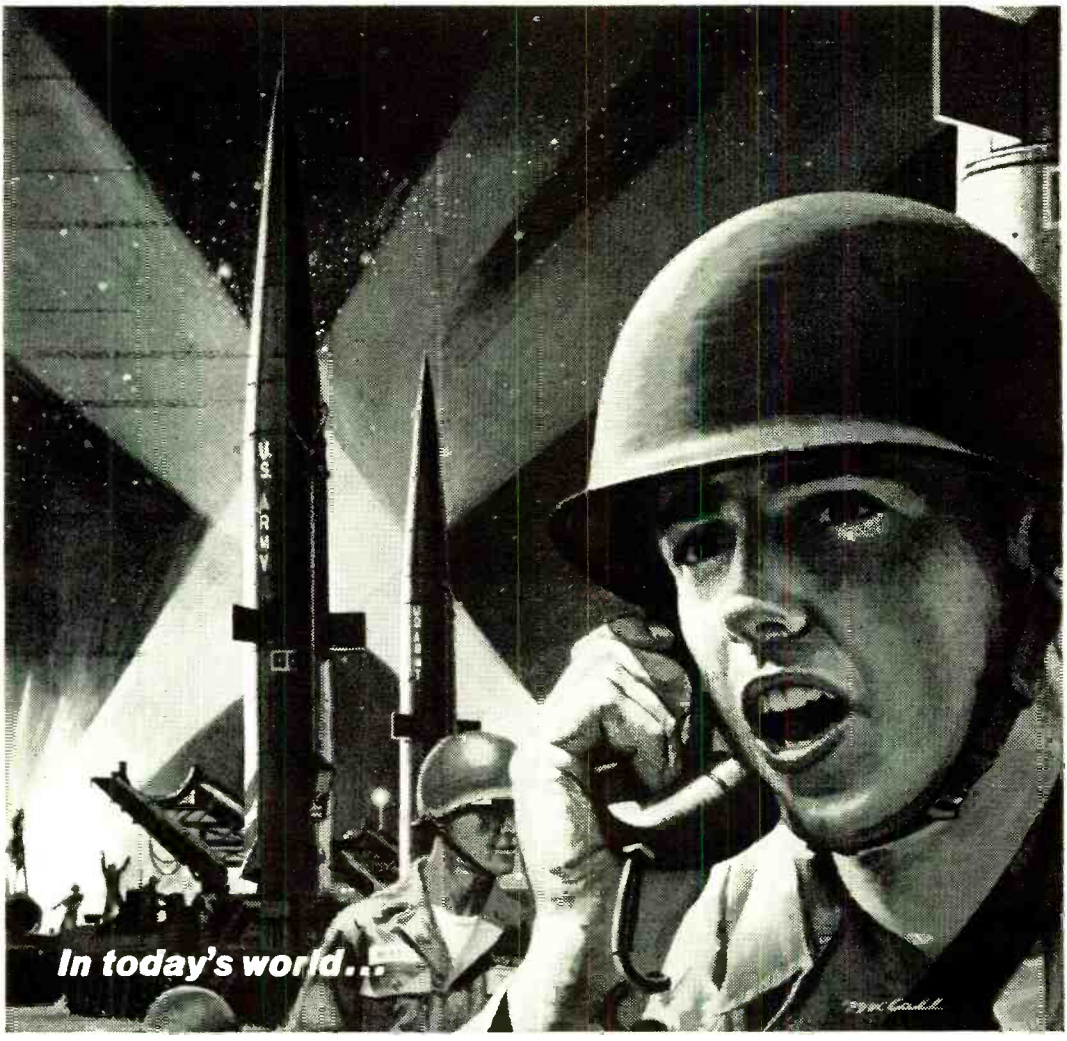
the HEATHKIT AA-21

IF you took a good look at this month's cover, you must have noticed how much a transistorized stereo amplifier differs in appearance from the more conventional vacuum-tube unit. Rated at 50 watts per channel (IHFM music power), the Heathkit AA-21 pictured there is one of the "new departures" in stereo amplifier kits. Since it's transistorized, it's more challenging than a tube-type amplifier kit, but the results should justify the extra effort required.

Unfortunately, we weren't able to get the performance figures for the AA-21 into our *Hi-Fi Lab Check* this month. However, the AA-21 has been assembled (a 19-hour wiring job), and it's presently undergoing exhaustive testing. Details of our findings are now scheduled for the March issue.

Six modules—one of which is shown below bigger than life-size—form prefabricated tone, biasing, and phono equalization networks in the Heathkit AA-21 amplifier.





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Kit $89.95* Wired $129.95*
*Incl. FET

70-Watt Integrated Stereo Amplifier ST70
Kit $99.95 Wired $149.95

40-Watt Integrated Stereo Amplifier ST40
Kit $79.95 Wired $129.95

28W Integrated Stereo Amplifier HF81
Kit $69.95 Wired $109.95

FM Tuner HFT90
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Incl. FET Metal Cover $3.95

AM Tuner HFT94 Incl. FET
Kit $39.95 Wired $65.95

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Kit $59.95 Wired $89.95

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70W HF87A:	$74.95	$114.95
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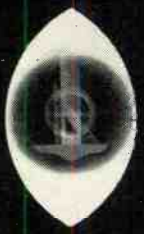

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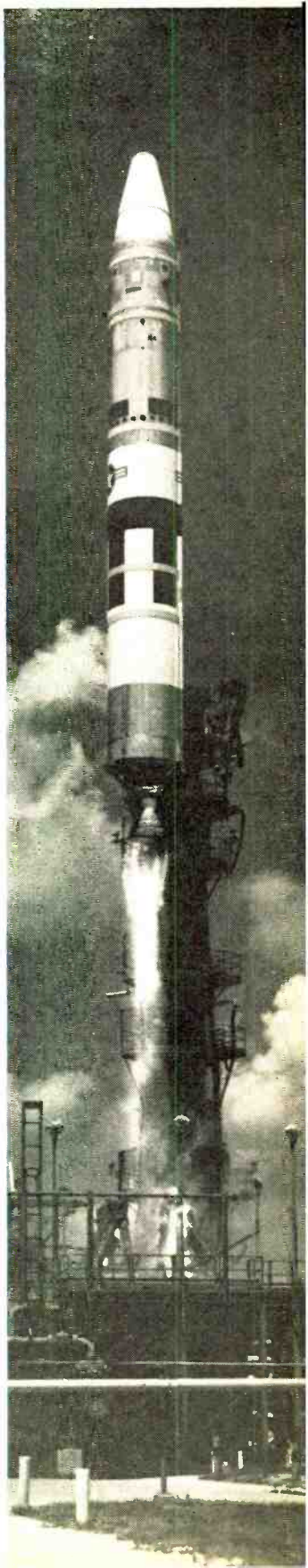
WANTED: an ELECTRONIC PAUL REVERE

By ED NANAS, WA2HFF

A FREQUENT NIGHTMARE among Pentagon brass over the past decade has gone something like this: A missile comes streaking across the North Pole, a big red star painted on its side. Somewhere in America, a radio station operating in the "public service" is blaring rock-n-roll. Inside the missile, the guidance system is jumping happily to the music, using it to home in on a key U.S. target. Suddenly, BOOM! The enemy warhead lands smack on the antenna site. And the Pentagon brass wakes up in a cold sweat.

continued

BETTMANN ARCHIVE



U. S. Air Force photo

In 1775, a man on horseback was enough. But

CONELRAD

The Pentagon has, in fact, awakened. While our top officers still worry about missiles (along with the rest of us), they're no longer concerned about the possibility that radio stations might furnish navigational aid and comfort to the enemy. It seems they have finally realized that inertial guidance and the navigator's art have progressed to a point where an enemy-manned bomber or missile wouldn't *need* electromagnetic radiation in order to successfully "home in" on its target.

This realization has resulted in some sweeping changes in CONELRAD, an old acquaintance to anyone who operates a transmitter in any service licensed by the Federal Communications Commission —including, of course, the radio amateur and the Citizens Bander.

To most hams and CB'ers, CONELRAD (*Con*trol of *El*ectromagnetic *Rad*iation) has meant monitoring a broadcast station while operating their equipment —and shutting down if a CONELRAD alert should come over the monitor.

To the average citizen, CONELRAD has become a household word meaning he should turn to 640 or 1240 on his AM receiver in case of emergency.

To the broadcast industry, CONELRAD augured a severe disruption of its regular operations in time of emergency.

CONELRAD, which came into being in 1951, has applied to the portion of the spectrum between 10 kc. and 100,000 mc., and has had a two-fold purpose: first, to deny the enemy use of radio signals as navigational aids (hence the requirement to shut down transmitters), and, second, to provide a means for effective Presidential and civil defense communications with the public in the event of national emergency (hence those two famous spots on the dial—640 and 1240).

But, on July 13, 1962, the FCC announced that it had deleted provisions in its CONELRAD plans, rules, and manuals affecting all *but* the Radio Broadcast Services (Part 3); Experimental, Auxiliary, and Special Broadcast Services (Part 4); Land and Shipboard Maritime Services (Parts 7 and 8); and Aviation Service (Part 9).

What does this action mean to the ham, CB'er, and those others in the communications field not specifically excepted? It means that the requirement for maintaining special radio equipment to receive the CONELRAD alert has been lifted. It means that certain operating restrictions in the event of national emergency have also been relaxed.

And what will be the results of these changes to the general public? Obviously, better military and civil defense communications. Suppose, for example, that the President is in Newport when an emergency breaks and it becomes essential to inform Americans of events which directly affect our welfare.

Under the old setup, the President would have had to go to one of the few designated CONELRAD facilities. Under a new plan now being formulated by the FCC's National and State Industry Advisory Committees and the Defense Department, he will be able to get on the air through the Emergency Broadcasting System almost wherever he may

missiles make him as outmoded as a candlestick

happen to be—and on very short notice.

Under the new setup, amateurs, CB'ers, and certain industrial users of the spectrum will be in a much better position to be of assistance to civil defense. In short, more stations will be able to be on the air in effective CD networks.

Working groups of both Amateur and Citizens Radio Services have been appointed by the FCC to develop new plans and procedures for optimum use of these services in National Emergency Communications, without the old "navigational aid" restrictions.

These groups are now formulating plans based on the assumptions that amateur and CB operations in certain bands will be terminated by the FCC and radio silence observed in case of emergency, but that other amateur and CB stations will be issued authorizations to supplement communications facilities of survival and rescue organizations.

Once their reports are submitted, correlated, and adopted, we can all rest easier with the knowledge that, in the event of emergency, the word will get out louder and clearer than ever before anticipated. And civil defense communications, particularly on state and local levels, will be able to rely on public-spirited hams and CB'ers.

NEAR

Another side of the CD coin is home warning in the event of surprise attack. This continues to be somewhat of a question mark in official circles. The attack warning system starts with data received directly at the headquarters of the North American Air Defense Command in Cheyenne Mountain, near Colorado Springs, Colo. "Alert" information is flashed to civil defense regional warning centers, Federal agencies, and civilian warning points.

The states and other political subdivisions are responsible for disseminating these alerts to local communities and rural areas. And, for the most part, local communities depend on outdoor siren systems to alert the citizenry; but the limitations of this method have long been recognized. The possibility of using telephones in a nationwide warning system has been seriously considered; the problems here center around high cost and the fact that there are many homes without telephones. Incorporation of warning devices in radio receivers would offer better coverage, but reliability—as well as high cost—would be major problems in this case.

The solution to the home warning problem most favored by the Federal civil defense officials is the use of power lines through which an alert signal could be multiplexed on the basic 60-cycle system. Tests conducted in Michigan (details of which appeared in the August, 1961 issue of POPULAR ELECTRONICS—page 41) were highly successful. The system is called NEAR (*N*ational *E*mergency *A*larm *R*epeater).

This home warning scheme involves the transmission of a power pulse (by superimposing a 240- to 270-cycle signal on the 60-cycle power) over utility lines to a special receiver which can be plugged into any home or office wall socket or other power receptacle; the re-

(*Continued on page* 108)

TD/RFG

Tunnel Diode Radio Frequency Generator

Remember the intriguing little tunnel diode? It's the heart of this handy piece of test gear and the principal reason why this generator outperforms a good many tube-operated designs

By STANLEY E. BAMMEL

INTEREST in tunnel diodes has died down somewhat since their sensational debut a few years ago—partially, perhaps, because most TD circuits have been of a novel nature. Nonetheless, tunnel diodes have some outstanding advantages which can be put to very good use.

For one thing, TD circuits are extremely simple—all it takes to make an oscillator, for example, is a tuned circuit in series with the diode (and, of course, a suitable power source). In addition, tunnel diodes require very little power for operation.

The instrument presented here is a five-band r.f. signal generator having features commensurate with many tube-operated generators on the market. In fact, the TD generator even offers features which aren't practical with tubes —flashlight cell operation and small size are but two examples. Also, it has no warm-up drift, since there is actually no warm-up!

The Circuit. The complete circuit of the TD generator appears in Fig. 1, and a simplified circuit (less the switching networks and the audio oscillator) is shown in Fig. 2. Battery *B1*, a 1.5-volt flashlight cell, provides the power; resistors *R1*, *R2*, *R3*, and diode *D1* form a voltage divider which supplies the required 200 millivolts at 1.6 ma.

The forward characteristic of *D1* is used to achieve a good degree of voltage regulation, since this diode doesn't conduct appreciably until about 0.7 volt of forward bias is applied. As current is increased above this point, the voltage tends to remain pretty constant, rising very slowly. The result is that the generator functions well with variations in supply voltage ranging from 0.75 to 2 volts.

As you may already know, the fre-

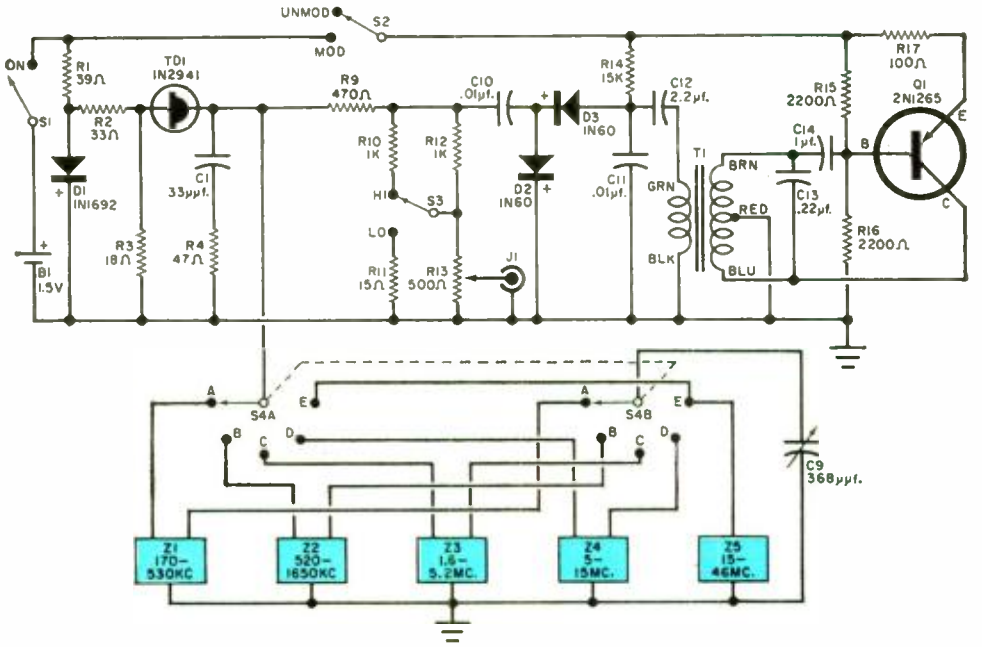
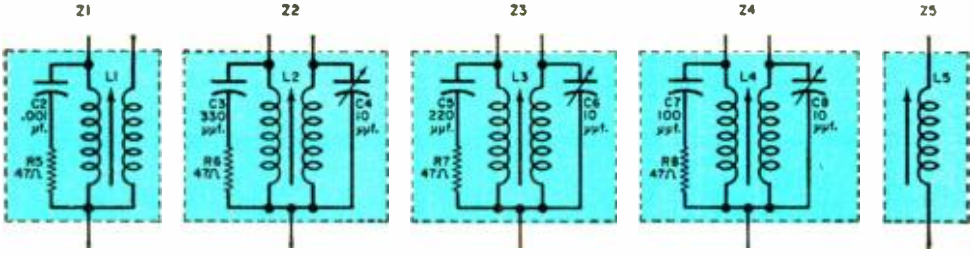


Fig. 1. Circuit of the TD/RFG. Details of networks Z1 through Z5 appear below, and a simplified version of this circuit is shown in Fig. 2. Note that coils L1-L4 each have an added primary winding.



quency of a tunnel diode oscillator is dependent upon its negative resistance. In other words, the greater the effect of negative resistance, the more the frequency of oscillation will differ from the

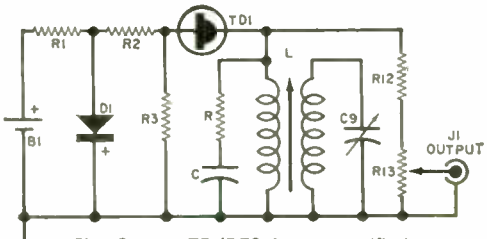


Fig. 2. The TD/RFG in a simplified circuit; L, R, and C represent networks Z1 through Z5 shown in Fig. 1.

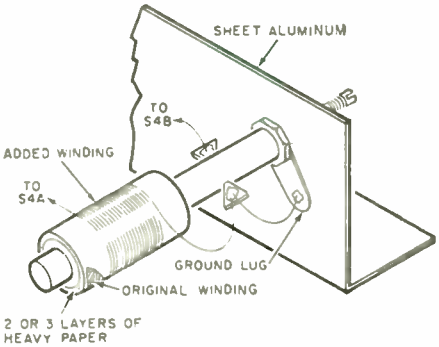


Fig. 3. Details of coils L1 through L4. The added winding is wound on top of heavy paper separator with No. 26 enameled wire and consists of 22 turns on L1, 12 turns on L2, another 12 turns on L3, and 7 turns on L4. Only the original winding is required for coil L5.

PARTS LIST

B1—1.5-volt flashlight battery (Burgess Type 1 or equivalent)
C1—33 μμf. } *All ceramic disc capacitors unless otherwise stated—working voltage not critical*
C2—0.001 μf. }
C3—330 μμf. }
C4, C6, C8—1.5-10 μμf. ceramic trimmer capacitor (Centralab 829-10 or equivalent)
C5—220 μμf.
C7—100 μμf.
C9—368-μμf. midget variable capacitor (r.f. section of midget superhet AM tuning capacitor—Allied Radio 61 L 008 or equivalent)
C10, C11—0.01 μf.
C12— 2.2 μf.
C13—0.22 μf.
C14—1 μf.
D1—1N1692 diode
D2, D3—1N60 diode
J1—Microphone receptacle, single-button contact type (Amphenol 75 PC1M or equivalent)
L1—0.2-3 mh. horizontal linearity and width control coil (J. W. Miller 6318 or equivalent—see text)
L2—Loopstick antenna coil (Superex Vari-Loopstick—Allied Radio 91 C 060 or equivalent—see text)
L3—16-24 μh. adjustable ceramic r.f. coil (J. W. Miller 4507 or equivalent—see text)
L4—1.6-2.8 μh. adjustable ceramic r.f. coil (J. W. Miller 4503 or equivalent—see text)
L5—0.17-0.27 μh. subminature r.f. coil (J. W. Miller 4301 or equivalent)
Q1—2N1265 transistor (Sylvania)
R1—39 ohms } *All resistors ½ watt, 10%*
R2—33 ohms }
R3—18 ohms }
R4, R5, R6, R7, R8—47 ohms
R9—470 ohms
R10, R12—1000 ohms
R11—15 ohms
R13—500-ohm potentiometer, linear taper, with s.p.s.t. switch S1
R14—15,000 ohms
R15, R16—2200 ohms
R17—100 ohms
S1—S.p.s.t. switch (on R13)
S2, S3—S.p.d.t. slide switch
S4—2-pole, 5-position, non-shorting rotary switch (Centralab 1003 or equivalent)
T1—Transistor input transformer: primary, 600 ohms CT; secondary, 10 ohms (Stancor TA-1 or equivalent)
TD1—1N2941 or 1N3562 tunnel diode
1—7-lug terminal strip
1—4-lug terminal strip
1—Vernier dial (National MCN or equivalent)
1—Battery holder for B1 (Keystone 173 or equivalent)
1—6" x 4" x 3" aluminum interlocking chassis box (LMB 142 or equivalent)
2—Pointer knobs
Misc.—Decals, transistor and diode sockets, #26 enameled wire, hookup wire, solder, hardware, etc.

"natural" frequency of the tuned circuit. In order to make this effect negligible, a primary winding is added to coils *L1* through *L4*.

Stray capacitance and inductance in a TD circuit can also be a source of trouble, since they can cause the diode to oscillate parasitically at some very high frequency. Therefore, capacitors *C1*, *C2*, *C3*, *C5*, *C7*, and resistors *R4* through *R8* are added to suppress such oscillations. In addition, leaving *R3* unbypassed improves the stability. The "strays" which do remain add a goodly number of harmonics, resulting in usable output at frequencies several times that of the highest fundamental.

Output is taken directly from *TD1* through the attenuator network consisting of *R9*, *R10*, *R11*, and *R13*. An attenuation of approximately 100 times (40 db) is provided with switch *S3* in its "LO" position.

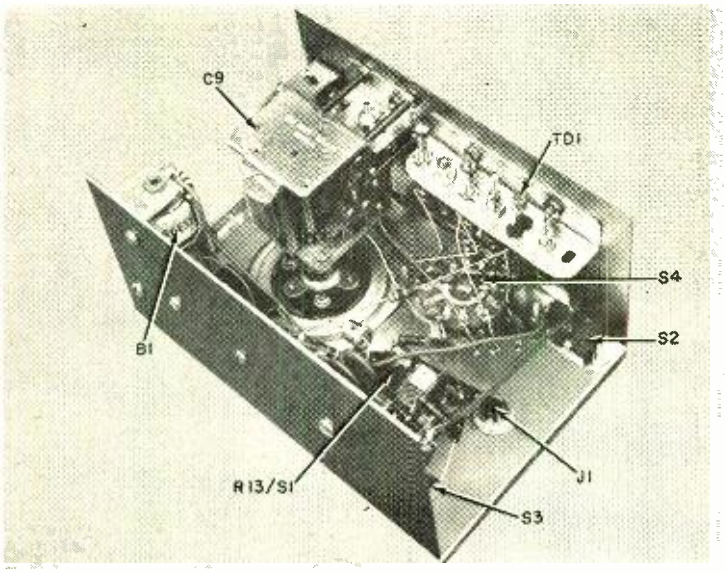
Transistor *Q1* is an audio oscillator which supplies a 400-cycle signal to diodes *D2* and *D3* whenever switch *S2* is closed. The nonlinearity of the diodes mixes the r.f. and a.f. and provides approximately 50% modulation.

Construction. As shown in the photos, the generator is built in a 6" x 4" x 3" chassis which leaves you plenty of "elbow" room inside. The front panel components (*S2*, *S3*, and *S4*, *R13*, *J1*, and the vernier dial) should be mounted first, then *B1*, *T1*, and the two terminal strips. This done, you're all set to wire the audio oscillator, modulator, and attenuator circuits.

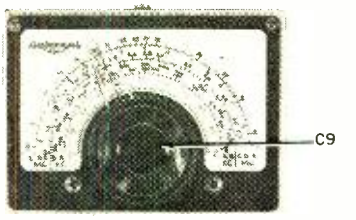
The audio oscillator isn't critical and other layouts can be employed. On the other hand, the modulator and attenuator circuits *are* critical. The components for these two circuits should be mounted with leads as short and direct as possible to reduce stray capacitance.

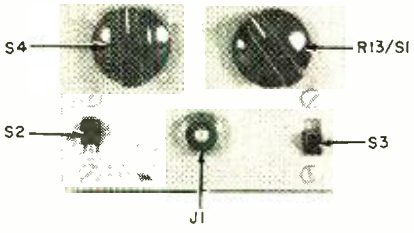
Since the coils consist of few turns and have no taps, winding them is comparatively simple. Number 26 enameled wire will do very nicely. Figure 3 shows how the coils are wound and gives winding data. Ground the "outside" end of the original winding of *L1* and *L2* (these are multilayer coils), and ground whichever end is most convenient on the other coils. Apply some melted wax on the windings after they are finished to hold them in place.

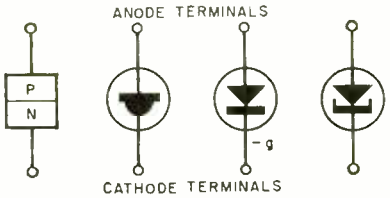
Now, prepare an aluminum mounting bracket for the coils and their respective trimmers. Mount the coils and trimmers on the brackets and install the brackets.



Rear view (left) and front view (below) of the completed TD/RFG. Coils L1 through L5 are mounted on aluminum bracket along with the tunnel diode (TD1), and shaft of capacitor C9 is centered between sides of case through use of extra-long screws. When wiring, keep in mind that leads should be kept as short as you can possibly make them.







Commonly used symbols for tunnel diodes. Cathode terminal is at bottom in each case.

Wiring the coils is a very critical operation—the high-frequency coils in particular must be mounted so that they can be wired with the shortest possible leads.

Calibration. Once the TD generator is fully wired, the next step is calibration. There are a number of ways this can be handled, but one of the easiest is through use of a standard communications receiver. If the calibration of the receiver is questionable, tune in stations of known frequency, then zero-beat the generator with the stations. But be sure that you are using the fundamental and not a harmonic (the fundamental will be the highest frequency which will give a zero beat).

With the exception of *L1*, the respective coil slugs should be adjusted for the correct frequency at the low ends of the bands; the trimmers and the slug of *L1* should be set for the correct frequencies at the high ends of the respective bands. Incidentally, if you don't know the frequencies of enough stations to calibrate the TD generator directly, it's a simple matter to plot the points of the known stations on a sheet of graph paper and connect these points with a smooth curve.

Applications. The TD generator is used in the same way as any other r.f. generator. The r.f. is unmodulated with *S2* in the "UNMOD" position, and modulated with *S2* in the "MOD" position.

As an example of how to use the generator, let's consider alignment of a "standard" AM table receiver (an isolation transformer should be employed for safety). First, align the i.f. transformers by setting the generator to the i.f. frequency (usually 455 kc.). Turn *S2* to "MOD," connect the ground lead to the receiver chassis, and connect the hot lead to the signal grid of the converter tube (the ungrounded end of the antenna coil). Then turn the receiver volume all

(*Continued on page 97*)

ADD-ON S-METER

Now anyone can measure relative signal strength on his Citizens Band, amateur, or SWL receiver

By R. L. WINKLEPLECK

IF your communications receiver isn't equipped with an S-meter, you're losing out on more than just the chance to issue accurate signal reports. For one thing, the ability to measure signal strength is not only a great help in tuning a receiver, but it also facilitates alignment and other adjustments of the set. For another, a receiver equipped with an S-meter automatically becomes a field-strength indicator and, as such, is a great help in tuning transmitters, evaluating antenna performance, etc.

The S-meter described here can be attached to any tunable or fixed-tuned receiver (whether ham, broadcast, or CB) equipped with an automatic volume control. Its sensitive VTVM-type circuit has an input impedance of about 12 megohms and will not affect receiver performance. Self-powered, the unit requires only two connections to your set (and one of these is a simple ground).

Construction. The circuit is housed in a 4½" x 4$^{3}/_{16}$" x 4¼" sloping-panel utility box, for which the author constructed a chassis from scrap sheet aluminum. If you wish, you can use the kind of box that comes equipped with its own chassis. Just be sure that you provide ventilation for the 12AU7 tube (*V1*).

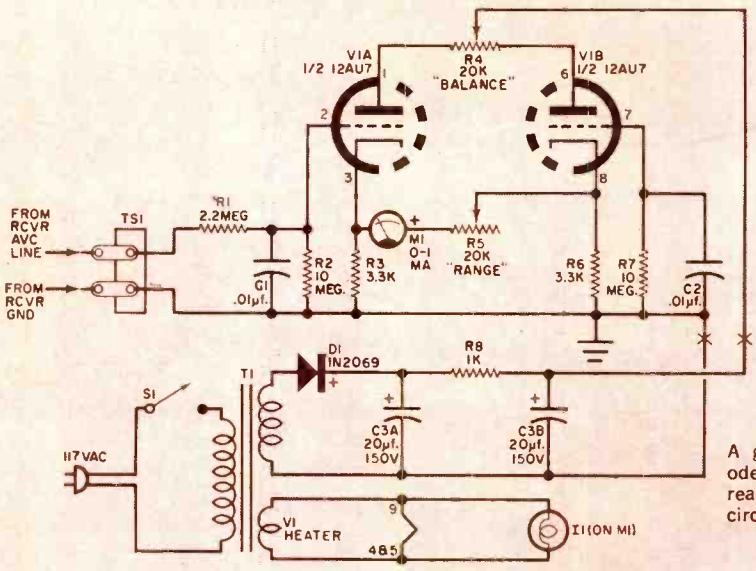
The S-meter unit (*M1*) is mounted on the sloping panel of the box, and the chassis is held in place by means of the two meter-mounting screws. Switch *S1*, as can be seen in the photos, is installed on the top of the box, and the rear apron of the chassis holds potentiometers *R4* and *R5* as well as the grommet for the line cord.

A 2-lug (one-grounded) terminal strip, *TS1*, is fastened on top of the chassis (at the rear). This strip accommodates the connections from the meter circuit to the receiver.

The other components are placed on, or under, the chassis as illustrated. The arrangement is a compact one, but you should have no trouble installing or wiring all the parts.

Transformer *T1*, switch *S1*, diode *D1*, capacitors *C3a* and *C3b*, and resistor *R8* can be eliminated if you would like to tap the necessary power from your receiver. Simply ignore all wiring below the leads marked "X" on the schematic diagram, and connect the center arm of potentiometer *R4* to a 150-volt d.c. point in your set.

Meter pilot light *I1* and the heater for *V1*, of course, should be wired to a 6.3-volt a.c. or d.c. source. The *V1* heater will operate from 12.6 volts if contact is made across pins 4 and 5 of the tube instead of across 4, 5 and 9 as shown. Naturally, if you decide to operate *V1*'s heater from 12.6 volts, you'll either have to substitute a 12-volt

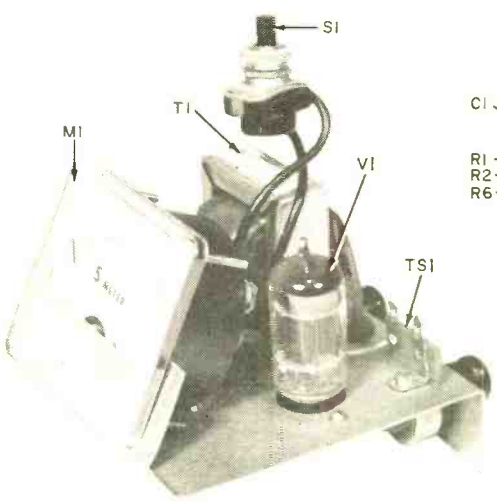


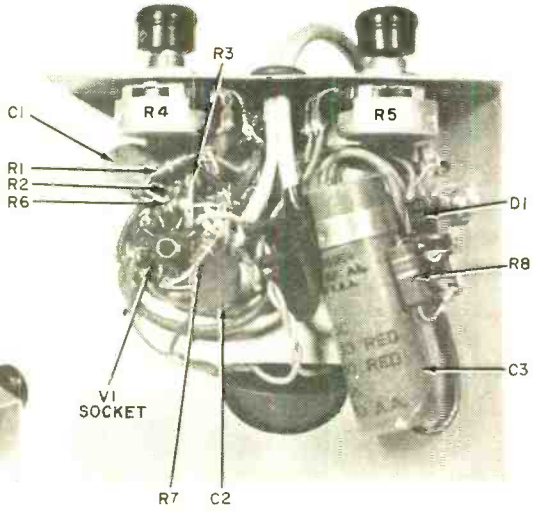
A glance at the two triode stages may cause the reader to recall similar circuits used in VTVM's.

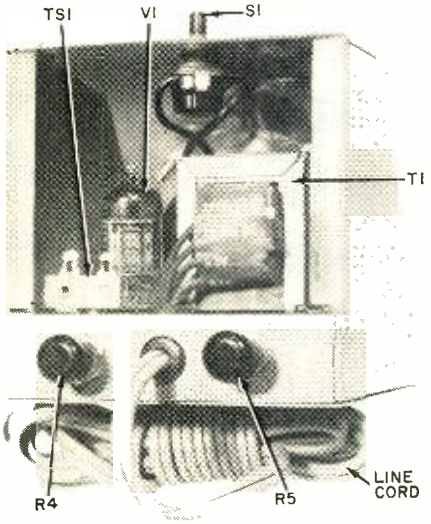
PARTS LIST

C1, C2—0.01-μf., 150-volt capacitor
C3—Dual 20-μf., 150-w.v.d.c. electrolytic capacitor
D1—1N2069 diode (Texas Instruments)
I1—6.3-volt pilot lamp (on M1)—see text
M1—2⅜"-square illuminated S-meter, 1-ma. movement (Lafayette TM-26 or equivalent)
R1—2.2 megohms
R2, R7—10 megohms
R3, R6—3300 ohms
R4, R5—20,000-ohm potentiometer, linear taper
R8—1000-ohm, 5-watt resistor
S1—S.p.s.t. switch
T1—Power transformer: primary, 117 volts a.c.; secondaries, 125 volts @ 15 ma., 6.3 volts @ 0.6 amp (Stancor PS-8415 or equivalent)
TS1—2-lug terminal strip
V1—12AU7 tube
1—4½" x 4⅜6" x 4¼" aluminum sloping-panel utility box (Premier ASPC-1200)
Misc.—Line cord and plug, socket for V1, grommets, terminal strips, knobs for R4 and R5, wire, sheet-aluminum stock for chassis, etc.

Size of aluminum chassis which mounts most of the parts is determined by the dimensions of the sloping-panel utility box used. Meter M1 and switch S1 mount on utility box.







The "Add-On S-Meter," complete with its own power supply, needs only two wires from TS1 to connect to receiver a.v.c. line. Controls R4 and R5 are employed to adjust the "swing" of the meter's pointer.

bulb for pilot lamp *I1* or make some other arrangement for illuminating the meter. Probably the simplest way out is to use a VOM to determine the amount of current drawn by lamp *I1* at 6.3 volts, and then add a small series resistor to provide the required 6.3-volt drop (the value of this resistor can be computed with Ohm's law).

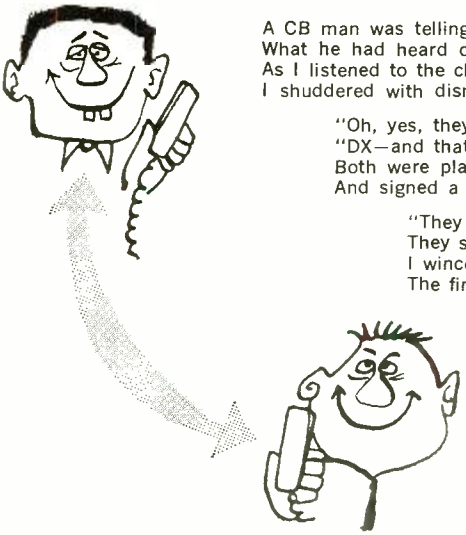
If you have room on your receiver's front panel and chassis, you might even want to dispense with the utility box and build the S-meter circuit right into the set. Smaller S-meters than the one specified for *M1* are available should panel space be limited. But be sure you get one with a 1-ma. movement.

Installation and Adjustment. Installation is simplicity itself. Connect the "ground" terminal on *TS1* to your receiver ground, then connect the other terminal to the receiver a.v.c. line (the set's schematic should show the location of the latter). If you are not using a built-in power supply, tap your receiver for power as described in the previous section.

With both the receiver and S-meter circuits warmed up, disconnect the receiving antenna and adjust *Balance* potentiometer *R4* for a zero reading on *M1*. Then reconnect the antenna and tune to a strong local signal. Adjust *Range* potentiometer *R5* so that the signal almost "pins" *M1*.

Of course, this calibration, like that of any other S-meter, isn't "exact." But your newly installed "Add-On S-Meter" will now give you the same kind of relative readings you would obtain from a commercially manufactured unit. —30—

CB Spree



A CB man was telling me
What he had heard one day;
As I listened to the charges made,
I shuddered with dismay.

"Oh, yes, they worked DX," he said,
"DX—and that's not all!
Both were plainly out of band
And signed a different call.

"They weren't made of CB stuff,
They sat and talked quite gay."
I winced and tried to figure out
The fine they'd have to pay.

And then the final clincher came:
It really made me stew;
The FCC he would not call,
For nothing could they do.

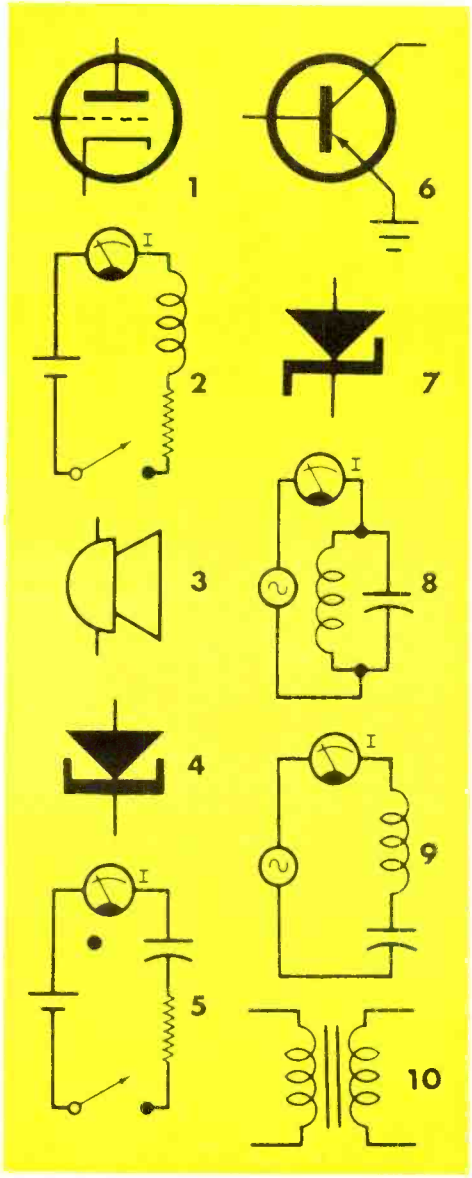
"How come these clowns cannot be caught?
In jail they ought to land."
" 'Cause these were hams," my friend guffawed,
"On their 10-meter band!"

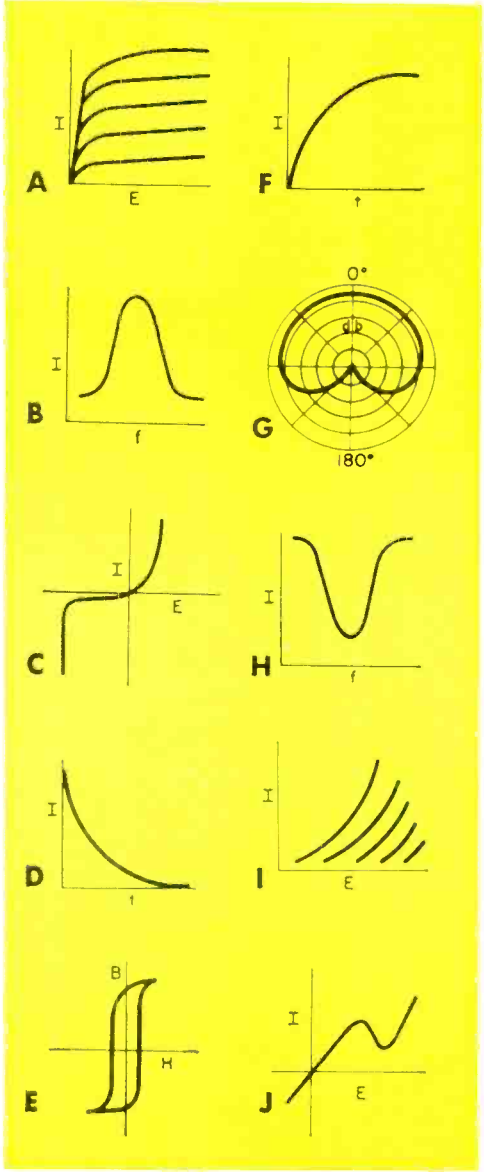
by David Moore

ELECTRONIC CURVES QUIZ

By ROBERT P. BALIN

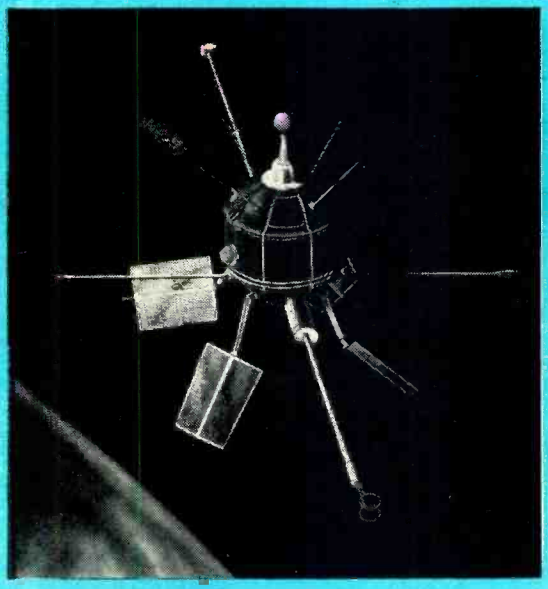
The operation of electronic devices and circuits is often represented by characteristic curves. See if you can match the electronic devices and circuits at left (1 - 10) with their corresponding curves (A - J). Answers appear on page 105.



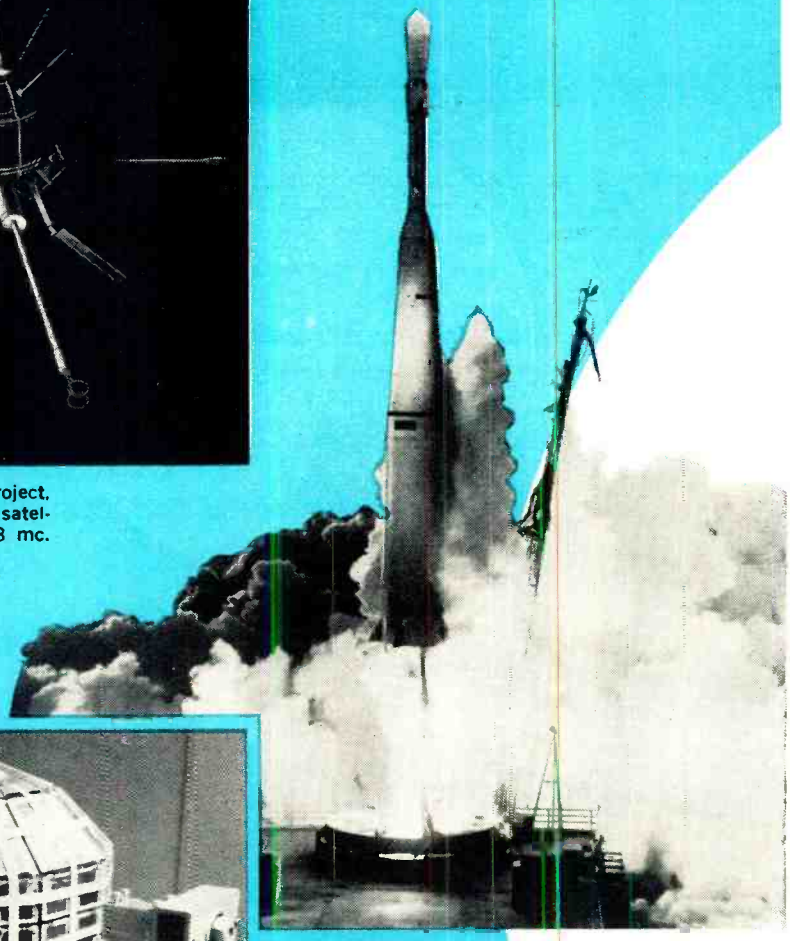


Eavesdropping

OR HOW TO



ARIEL, a joint U.K.-U.S. project, is world's first international satellite. You'll find it on 136.408 mc.



TIROS meteorological satellites (that's Tiros I lifting off above) are now six in number, with IV, V, and VI still going strong.

NASA Photos

ALOUETTE (left), a combined Canada-U.S. undertaking, can be heard on 136.590 and 136.979 mc.

on Satellites

TELL ARIEL FROM ALOUETTE

By **TOM LAMB,** K8ERV

With at least six easy-to-snag NASA satellites in the 136-137 mc. band, there's no time like *right now* to start pulling them in. How? Well, a receiver offers no real problem—your present communications set can be made to tune the 136-mc. band simply by adding a converter. And, you can either modify an existing converter designed to cover the 2-meter ham band, or, better yet, you can build the special "NASA 136" for this very purpose (for full details, see the June 1962 issue of POPULAR ELECTRONICS, p. 39).

Fortunately, too, a large and elaborate antenna system is NOT necessary at these frequencies. In fact, near overhead passes can be picked up with a 3′ 7″ dipole, and you may even get satisfactory results with a TV antenna.

Start by listening for the Tiros satellites, since their signals are moderately strong. With your antenna pointed SE or SW (in the U.S.), set your receiver for c.w. reception, use a medium i.f. selectivity, and tune to 136.230 mc.

If your converter and receiver calibration aren't spot on, tune around the satellite's frequency every five minutes or so, listening carefully for a weak carrier. An accurate receiver can be left on the frequency until the carrier appears, although it *could* take up to 12 hours for you to hear the first pass. A single, low-orbit satellite can be heard for up to seven successive passes, followed by a 12-hour quiet period; the exact sequence will depend to some extent on your location and system sensitivity. Once you pick up the carrier, change to a narrow i.f., use a Q-multiplier, or try any of the other tricks you may have for receiving very weak signals.

Identifying Satellites. All NASA satellites transmit a carrier (beacon) for tracking purposes, and it's relatively easy to tell when you've picked one up:

(1) It will be accurately on frequency, but—

(2) A satellite will appear to be slightly high in frequency when approaching, slightly low when receding. This Doppler effect will vary from nearly zero for a distant pass to about 7 kc. for an overhead pass, and it's one sure way to identify a satellite.

(3) Low-orbit (750-mile or so) satellites will be heard for only about 18 minutes during each pass—usually considerably less.

(4) A satellite will usually be heard for several successive passes. (Since both Tiros V and Tiros VI are on the same frequency, they confuse the picture somewhat—but their transmissions will still be separated by the orbit period.)

(*Continued on page* 107)

Short-Wave Broadcast Predictions

By STANLEY LEINWOLL
Radio Propagation Editor

FEBRUARY 1963

BECAUSE OF the ever-increasing interest in short-wave listening, the Editors of POPULAR ELECTRONICS have arranged to present "Short-Wave Broadcast Predictions" as a regular monthly column. The tables below list frequencies (in megacycles) for best reception between two geographic areas during any given time interval. (Local standard time is given in two-hour intervals at the top of each column for each of the three main listening areas in the United States).

To use the tabulated information, just select the table corresponding to the time zone in your location, read down the left-hand column to the region you want to hear, then follow the line to the right until you're under the figure indicating the approximate local time. In short, you pick the time in your own geographical area; the tables will tell you the frequency band for best DX results.

TIME (EST)

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

TIME (CST)

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

TIME (PST)

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

ME TECHNICIAN YOU ENGINEER

By MORTON H. BURKE

WHEN I punched in for the first time at Flashover Electronics, I had the same kind of butterflies in my stomach that most people have when they start a new job. I was confident of my abilities as a technician, of course, but I was still a little scared about having to work on a 25-kilowatt "auto-tuned" transmitter.

While I waited at my workbench, I saw a small, thin man with straight, black hair and dark "out-of-this-world" eyes dash from a nearby office. He glanced nervously in my direction and then sped straight up to me.

"You're the new technician, Orville Watson, aren't you?" he queried.

"Yes, I am," I returned.

He extended a firm hand and introduced himself as Frank Flashover, company president and chief engineer.

"I'm sorry I couldn't interview you before you were hired," he mumbled hastily, "but my business manager told me that you had the best qualifications of any applicant.

"As you can see, Orville," he continued, "this is a small company. We have to expect a lot from our employees. Am I correct in assuming that you can read and understand schematics; that you can wire equipment directly from schematics; that you can solder well; that you can make wire harnesses and harness boards; and that you can trouble-shoot all kinds of electronic instruments?"

I gasped for air and was about to open my mouth to answer him, but he continued to outline what he expected of me.

"If you don't already know how, I want you to learn to use all our test equipment. That means oscilloscopes, VTVM's, distortion analyzers, 'Q' meters, SWR indicators, and so on."

"Enough of this," I thought to myself. "This guy thinks I'm an engineer, too."

"And incidentally, Orville," he went on, "as you can also see, we're a little short of help right now. I hope you won't mind if I ask you to make an occasional metal part. Our machine shop is at the end of the building there, and it has a small lathe, a brake, a shear, and a few drill presses."

I determined to hold my temper until he finished his little speech, because I

(*Continued on page 88*)

ANY PHONE GOES

EVER SINCE the advent of the transistor, one of the most popular receiver circuits among beginners and students has been a simple one-diode/one-transistor hookup of some kind or other. Unfortunately, the high output impedance of the transistor and the presence of d.c. in most of these circuits makes it necessary to use high-impedance magnetic earphones *only*. But, add an output transformer and six Fahnestock clips, and you can use phones of practically any type and impedance.

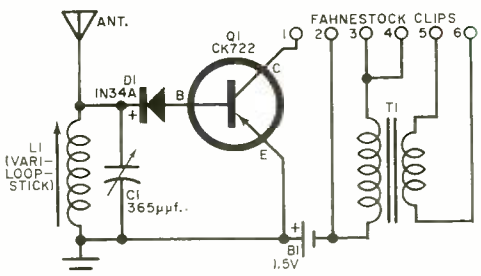
All you have to do is hook up the transformer and clips as shown in the diagram. Just about any type of output transformer should do the trick, although one having a primary impedance of 3000 ohms and a secondary impedance of 6 ohms worked best in the model tested. The secondary is connected to clips 5 and 6.

For high-impedance magnetic phones, connect the phones to clips 1 and 2.

For crystal phones, connect a wire jumper from clip 1 to clip 3, then connect the phones to clips 2 and 4. In this way, the d.c. will flow through the primary of the transformer rather than the phones, as in the instance above.

For low-impedance dynamic phones, connect a wire jumper from clip 1 to clip 3, then connect the phones to clips 5 and 6.

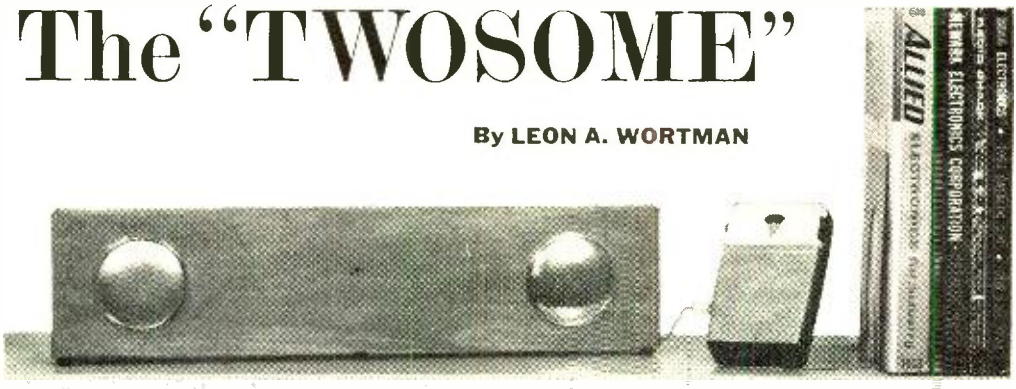
Incidentally, Government-surplus 600-ohm magnetic and dynamic phones will probably work better when they're connected to clips 1 and 2 rather than to clips 5 and 6. —*Art Trauffer*



This little receiver is happy with any kind of phones—magnetic, dynamic, or crystal. Even more important, you can adapt the basic transformer-and-clips idea to almost any piece of transistorized equipment which uses headphones.

The "TWOSOME"

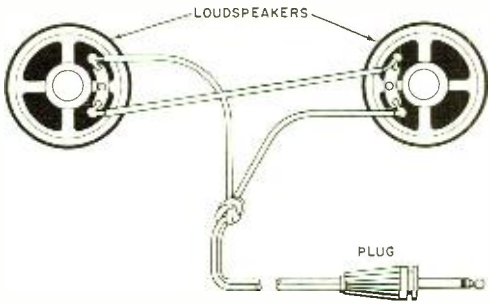
By LEON A. WORTMAN



Lonesome for "big sound" from your pocket transistor radio?

Then add a plug-in miniature speaker system called "Twosome"

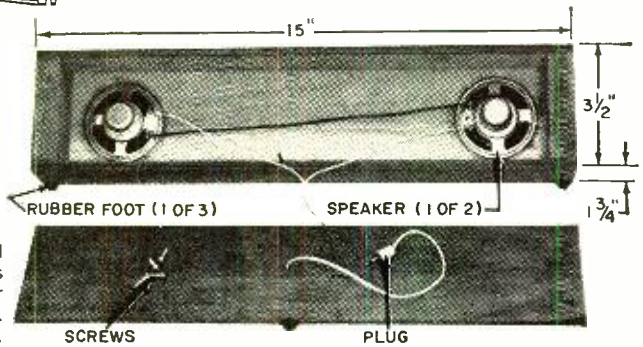
HAVE YOU EVER walked through an appliance store's radio department and noticed the "big sound?" It's caused by speakers from many receivers reproducing the same program. You can hear this kind of sound at home if you play two table radios at equal volume; each speaker alone sounds fair, but together they seem to put out "big sound." The "Twosome" speaker system can do the same thing for your transistor portable.



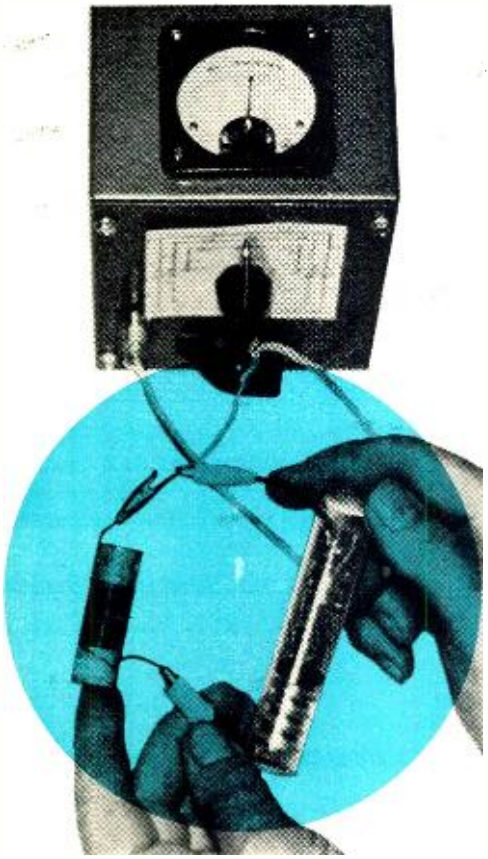
Cable and plug used to wire up the "Twosome" were part of portable's earpiece. Knot is made after cable is passed through hole in rear cover.

Few parts are needed: two 2½" PM speakers; a plug to match your transistor radio's earphone jack; some wire; and some plywood for a box. Cut the wood and glue the pieces together to form a box like the one in the photo below. Then cut holes for the speakers and glue them in place. After you wire the unit, as shown in the diagram, put on the back cover. Finally, mount the speaker grilles to protect the exposed paper cones, and paint or stain the wood.

Now tune in a music program on your transistor radio, turn up the volume, and listen to the sound. Then plug in the "Twosome"—you should hear "big sound," with improved bass response as a result of the larger moving "wall" of air. Although speaker phasing isn't too important, you may want to reverse one set of speaker leads to see if there's any difference. —30—



Dimensions of author's model are shown at right. Exact size is not critical provided speaker centers are 12" or more apart. Rubber feet prevent scratching.



RF Power Capsule

By I. C. CHAPEL

Pinpoint the frequency and eliminate guesswork when tuning LC circuits

THIS little "gimmick" is probably one of the most unusual pieces of test equipment you'll ever come across. And once you've put it together, it's a fair bet that you'll find it as useful as it is "different."

The "R. F. Power Capsule" is essentially a battery-powered, transistorized, r.f. oscillator—minus the *LC* "tank" circuit. As you might guess, its purpose is to energize experimental coil/capacitor combinations. Just connect any paralleled coil and capacitor (resonating between 4 and 40 mc.) to the "capsule," and you have a small radio transmitter.

Frequency and strength of the resulting signal (and hence of the *LC* combination) can be checked on a communications receiver equipped with an S-meter An ideal method for tuning two *LC* circuits to the same frequency, adjusting one for maximum output at a given frequency, or—you name it!

The construction details below will allow you to duplicate the author's unit, but the circuit will work equally well if wired on a piece of perforated board in standard fashion.

Construction. In the author's case, transistor *Q1* and the capacitors and resistors were installed on a ½" x 1½" Formica panel. This panel, together with the four mercury cells which power the unit, was then housed in a 3" length of ⅝"-i.d. plastic tubing.

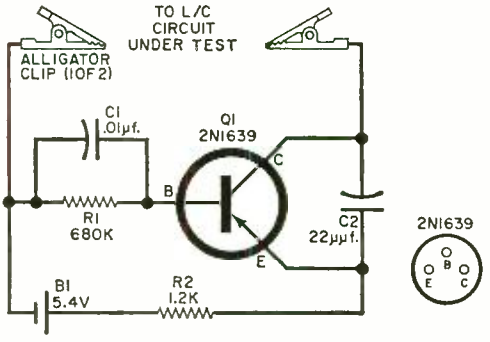
Cut a slot a bit larger than *Q1*'s body in the Formica panel and slide the transistor into it—base lead on one side, emitter and collector leads on the other. Capacitors *C1* and *C2* are placed on the base side of the panel, resistors *R1* and *R2* on the collector side. The leads of all components are run through holes drilled in the Formica, and these holes are used as "solder lugs."

A flat piece of brass, mounted on one end of the panel and backed up by a washer, acts as the positive battery contact. For the negative contact (which also serves as a spring to clamp the mercury cells together), bend another piece of brass almost double (see top photo at right).

Preliminary Check-Out. Before installing the mercury cells and panel in the tubing, you might want to check the operation of the unit. For this purpose, it's convenient to use a couple of flashlight

PARTS LIST

B1—5.4-volt battery (4 Mallory RM625RT mercury cells in series, or equivalent)
C1—0.01-μf. metallized-paper capacitor, voltage not critical (Aerovox Type P83Z or equivalent)
C2—22-μμf. ceramic capacitor, voltage not critical
Q1—2N1639 transistor (RCA)
R1—680,000-ohm, ½-watt resistor
R2—1200-ohm, ½-watt resistor
1—3"-long piece of ⅝"-i.d. plastic tubing
1—¼" x 1½" piece of Formica
2—Alligator clips
Misc.—Scrap brass for battery contacts, washers, wire, etc.



batteries (or dry cells) wired in series to make a 3-volt power source. Temporarily connect the batteries to the appropriate contacts on the unit, placing a 0-1 ma. meter in series with one of the leads. You should get either no reading or a negligible one.

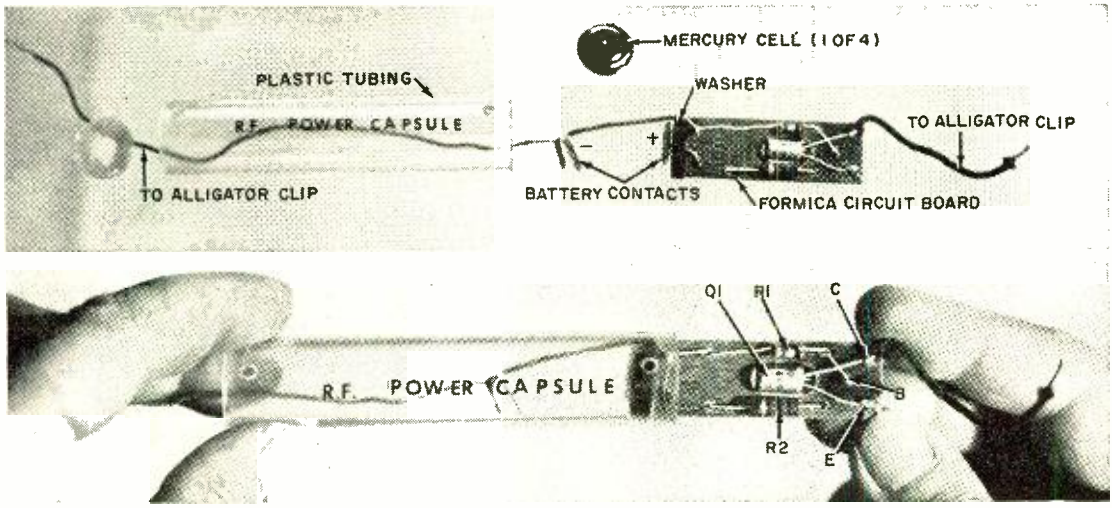
Now wire a paralleled coil and capacitor across the circuit points where the alligator clips will later be connected (these clips should not be installed until all other work is complete). The coil and capacitor must resonate at a frequency somewhere within the 4-40 mc. range of the "power capsule." As soon as this experimental tank circuit is in place, the milliammeter should indicate a battery drain of about 400 ma.

If the drain is about right, check the circuit for oscillation. This may be done by loosely coupling the antenna terminal of your communications receiver or field strength meter to the collector end of the experimental tank coil. Once oscillation is confirmed, you can proceed with the final assembly.

Finishing Up. Stack the four mercury cells (with all positive terminals pointing in the same direction) and place the positive end of the stack against the flat positive contact on the Formica panel. Put the negative contact at the other end of the stack and slide the whole assembly into the tubing. Leads for the alligator clips are brought through holes drilled in the tubing (one at each end).

Next, seal up each end of the tube

(*Continued on page 99*)



Construction design is optional, limited only by assembler's imagination. Author's unit was housed in plastic tubing and space not taken up by circuit board was used to store the four mercury cells.

What to do with a Tape Recorder
(until the hi-fi arrives)

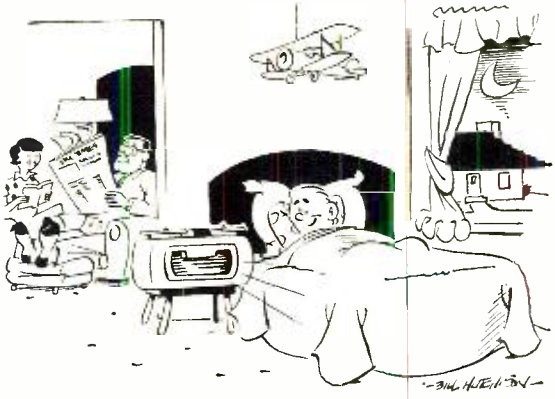
By BILL HUTCHISON

"That is NOT my voice! You've fiddled with those controls to make it sound awful."

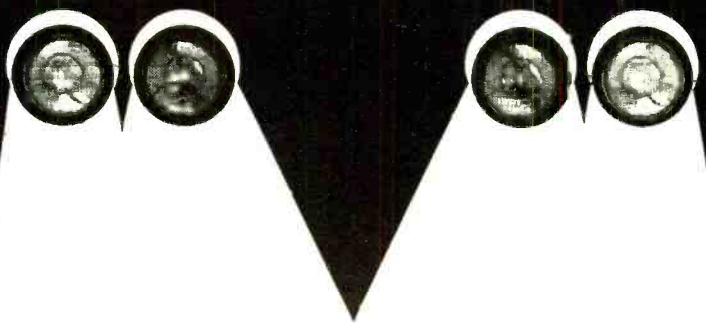
". . . don't let anyone kid you; you are the brainiest executive this company, or any company, ever had . . ."

"He read in POP'tronics about someone who recorded porpoises talking together."

". . . then the Lone Ranger mounted his white horse . . ."



AUTOMATE YOUR REAR VIEW MIRROR



By **CHARLES CARINGELLA,** W6NJV

This electronic rear-view mirror system automatically eliminates reflected glare from headlights of automobiles behind you

FOR SOME TIME NOW, drivers bothered by glare from the headlights of automobiles behind them have been able to buy "dimming" mirrors. When these useful car accessories are in the "normal" position, they reflect light in the same way that an ordinary mirror does. But when they are flipped to "dim," the reflected light is greatly dimmed.

Since most night drivers prefer to leave their mirrors on "normal" except when a car is actually behind them, however, a fair amount of reaching up and flipping back and forth has been called for. So one of Detroit's latest innovations is a dimming mirror which, with the aid of a photocell, does all its flipping automatically.

These little gadgets are expensive, though—especially in view of the fact that it's not too difficult to build your own. The automatic mirror described on the following pages makes use of a modified unit of the manually operated type and a handful of other parts. Take a few evenings to put it together, and you'll be able to

drive with full assurance that you won't ever be temporarily blinded by reflected glare.

Mirror Operation. The manual dimming mirror which was modified by the author, like most units of this type, contains both an ordinary mirror and a piece of plain glass. These are so arranged that the driver, by flipping a lever, can see the reflections of the cars behind him in either the mirror or the glass. When using the glass, of course, the reflection is quite dim and headlight glare is cut considerably.

In its original form, the mirror assembly consists of a metal frame holding both mirror and glass. The glass is set in the frame at an angle to the mirror, and the frame is pivoted within the outer enclosure of the mirror assembly. In this way, tilting the frame within the enclosure places either the mirror or the glass in a position to reflect the rear view into the eyes of the driver.

The modification consists of rearranging the mirror assembly so that it can be "flipped" by a pair of solenoids rather than by hand. Accordingly, the operating principle of the assembly is changed (primarily in order to decrease the weight of the frame) to that illustrated in Fig. 1. Notice that the glass is now fixed and the only moving part is the mirror.

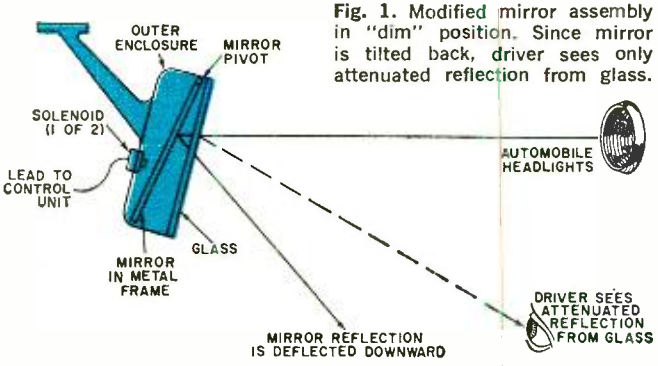


Fig. 1. Modified mirror assembly in "dim" position. Since mirror is tilted back, driver sees only attenuated reflection from glass.

When the mirror is in its normal position (flat against the glass), the reflection the driver sees comes essentially from the mirror. But when the energized solenoids pull back the mirror to the position shown, this main reflection is deflected downward—away from the driver's eyes. The only reflection now in view is the attenuated one from the glass. A small spring (not shown) returns the mirror to its normal position after the solenoid is de-energized.

Control Circuit. The sensing element for the mirror control circuit is a photocell of the "variable resistance" type. This photocell (*PC1* on the schematic diagram) is mounted near the back window of the car so that it can "see" the headlights of automobiles approaching from the rear. The "dark" resistance of *PC1* is in the neighborhood of 1 megohm. Under illumination of auto headlights, though, the resistance changes to a value somewhere between 10,000 and 100,000 ohms.

The photocell (neglecting, for the moment, resistor *R1* and switch *S1*) controls the base bias of transistor *Q1*. This transistor is connected as a d.c. amplifier, and variations in the base bias cause changes in the emitter current. The "dark" resistance of *PC1* is too high to allow much base bias; therefore little emitter current flows. But the "illuminated" resistance is low enough so that adequate current flows to close emitter-circuit relay *K1*'s contacts.

The relay's contacts are in series with one of the leads running to coils *L1* and *L2* (the mirror solenoids). When they close, *L1* and *L2* are energized, pulling the mirror (see Fig. 1) back to the "dim" position.

Switch *S1*, when closed, bypasses *PC1* with a fixed resistance (*R1*). This has the effect of holding the mirror in the "dim" position. The "hold" switch comes in handy in heavy traffic conditions, when the constant flicking of the mirror from "dim" to "bright" would be an annoyance.

"Sensitivity" control *R2* determines the light intensity required to pull in *K1*, and can be adjusted for a wide range of conditions. Power for the circuit is supplied by the auto battery (12-volt) and controlled by "power" switch *S2*.

Modifying the Mirror. The modification described here was carried out on a

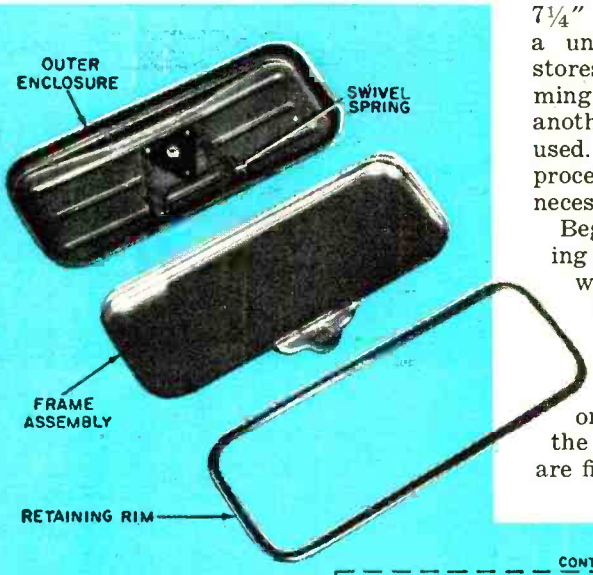
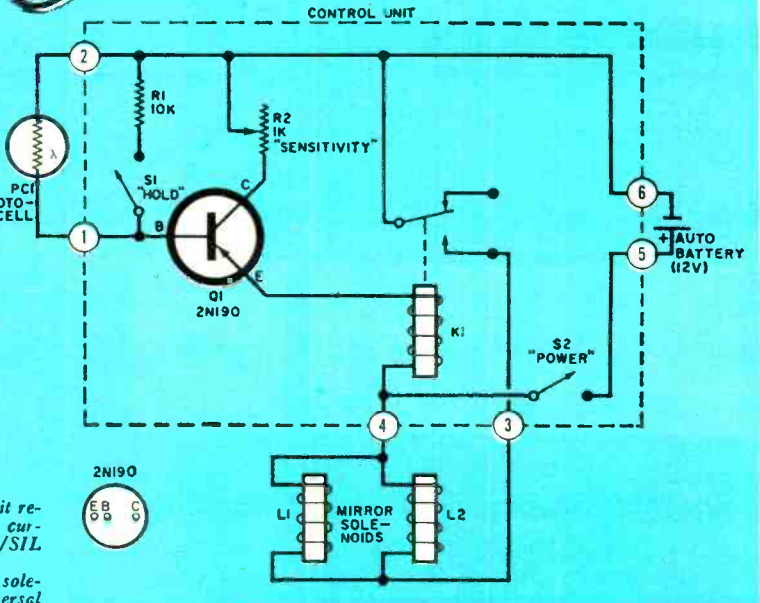


Fig. 2. First step in modification of mirror is to remove retaining rim and frame assembly from outer enclosure.

7¼" x 2¾" Monarch "Flip" mirror—a unit available at many auto parts stores. But the construction of one dimming mirror is very much like that of another, and any similar mirror can be used. Of course, some variations in the procedure outlined below would then be necessary.

Begin by removing the chrome retaining rim from the outer enclosure. This will expose the metal frame on which the glass and mirror are mounted. The frame assembly may then be removed from the outer enclosure by prying the pivot tabs located on the top of the assembly away from the slots in the enclosure. When you are finished, you will have separated the unit into the three pieces illustrated in Fig. 2.



Schematic diagram of complete system. Numbered circles represent terminals on control unit (see pictorial diagram and photo of unit on page 67).

PARTS LIST

K1—1000-ohm plate-circuit relay, 4.5-ma. "pull-in" current (Sigma 4F-1000-S/SIL or equivalent)
L1, L2—6-volt d.c. relay solenoid (Guardian Universal "200" series, Potter and Brumfield Type GPD, or equivalent)
PC1—"Variable-resistance" photocell (Clairex CL-4 or equivalent)
Q1—2N190 transistor (G.E.)
R1—10,000-ohm, ½-watt resistor
R2—1000-ohm potentiometer
S1, S2—S.p.s.t. toggle switch
1—Manually-operated "dimming mirror" (7¼" x 2¾" Monarch "Flip" or equivalent)*
1—2¾" x 2⅛" x 2¾" aluminum utility box (LMB T-F771 or equivalent)
Misc.—Terminal strips, washers and fiberboard for insulating relay frame, knob for R2, insulated terminals, interconnecting cables, cement, #16 steel wire for mirror return spring, ¼"-i.d. tubing for mounting PC1, etc.

*Manufactured by Monarch Tool and Machinery Co., 3435 South Racine Ave., Chicago 8, Ill.

Now take apart the frame assembly—removing the glass and mirror. These pieces are cemented in place and must be disassembled very carefully. You should then have an array of parts like that shown in the exploded view of Fig. 3.

Cement the glass to the inside of the retaining rim, being careful to center the glass within it. If the glass is not centered, you won't have enough clear-

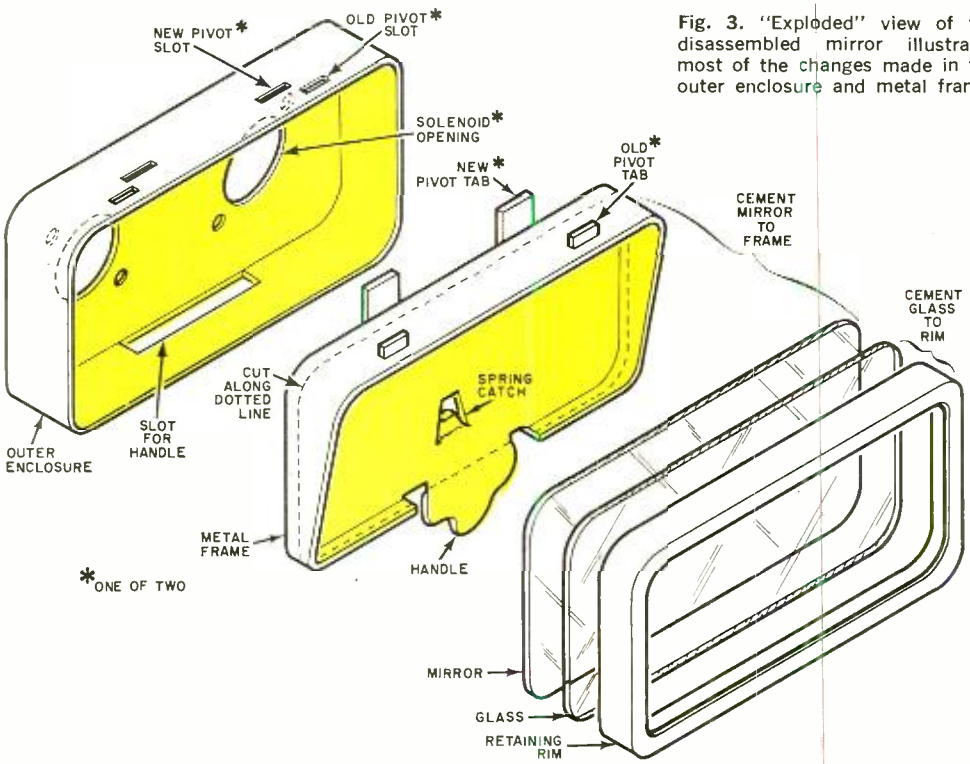


Fig. 3. "Exploded" view of the disassembled mirror illustrates most of the changes made in the outer enclosure and metal frame.

ance to slip the rim over the outer enclosure when the mirror unit is reassembled.

Next, cut the frame as indicated by the dotted line on Fig. 3, leaving a rim just deep enough to accept the mirror (about $\frac{1}{8}$"). Also cut off the handle along a line $\frac{1}{8}$" below the bottom of the frame (see Fig. 4). As much of the spring catch as possible is removed, and the rest hammered down into the back of the frame to make a flat surface.

Since the old pivot tabs were removed when the frame was cut, it is necessary to add new ones. Solder two metal strips (each about $\frac{1}{4}$" x $\frac{3}{4}$") to the back of the frame—locating them as shown in Fig. 4; each strip should extend about $\frac{1}{4}$" above the frame top. Then cement the mirror in place on the front of the frame.

The next step in the modification is to make new pivot slots in the top of the outer enclosure of the mirror assembly. These slots (see Figs. 3 and 5) will accept the pivot tabs previously soldered to the back of the frame. They should have the proper width and placement to mate with the tabs when the frame is installed, and they should be placed about $\frac{1}{4}$" behind the front edge of the enclosure.

Now mount the mirror solenoids on the back of the enclosure (see Figs. 5 and 6). These are 6-volt d.c. units removed from old relays. (If you prefer, you can buy them separately—see Parts List.) Six-volt solenoids were used, even though the supply voltage is 12 volts, to get as much "pulling power" as possible. The author found that no overheating was evident—even during periods of extended use.

Mechanical details of the mounting will depend pretty much on the solenoids you use. The author made up a couple of "U" brackets, as shown in Fig. 6, and screwed the solenoids to the brackets via tapped holes already in the solenoid cores. A chassis punch was employed to cut 1"-diameter holes in the back of the mirror enclosure to pass the "business ends" of the solenoids.

The location of the solenoids on the back of the enclosure is not critical, so no dimensions are given. What *is* important is that they extend into the enclosure just far enough to touch the rear

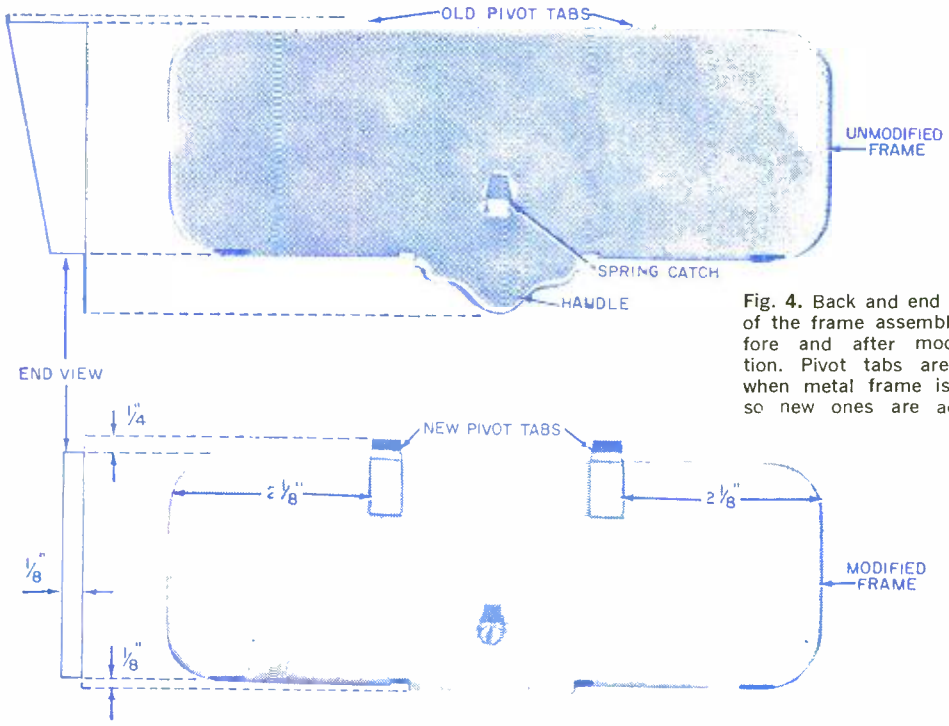


Fig. 4. Back and end views of the frame assembly before and after modification. Pivot tabs are lost when metal frame is cut, so new ones are added.

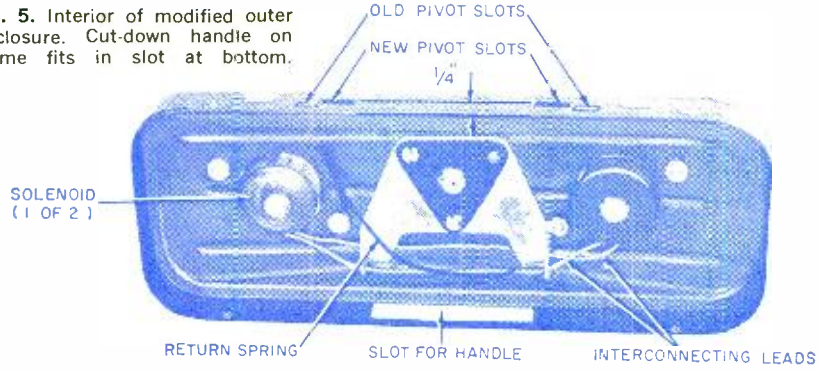


Fig. 5. Interior of modified outer enclosure. Cut-down handle on frame fits in slot at bottom.

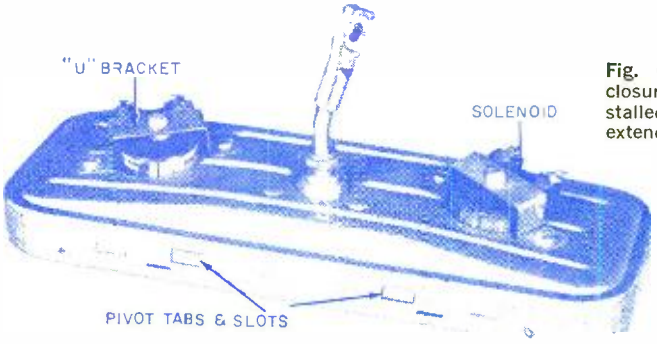


Fig. 6. Exterior of enclosure with frame installed (note pivot tabs extending through slots).

of the frame when the latter is pushed back all the way. After making the large holes to pass the solenoids, temporarily install the frame (see instructions below) so that you can measure the clearance.

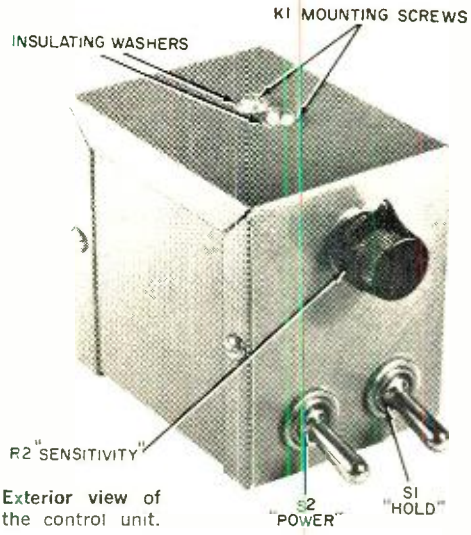
With the solenoids mounted, a return spring should be installed. The swivel spring already in the enclosure (see Fig. 2) is not suitable and should be removed. Make a new spring by bending double a 4" length of #16 steel wire and anchoring it to the back of the enclosure as shown in Fig. 5.

Fig. 7. First step in reassembly of mirror is to push pivot tabs on frame through matching slots in enclosure.

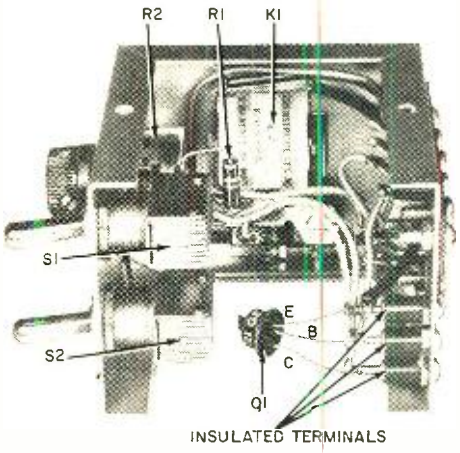
Now all you have to do before reassembling the mirror unit is to wire the two solenoids in parallel. Run the interconnecting leads inside the enclosure as illustrated. The cable connecting the mirror and control units will be installed later and can be wired to the terminals of whichever solenoid is most convenient.

To reassemble the unit, push the pivot tabs on the mirror frame into the slots in the top of the enclosure (Fig. 7), then pry the cut-down handle into the slot in the bottom of the enclosure. Bend the tabs over to hold the frame securely in place. The mirror frame should now pivot smoothly within the enclosure, the cut-down handle serving as a stop; and when the mirror is pushed back and released, it should return quickly to its normal position. Finally, install the outer-rim-and-glass assembly on the enclosure.

Building the Control Unit. The control circuitry is housed in a 2¾" x 2⅛" x 2¾" utility box. Two screw-terminal strips (one 2-lug, one 4-lug) are used to make connections from the control unit to the mirror solenoids, photocell, and battery. The terminals are keyed with corresponding numbers on the pictorial and schematic diagrams.

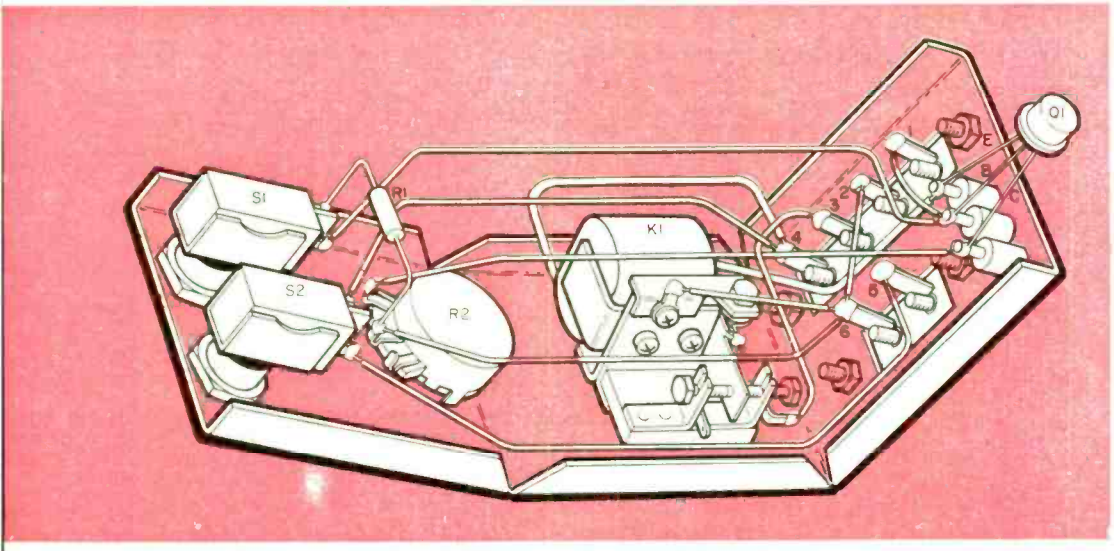


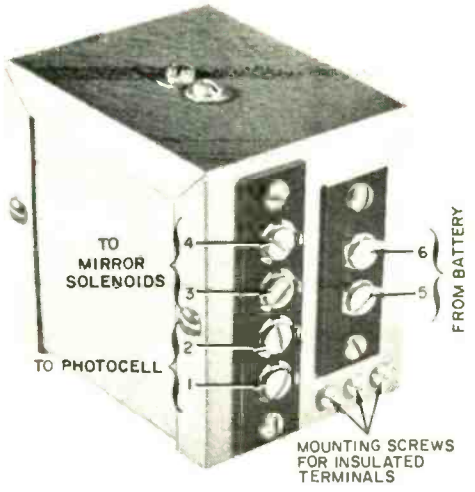
Exterior view of the control unit.



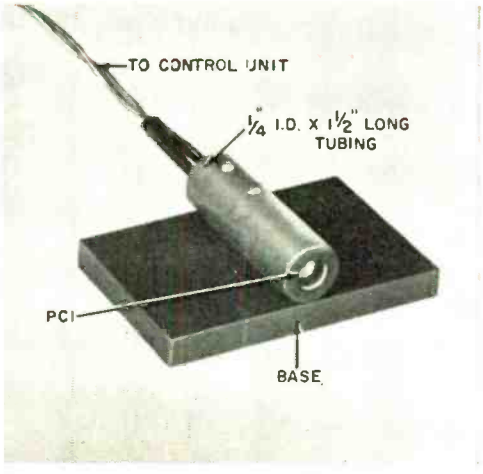
Interior view shows simple construction and uncluttered wiring. Frame of K1 is insulated from box.

Install the parts as illustrated in the photographs and pictorial diagram. Because the entire circuit floats above chassis ground (to allow operation from either a positive- or negative-grounded auto electrical system), the frame of relay *K1* must be insulated from the box. Use a piece of fiberboard between relay





Numbers on terminal screws of control unit are keyed to pictorial (above) and schematic (p. 63).



Method of mounting photocell PC1. The cell is set back about a quarter inch from end of the tubing.

frame and box, and place insulating washers under the heads of the mounting screws. The mounting holes should be made large enough to prevent any contact between screws and box.

Transistor *Q1* is mounted, by its leads, on three insulated terminals. These terminals also serve as lugs to connect the transistor into the circuit. All wiring is point-to-point and lead dress is not critical.

Installation and Operation. First install the control unit in some convenient location. You may want to strap it to the steering column, for example, or bolt it under the dash. If you have a negative-ground electrical system, ground terminal 6 of the control unit to the car body and wire terminal 5 to a convenient battery lead; if your electrical system is positive-grounded, ground terminal 5 and connect 6 to the battery lead.

Install the modified mirror assembly in place of your original rear-view mirror, following the instructions supplied by the manufacturer. Then run a cable from the mirror solenoids to terminals

(*Continued on page* 105)

Hi-Fi Lab Check

EICO ST-84 Stereo Preamplifier

Manufactured by EICO Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, N.Y.

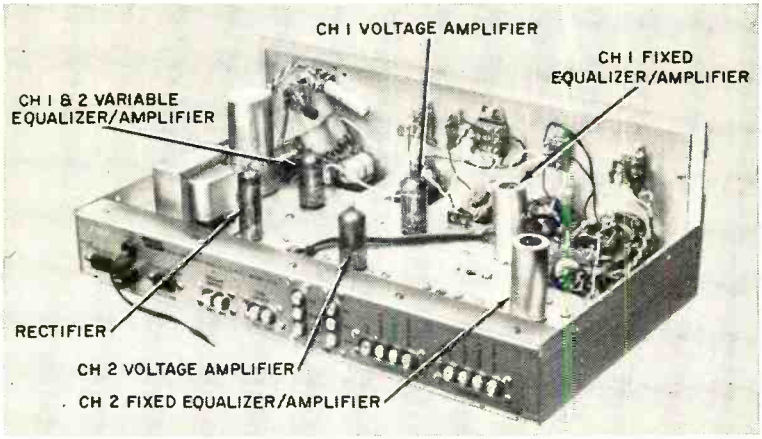
Prices: $59.95 (kit); $89.95 (factory-wired)

THERE ARE many arguments both for and against separate preamplifiers as opposed to those in integrated amplifiers. The EICO ST-84 preamplifier is a complete hi-fi/stereo control center that may win the day for separate preamps. It has practically every control and switching facility.

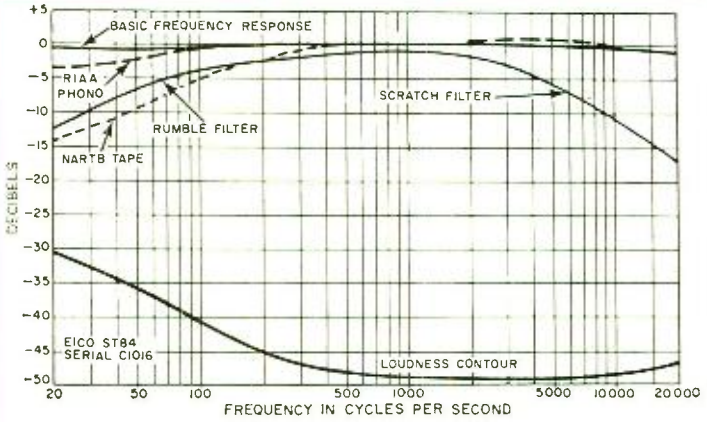
Low-boy front-panel styling and full depth design provide a large chassis deck area for mounting of parts. Putting the ST-84 together is a 10½-hour pleasure, due mainly to the well-prepared construction manual and accessibility of parts.

CIRCUIT REPORT: The ST-84 employs five ECC83/12AX7 triode sections per channel. The first two triode sections provide low-level signal boost with fixed feedback equalization for phono and tape inputs. The following two sections give added high-level signal boost needed to make up for losses due to the balance, level, loudness, rumble, and scratch networks. The last triode section incorporates the bass and treble tone controls in its feedback network. Impedance at the preamp's output terminals is 8000 ohms, permitting cable lengths to the power amplifier to be as long as 10 feet if needed.

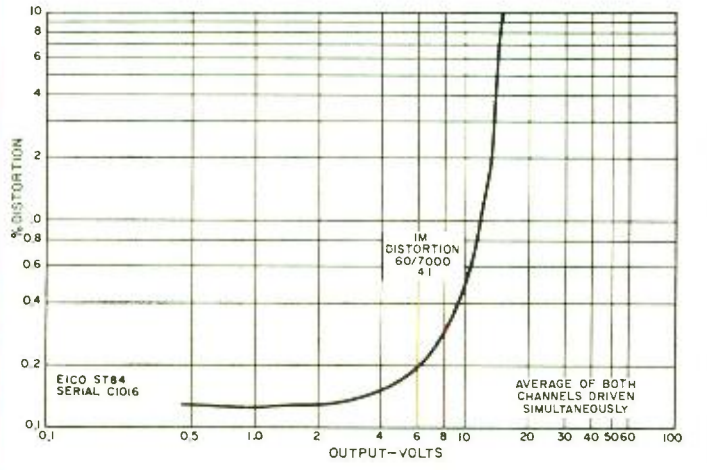
The "Mode" and "Selector" switches on the front panel allow each input (tape, phono, tuner, and other auxiliary equipment) to be programmed for either stereo or monophonic output and also



Note the wide-open spaces between parts on the chassis top deck. This extra elbow room makes wiring easier and may be the reason for the ST-84's low crosstalk figure (less than −35 db).



Frequency response for the ST-84 is flat in the 20-20,000 cycle range within ±0.5 db. Other curves at top show effects of equalization and filter networks. Loudness curve was plotted with audio level control set at mid range (−30 db).



IM distortion level was better than the manufacturer's claim and dropped noticeably when only one channel was driven. Since the average power amplifier provides full output from an input signal of 2 volts or less, the IM introduced by the ST-84 is very low.

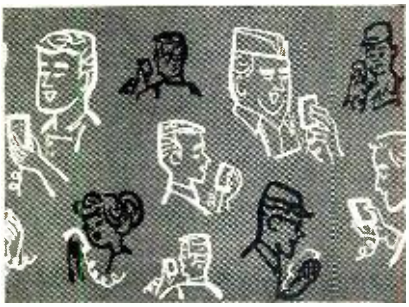
provide such features as stereo reverse, channel balancing, and separate or summed channel selection for both outputs. A row of slide switches lets you select 7½/15 or 3¾ NARTB tape equalization, monitor tapes, turn loudness on and off, as well as select high and low filters. The power switch is ganged to the Channel 2 treble control.

HIRSCH-HOUCK LAB CHECK: The basic frequency response of the preamp is very flat, within ±0.5 db from 20 to 20,000 cycles. Tone controls cover ±15 db at 50 cycles and ±16 db at 10,000 cycles with no effect on the level of the mid-range frequencies. Hum levels in each channel are about −60 db on the phono inputs and −70 db on the *AUX.* inputs—both quite low.

The loudness control drops the overall volume 10-20 db. Note that the user must be sure the "Level" control is turned down before switching the loudness control off to avert the ear-shocking 20 db jump in volume which would otherwise follow.

In the EICO specifications for the ST-84, harmonic distortion is claimed to be 0.05% at 2 volts out. The equipment used to make the Hirsch-Houck test had a residual distortion level of 0.10%, and the ST-84 checked out to be 0.13%—proving that the manufacturer's claim was just.

IN CLOSING: The ST-84 is a "pro" type audio control center that anybody with a soldering iron and hand tools can assemble and "get working" at home. —30—



On the Citizens Band

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

SEVERAL THOUSAND CB'ers across the nation agreed many transmissions ago that channel 9, as a National Calling Channel, could be as beneficial to CB operators as a "toll-way" from Maine to California would be for motorists. Without trying to incite a CB riot, or re-create the debates of a couple of seasons ago over this voluntary move by Citizens Banders, we can't help noticing how the "swing to nine" idea seems to have gradually taken shape.

Organizations that had not previously adopted a calling channel have been proposing channel 9 for the purpose, and groups that originally started with another channel have since switched to 9. For example, the Citizens Radio League of Chicago recently adopted such a proposal, and made the following explanation to its members:

"... There is an organized effort across the nation . . . to establish channel 9 as a monitoring and calling channel, which means, briefly . . . make your call on channel 9 . . . when your party answers . . . 10-41 to any of the other 22 channels . . . This leaves one channel (9) . . . free for any possible emergency.

"This movement is gaining momentum every day as more individual CB'ers are co-operating . . . The advantages of a recognized National Calling Channel are obvious at both the local level and on a national scale.

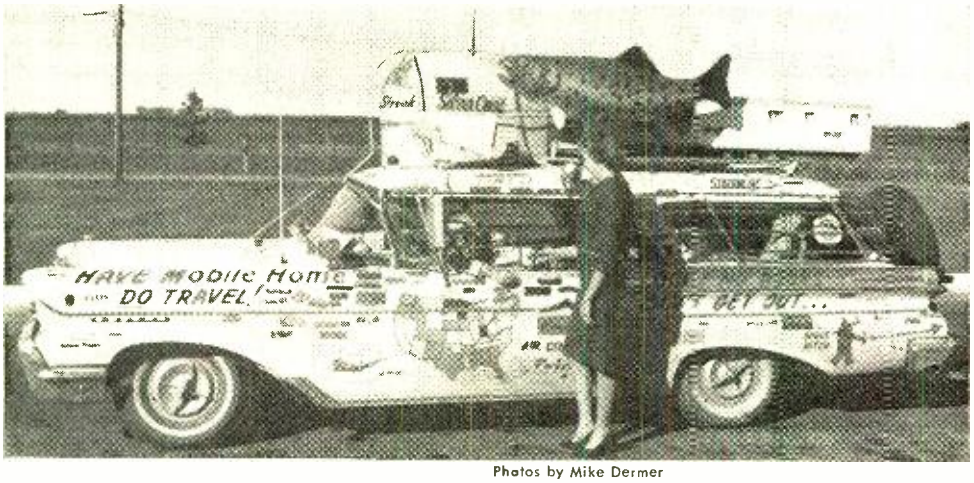
"We realize that many CB'ers now using channel 9 may consider this . . . an unreasonable request, or argue that they do not possess other channels. But, crystals are not too costly, and in all fairness, if one can afford the price of a rig, a few extra crystals are not out of reach. We ask that you give serious consideration to this proposal, and weigh the advantages of such a plan.

"Your club believes that this service in our area can assist those already operating, and perhaps someday one of us may require this monitoring service for some worthy cause, and be thankful we undertook this operation. . . ."

Any comment from our readers on this subject?

No Riders Allowed. Thanks to Ray Hughes of Monroe, Wis., we had an opportunity to chat with Don Haynes, whom you can almost see (on the next page) *sealed* within his station wagon.

Wiener roast rouses "Rebel Rousers"—no less than 85 CB'ers attended the Rebel Communications Association's first sausage cook-out last October. Shown at the affair (left to right) are Joel Harper, director; "Pat" Patterson, secretary; Larry Rumsey, president; and members Dan Orton, Frank Bingham, and Bill Nance. Secretary "Pat" asked us to announce that the "R.C.A." mailing address has been changed to P.O. Box 6487, Marietta, Georgia.



Photos by Mike Dermer

Got the urge to travel? Well, you might do what Don Haynes did—lock yourself up along with your CB set in a Mercury station wagon and tour the good ol' U.S.A. Don's car (above) has no doors and the windows are barred. He's been in there for the last 48 months and plans to go another 24 moon cycles before he quits. The photo at right tells only part of the story of Don's four-year traffic tour to date.

Besides driving the only station wagon without doors that we've ever come across, we feel quite confident that Don's particular need for CB equipment is distinctly different than that of any other user on the band.

Don was sealed inside of his car on October 25, 1958, at Sheridan, Wyo. He intends to remain in the car for a total of 72 months, 48 of which are already behind him. With a running account of his six-year trip painted on the car hood, Don had already traveled some 282,000 miles when we saw him. He had visited 48 of the 50 states, averaging eight miles per gallon of gas, and had spent a total of $7,617.13 for repairs on the vehicle.

Don's 8540-pound home-on-wheels includes a full-size bed, a chemical "little boy's room," two TV sets (one mounted on the dash), a radio, hi-fi record player, folding bathtub, air conditioning, gold drapes, a public address system, 110-volt electric system, hot and cold running water, a "penthouse" so that he can stand up, electric heat, an electric blanket, fire extinguishers, wall-to-wall carpeting, portable typewriter, coffee maker, electric razor, motion picture cameras, and a Citizens Band transceiver! The sealed car is valued at $13,000.41 with all its equipment.

How does Don use his CB gear? When we asked him this question, he stated that it had been invaluable coast-to-coast because of the direct communication facilities it afforded between his car and the young lady's auto that follows close behind. In the event of a breakdown, change of plans, or message of any importance along the way, he merely intructs the young lady via CB.

Don has made a standing offer to anyone who can take him out of his sealed car without cutting, breaking, bending, or causing glass to be broken: $5,000.00, a 55' x 10' mobile home, a new speedboat, a new station wagon, and an additional

Presenting the officers of the "Static Pushers" CB club of Rockford, Illinois: (left to right, seated) Mardelle Hendel, vice chairman; Raleigh Ingram, chairman; Winogene Nichols, secretary; (left to right, standing) Dick Burman, treasurer; and Jack Waterson, editor of the "Static Pusher" newspaper. Prefer call signs? They are, in the same order, 18Q0299, 18Q6890, KHA2036, 18Q7591, and 18B1902.

travel trailer. Watch for him—we didn't get him out!

The "Static Pushers." Those of you who have been asking how to get a CB club started, and what to do after you've found enough interested CB'ers, might try this one on for size. Jack Waterson, 18B1902, publicity chairman of the recently organized "Static Pushers" Citizens Band Radio Club of Rockford, Ill., sent us a neat package of information regarding their brief club history as well as their future plans.

The first few meetings of the "Static Pushers" were informal gatherings covering the "idea and planning" stages of organizing a CB club. Later, the club name was drafted, along with a constitution, and officers were elected. The main purposes of the "Static Pushers" are:

(1) To promote fellowship and good will between users of CB equipment.

(2) To provide a place for the free interchange of information pertaining to CB radio; specifically, on equipment, rules and regulations of the band, and uses of CB radio.

(3) To adopt and promote standards that will make the band more useful and orderly.

(4) To offer voluntary communications service to the general public and various organizations.

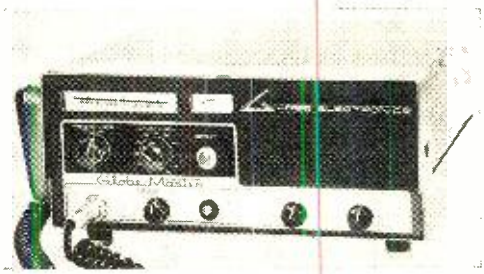
Until they're able to find a permanent base, the "Static Pushers" are holding their meetings at different places every other Saturday. And they have also been busy with picnics, tours, and attendance at several jamborees.

The club's most important project at present is the installation of a monitoring base station to be handled by John Schleicher, a paraplegic, in Rockford. John will monitor channel 9 in the area, relaying messages and giving assistance to CB'ers traveling through. All equipment for the monitoring station is being furnished by the club.

The "Static Pushers" have already published four interesting issues of their newspaper. It's mimeographed on a colored paper that accepts ink on both sides without print-through—a good economy feature.

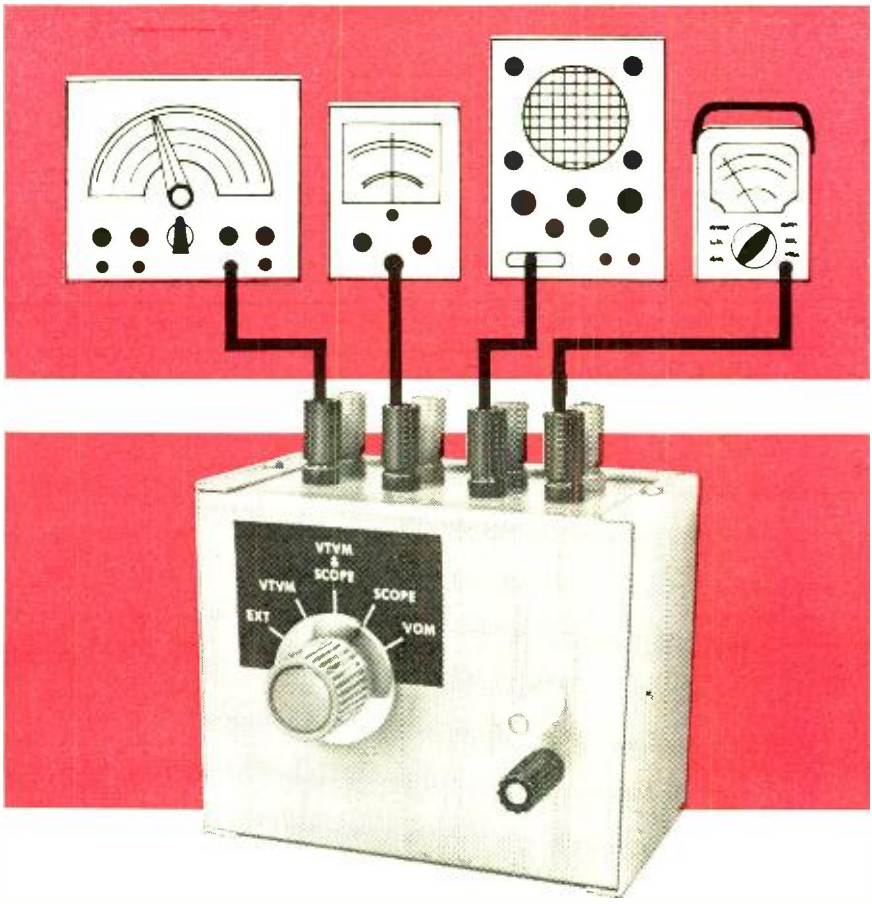
Remember—you can start small! But be sure you're organized. Have a purpose and a goal—then think about enlarging the organization. It worked for the "Static Pushers." Try it!

"Globe Master." Announcement of the "all-new" "Globe Master" de luxe CB transceiver was made recently by the Globe Division of GC Electronics Co. (400 S. Wyman St., Rockford, Ill.) The "Globe Master" has provisions for 11 crystal-controlled channels for transmitting, using fundamental type crystals. The receiving end features a dual-conversion superheterodyne with a choice of 11 crystal-controlled channels or tunability over all channels.



Added general features include a hinged cabinet (to facilitate servicing and adjustments), accessory socket on rear panel, series gate noise limiter, external speaker jack, and transmit light to indicate transmitter keying. The entire receiver is voltage-regulated for

(*Continued on page* 95)



TEST EQUIPMENT CONTROL CENTER

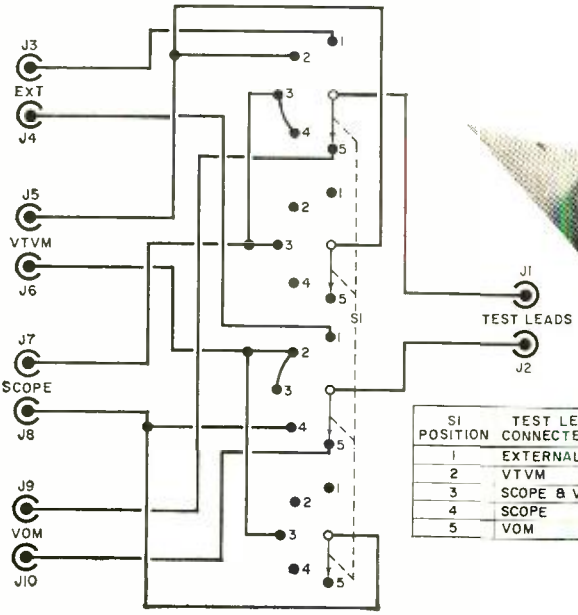
By ROBERT J. SPENCER

TANGLED test instrument leads is the price usually paid by the home experimenter or serviceman for having a fully equipped workbench. Selecting the particular leads he wants to use may be difficult or impossible, depending on how severely the leads are tangled. To solve this problem, the author constructed a simple switching box, tabbed the "Test Equipment Control Center," and eliminated all but two test leads—which are used for all types of measurements.

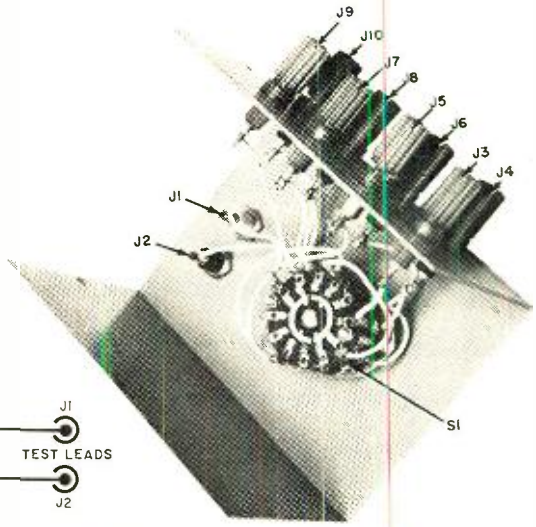
The photo above shows how the unit works. Four pieces of test gear (signal generator, VTVM, oscilloscope, and VOM) connect to binding terminals on the top of the unit. With the test equipment seated on a shelf, and the "control center" located at the rear of the workbench, all the interconnecting leads can be positioned out of harm's way, keeping the working area clean.

The two test leads connect to the front panel binding posts, and they

To learn how the "control center" works, trace the circuit for each test instrument input and switch setting. Additional switch positions can be added to box if more than five functions are needed.



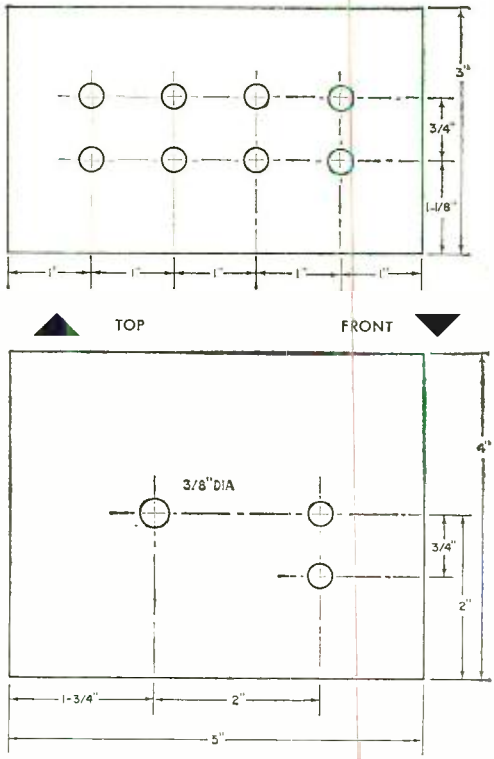
S1 POSITION	TEST LEADS CONNECTED TO:
1	EXTERNAL
2	VTVM
3	SCOPE & VTVM
4	SCOPE
5	VOM



Binding posts J3-J10 are mounted on top of aluminum chassis box. Keep leads relatively short; shielded wire is not required except for extremely low level signals. Screw-type terminal blocks can be used instead of binding posts if you prefer. To make your unit look like the author's, follow detail drawings below; unmarked holes are $\frac{1}{16}$" in diameter.

PARTS LIST

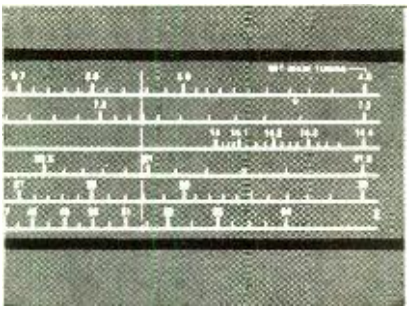
J1, J3, J5, J7, J9—Binding post, red (E. F. Johnson Type 111-102 or equivalent)
J2, J4, J6, J8, J10—Binding post, black (E. F. Johnson Type 111-103 or equivalent)
S1—4-pole, 5-position rotary switch (Centralab Type 1013 or equivalent)
1—3" x 4" x 5" aluminum chassis box, gray finish (Bud CU-2105A or equivalent)
1—Knob, optional (National HRS-4, gray)



are all the leads you really need. If you want to make a voltage check in a circuit, just set the rotary switch (*S1*) on the "control center" to *VTVM*; the probes on the bench are now connected to the VTVM. The same is true for the other positions of the switch.

One switch position, marked *VTVM & SCOPE*, connects the inputs to these two test instruments in parallel, so that you can look at a waveform and measure its peak-to-peak voltage. The switch's *EXT* (external) position is used to connect other types of test gear.

Since the unit is light in weight, it's best to screw it to the workbench. And a little black paint and press-type lettering will make your "control center" as beautiful as it is useful. —30—



Across the Ham Bands

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

ARRL NOVICE ROUNDUP COMPETITION

WOULD YOU LIKE to stack your signal and operating skills against those of other Novices in a friendly contest to see who can work the most stations in the same number of hours? Or would you like a golden opportunity to add a number of new states to your states-worked total and become a sharper operator at the same time? Then the 12th Annual ARRL Novice Roundup Competition is for you.

Starting February 2, 1963, at 6:00 p.m., local time, and ending on February 17 at 9:00 p.m., local time, the object of the Roundup is to work as many stations as possible in the different ARRL sections in a maximum of 40 hours. The ARRL will award an attractive 8" x 10" certificate to the highest scoring Novice in each section.

To make contacts, you call "CQ NR" or answer such calls. For example, if your section is Wyoming, you would send "NR 1 Wyoming" to the first station you work. "NR 2 Wyoming" to the second one, and so on. You earn one point every time another station acknowledges receiving your contest (NR) number and ARRL section *and* you acknowledge his contest number and ARRL section.

Novice Station of the Month

Jon Gicker, of Mill Valley, Calif., sent in this month's prize-winning photograph. Although Jon is now WV6TNC, he was both a DX'er and a "rag chewer" during his Novice career—if contacts with places like Australia, Japan, Somoa, and 30 states, plus a Rag Chewers' Club certificate mean anything. The major equipment in his station is a Johnson Viking Ranger transmitter, feeding 40- and 15-meter dipole antennas, and two Hallicrafters receivers—an SX-111 and an S-85.

Jon will receive a one-year 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 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. Entries should be sent to Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana.

Annual Edison Award Terminated

After 10 years of sponsoring the annual Edison Radio Amateur Award, presented for outstanding public service, the General Electric Company has terminated the award. In explaining the action, L. Berkley Davis, Chairman of the Edison Award Council, stated that due to the swift growth of amateur radio and the complexity of the public services which amateurs perform, it is no longer possible to select a single "Ham of the Year." Also, the company feels that "the amateur service is now definitely established in public affairs and in the public mind as a vital national activity."

There is no credit given for partial exchanges.

Your final score will be the number of stations worked, plus the highest speed shown on your ARRL Code Proficiency Certificate (if you have one) multiplied by the number of ARRL sections worked. For example, if you work 10 different stations in six ARRL sections and have a 10-wpm Code Proficiency Certificate, your final score will be: $(10 + 10) \times 6 = 120$ points.

Novices participating in the competition may operate in any or all the Novice bands; and c.w.-to-c.w., c.w.-to-phone, and phone-to-phone contacts all count. So do contacts with Canada, Puerto Rico, and the Canal Zone. But cross-band contacts (such as a Novice on 3.7 mc. working a buddy on 14 mc.) do NOT count. However, you'll want to check the frequencies immediately adjacent to the different Novice bands for calls from high-power General's, who will be there to help you run up a score.

Why not drop a post card to the American Radio Relay League, Inc., 38 La Salle Rd., West Hartford, Conn., and ask for some Novice Roundup log sheets and a free ARRL section map. Then show the world what you can do. Immediately after February 17—within two weeks at the most—mail your score to the ARRL. Even if you don't win the certificate for your section (and who says you won't?), the QSL cards from the new states you work will look good on your shack wall.

SIX-BAND NUVISTOR BOOSTER

If you own an old or inexpensive ham receiver, you already know that their two common disadvantages are low gain and poor signal-to-noise ratio on the higher frequency bands. Adding this home-brew tuned r.f. booster with band-switching won't make a $500 receiver out of an "old dog," but it *will* put new "zip" into any receiver suffering from these drawbacks.

The new RCA 7587 nuvistor tetrode insures high gain and high signal-to-noise ratio over the booster's entire tuning range, making it useful all the way from 80 to 6 meters. For that matter, a selector switch setting can be "designed in" to extend coverage to the broadcast band, if desired.

Construction. In the model shown at right, all components except coil *L3* are mounted on the "frame" of a 4" x 4" x 2" aluminum utility box. (Although *L3* is mounted alongside this unit, it would be a better idea to support it on a bracket screwed to the bottom of the box.) The construction technique used makes it easy to reach all parts from either side of the box, in spite of the booster's compactness.

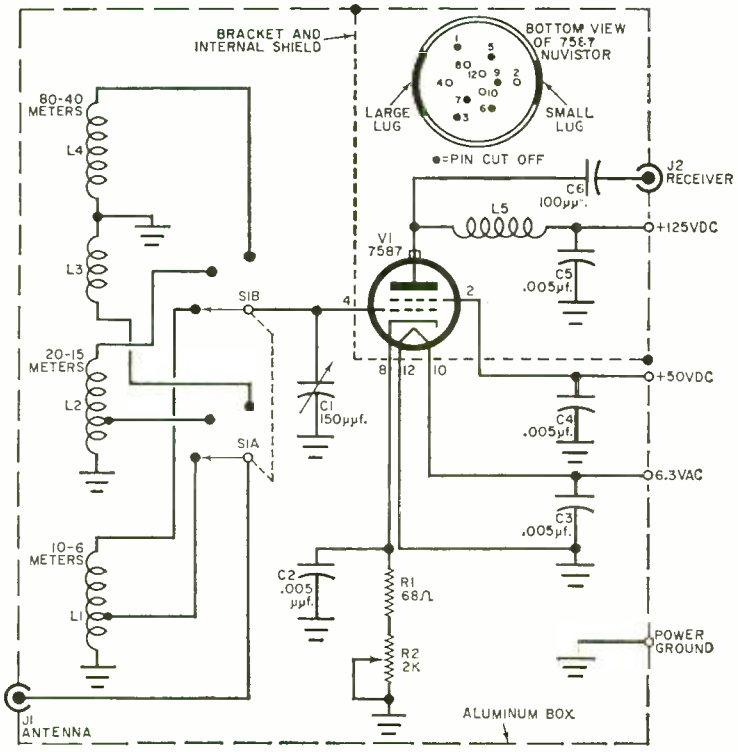
Exact parts placement isn't critical as long as leads are kept short, but it's a good idea to keep the bottom rear quarter of the box free of parts to accommodate a simple power supply. An appropriate power supply will be described next month for those who prefer not to obtain the booster's power from the receiver.

The bracket used to support the nuvistor socket also serves as an internal shield to isolate the booster's output circuit from the remainder of the unit. It is made from a 3½" x 1¾" aluminum sheet, bent in half along its shorter dimension to form a right angle. Two ¼" mounting lips are bent at each end, as shown in the photo.

Coils *L1* and *L2* are "air-wound" for highest efficiency; coils *L3* and *L4* are slug-tuned for compactness. The input signal is fed into coils *L1* and *L2* via a tap on each one, but additional input winding (coil *L4*) is placed on coil *L3*; a few drops of cement will hold this winding in place. (Refer to the Parts List for additional coil data.)

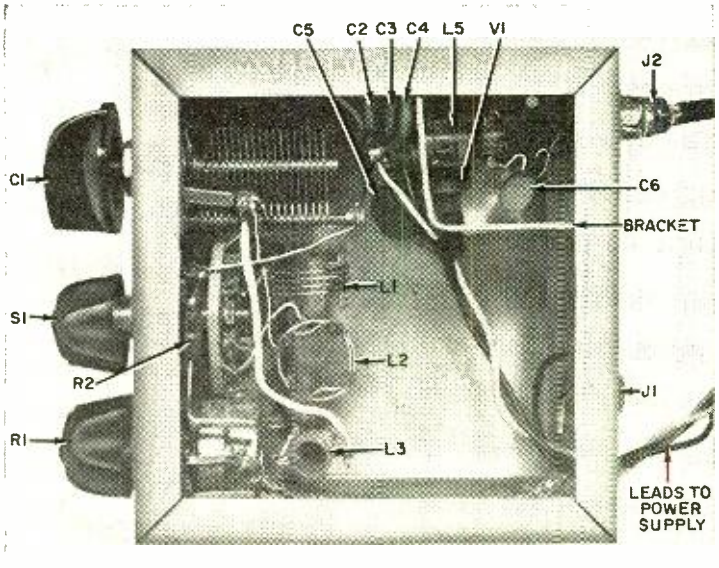
Operation. Connect the booster's heater and plate supply terminals to a suitable power supply. Connect its output jack (*J2*) to the receiver's antenna/ground terminals through a length of RG-58A/U

(*Continued on page* 100)



Nothing more than a tuned-grid r.f. amplifier, the multi-band booster uses a low-noise nuvistor to pep up those DX signals.

Bracket used to mount V1 socket also serves to isolate plate circuit coupling components from remainder of booster circuit.



PARTS LIST

C1—150-μμf. midget variable capacitor (Hammarlund HFA-140A or equivalent)
C2, C3, C4, C5—0.005-μf., 600-volt ceramic disc capacitor
C6—100-μμf., 600-volt ceramic disc capacitor
J1, J2—RCA phono jack
L1—4 turns of B&W 3003 "Miniductor" coil stock or equivalent (½"-diameter, 16 turns per inch) tapped 1¼ turns from ground end
L2—10 turns of B&W 3003 "Miniductor" coil stock or equivalent (½"-diameter, 16 turns per inch) tapped 2¼ turns from ground end
L3—10-25 μh. adjustable r.f. choke (Miller 4205, Stancor RTC-9105, or equivalent)
L4—10 turns of #30 enameled wire close-wound ⅛" below L3 on same coil form
L5—50-μh. r.f. choke (National R-33, Millen 34300-50, or equivalent)
**L6—120-330 μh. adjustable r.f. choke (Miller 4208, Stancor RTC-9107, or equivalent)*
**L7—15 turns of #30 enameled wire close-wound ⅛" below L5 on same coil form*
R1—68-ohm, ½-watt resistor
R2—2000-ohm potentiometer
S1—Double-pole, 3-position rotary switch (make from Centralab 2003 or equivalent)
V1—7587 nuvistor (RCA)
1—4" x 4" x 2" aluminum utility box (Bud AU-1083 or equivalent)
1—Nuvistor socket (Cinch-Jones 133-65-10-001)
Misc.—Knobs, wire, RG-58/AU coax cable, plate cap terminal, etc.

**Optional broadcast-band coils*

Transistor Topics

By **LOU GARNER**, Semiconductor Editor

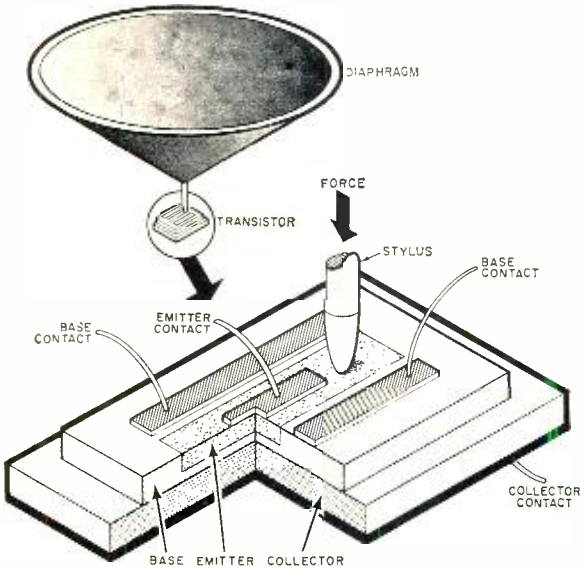
A NEW MICROPHONE that acts as its own amplifier is the invention of two Bell Telephone Laboratories scientists, Mathew E. Sikorski and Peter Andreatch Jr., assisted by Howard Christensen and Anthony Grieco. The unit contains no coils, permanent magnets, carbon granules, delicate ribbons, or fragile piezoelectric crystals. Instead, its main parts are a diaphragm, a sapphire stylus, and a junction transistor.

Until now, the most sensitive microphone has been the carbon telephone transmitter. In comparison, the new transistor mike is at least four times more sensitive, yet requires from 20 to 100 times less current, and has an efficiency up to 100 times greater than a typical carbon mike. Its signal-to-noise ratio of 54 db is also far superior to that of carbon types.

An experimental model of the transistor microphone is shown in use in the photo below, and its basic components and construction at the left. A junction transistor (this is an *npn* type, but a *pnp* unit could be used) is the heart of the instrument. The remaining components are a small diaphragm and a pointed stylus, the latter being quite similar to the styli used in ordinary phonographs. The device is assembled in such a way that the stylus bears against the transistor's emitter electrode.

In operation, sound waves in the air start the mike's diaphragm vibrating, causing the stylus to move up and down. The point of the stylus presses against the emitter region, developing stresses which are transmitted through the emitter to the transistor's two junctions, bringing about a change in the resistance across the junctions.

This change in junction resistance is



The piezoelectric properties of a transistor are the "secret" behind a new type of microphone (above) developed by Bell Telephone Laboratories. Drawing at left shows the three principle components—a diaphragm, a stylus, and a transistor.

analogous to what happens when a signal is applied to the base/emitter circuit of a transistor amplifier, and a similar result is obtained. With suitable bias currents applied, an amplified signal is developed in the collector/emitter circuit which corresponds to the changes in stylus pressure and thus to the sound waves striking the diaphragm.

The idea that a transistor could be used as a pressure transducer isn't new. As far back as 1957, Warren P. Mason of Bell Telephone Laboratories (BTL) suggested that the piezoresistive properties of some semiconductors could be used for converting "mechanical pressures" into electrical signals. Somewhat later, an experimental semiconductor microphone was made by F. P. Burns, also of BTL.

Research on transistor microphones has been carried forward independently and concurrently by both BTL and the Raytheon Company. In August of 1962, at the Western Electronic Show and Convention, W. Rindner and R. Nelson of Raytheon described a semiconductor strain transducer based on the sensitivity of shallow *pn* junctions to suitably applied stress. Shortly thereafter, the BTL transistor microphone was discussed by its co-inventors at a meeting of the American Physical Society.

After that, one development followed another quite rapidly. In September of last year, Dr. Rindner and R. Nelson of Raytheon disclosed that they were working on a very small transistor microphone of high sensitivity; they described their unit in the October issue of the *Proceedings of the IRE*. In the meantime, the BTL device was discussed in the October issue of the *Review of Scientific Instruments*, another highly technical journal, and both the Raytheon and BTL instruments were covered in detail in late October at the IRE 1962 Electron Devices Meeting in Washington, D.C.

Although the transistor microphone is still in the developmental stage as this is written, future possibilities are almost unlimited. Theoretically, the device can be made as small as a tiny button, and can be used in such potential applications as telephone transmitters, minute hearing aids, phonograph pickups, hydrophones to detect submarines, or in any other common ways in which standard microphones are employed. One intriguing possibility is its use in "cloak-and-dagger" espionage equipment.

Transistor "Twin" for Tube Manual

"Blood brother" of the famed RCA Receiving Tube Manual, the new RCA Transistor Manual is also intended for students, technicians, and hobbyists. The bulk of the manual is devoted to technical data, of course—in this instance. just about every spec you can think of for 373 different RCA semiconductor devices (including transistors, silicon rectifiers, and tunnel diodes). And that's not all—for, just like the Receiving Tube Manual, the Transistor Manual contains a Circuits Section which presents more than 30 representative transistor circuits, complete with parts lists. Included are a stereo amplifier, an AM/FM receiver, a Citizens Band transceiver, and both broadcast-band and short-wave receivers. The new manual (Technical Series SC-10) sells for $1.50 and is available from your local supply house or direct from Commercial Engineering, Semiconductor Materials Division, Radio Corporation of America, Somerville, N.J.

Readers' Circuits. Many readers have suggested that we feature a receiver circuit employing a crystal earphone rather than the dynamic types more commonly used in transistorized circuits. One reader, George Rollins (Box 204, Winter St., Guilford, Me.), even sent us his pet circuit—the two-transistor AM broadcast-band receiver shown in Fig. 1.

George has used two *pnp* transistors (*Q1*, *Q2*) as capacity-coupled, common-emitter amplifiers; in addition, he has provided a resistive load (*R2*) for the output stage (*Q2*), permitting the use of an inexpensive crystal earphone. Another interesting feature is the antenna connection to the tap on the r.f. coil; according to George, this improves overall selectivity.

In operation, r.f. signals picked up by the antenna/ground system are selected by tuned circuit *L1/C1* and coupled through diode detector *D1* and d.c. blocking capacitor *C2* to the two-stage audio

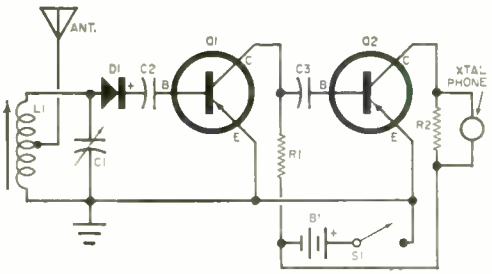


Fig. 1. Novel receiver circuit submitted by reader George Rollins drives a crystal earphone and operates without base bias resistors.

amplifier (transistors *Q1* and *Q2*). Resistor *R1* serves as *Q1*'s collector load, with the amplified signal developed across this resistor coupled through *C3* to the second stage. As noted previously, resistor *R2*, shunted by the crystal earphone, serves as *Q2*'s collector load. Operating power is supplied by a 3-volt battery, *B1*, controlled by an s.p.s.t. switch, *S1*.

Standard components are used throughout. Coil *L1* is a Superex VLT-240 transistor Vari-Loopstick, and *C1* is a conventional 365-$\mu\mu$f. tuning capacitor. A 1N34 or 1N34A diode can be used for *D1*, while *Q1* and *Q2* are both 2N107's. Capacitors *C2* and *C3* can be either small ceramic or tubular paper capacitors rated at 0.05-μf.; working voltage isn't critical. Both resistors (*R1* and *R2*) are ½-watt units, with *R1* rated at 22,000 ohms, *R2* at 10,000 ohms.

Battery *B1* (3 volts) can be assembled by connecting two penlight or flashlight cells in series. You can use a toggle, slide, or rotary type for control switch *S1*. And while George employed a Lafayette MS-111 crystal earphone, similar units should work as well.

The average builder should have no difficulty duplicating George's circuit. The unit can be assembled on a small chassis, on fiberboard, on an etched circuit board, or in a small plastic or wooden case; breadboard construction can also be used, if preferred. Wiring and layout aren't critical, although a moderately long (6 to 20 feet or so) external antenna will give best results.

You may have noted that *Q1* and *Q2* are operated without base bias resistors. George has relied on "self bias" for proper operation. With some transistors, however, the addition of suitable bias resistors may be desirable for optimum performance. Half-watt units can be used, connected between each transistor's base electrode and *B1*'s negative terminal. The correct value can be determined by trial and error—generally, values from 100,000 to 470,000 ohms will be suitable.

The wireless microphone circuit illustrated in Fig. 2 was submitted by reader Carl Wellington (44 Market St., Auburn, N.Y.). Carl has used an *npn* transistor (*Q1*) as a modified split-load Hartley oscillator, applying modulation through the base bias network, *R1/R2*; bypass capacitor *C1* prevents attenuation of the audio signal by resistor *R1*. A tuned output load, *L2/C2*, is used, while tapped coil *L1* provides the feedback necessary to start and sustain oscillation. Operating power is supplied by a single 9-volt battery controlled by a push-button s.p.s.t. switch (*S1*).

Suitable for room-to-room broadcasts, Carl's wireless microphone circuit contains readily available components. Resistors *R1* (47,000 ohms) and *R2* (1000 ohms) are both ½-watt units. Inductors *L1* and *L2* are Merit BC-400 tapped oscillator coils, while *C2* is a standard 340-$\mu\mu$f. padder capacitor. A small 10-μf., 10-w.v.d.c. electrolytic capacitor is used for *C1*, and *Q1* is a 2N168 transistor. Almost any standard carbon microphone cartridge can be employed; and *B1* can be either a standard 9-volt transistor

(*Continued on page 98*)

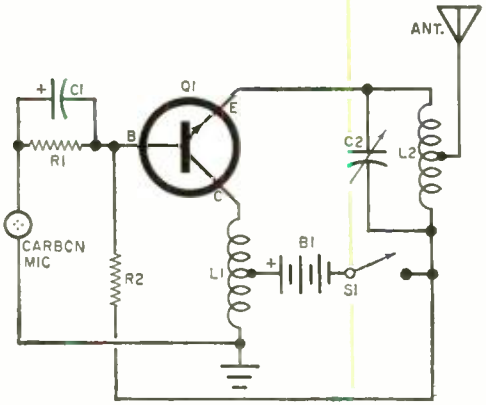
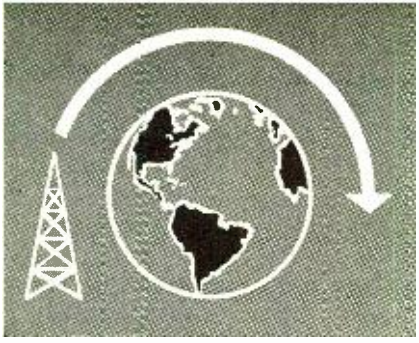


Fig. 2. Signals from this wireless microphone can be heard over nearby broadcast-band receivers. The circuit is the work of reader Carl Wellington.



Monthly Short-Wave Report

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

RADIO SWEDEN

"THIS is *Radio Sweden*" introduces the International Service of the Swedish Broadcasting Corporation. The growth of this service has been truly rapid. It began in 1947 with newscasts in English and German which were transmitted from two 12-kw. units at the Horby station. Only five years later, in 1952, the two modern 100-kw. transmitters now in use were completed, enabling *Radio Sweden* to reach listeners the world over.

As soon as the new transmitters were installed, *R. Sweden* began short-wave broadcasts in English (both American and British style, according to the station), German, French, Spanish, Portuguese, and Swedish. Since then, however, the French has been discontinued. And a far greater emphasis has been placed on the transcription service which produces programs on recordings and distributes them to stations in other countries for transmission. This did not stop the short-wave service, however—it continues to transmit over 6200 hours yearly.

The change of emphasis grew out of the fact that reception conditions are—at times—irregular and often quite unsatisfactory. The transcription service, therefore, had greater possibilities for reaching more listeners. But the contents of the programs were not radically changed even though the method of reaching listeners was altered. Foremost in programming are various features about Sweden and Swedish conditions, and interesting reports on the stories behind events in that country.

About 300 programs are produced annually by the transcription service, of which over 200 are destined for the

Some of the people behind Radio Sweden's English-language programs are Tony Baird (above), Al Simon, Trevor Williams, and Marjorie Lunden.

United States. Several of these programs are copied after their arrival in the U.S. and transmitted by a large number of stations. In a typical one, short interviews and reports on current events are interspersed with musical interludes. Others range from discussions on holidays in Sweden to "magazine-type" programs. In addition, the International Service also contributes frequent programs on current events to the Canadian Broadcasting Corp. in Montreal; plus a number of French-language programs which are produced in Sweden.

The short-wave broadcasts from *R. Sweden* to the United States, in both Swedish and English, are beamed separately to the East and West Coasts. The East Coast of the U.S., incidentally, is about the only part of the world with the opportunity to listen to programs from Sweden during the morning hours. Reception conditions in many other parts of the U.S. are quite poor, depending on their distances from Sweden, and there is often heavy interference from stations on or near the same wavelengths as those used by *R. Sweden*. As a result of the international survey of wavelengths, however, it is hoped that something may be done for listeners in America who want to hear these programs.

Radio Sweden's present s.w. schedule, in effect until March 2, 1963, is as follows: to Western N.A. in Swedish at 2130-2215 and in English at 2215-2245 on 9605 kc.; to Eastern N.A. in English at 0900-0930 on 17,840 kc., in Swedish at 2000-2045 and in English at 2045-2115 on 6065 kc. Other English transmissions: to Africa at 1245-1315 and 1445-1515 on 11,705 kc.; to Europe at 1700-1730 on 6065 kc.; to the Middle East at 1115-1145 on 11,705 and 6065 kc.; to South Asia at 0945-1015 on 15,240 and 9660 kc.; and to the Far East at 0730-0800 on 11,805 and 9620 kc.

The *National Program* is also transmitted on the short waves over one of Horby's 100-kw. outlets. Non-directional, it can be favorably heard in Europe, parts of the Middle East and Africa, and in Atlantic Ocean areas at 0000-0400 and 1200-1630 on 6065 kc., and at 0400-0715 on 9620 kc.

(*Continued on page* 110)

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

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

COUNTRY	STATION	FREQUENCY *(kc.)*	TIMES *(EST)*
Australia	Melbourne	17,840, 15,315 9580	2030, 2130, 2230 0745
Bulgaria	Sofia	9700	1900, 2000, 2300
Czechoslovakia	Prague	15,285, 11,990, 9795, 9550, 7345	2000, 2330[1]
Denmark	Copenhagen	9520	2100, 2230
East Congo	Leopoldville	11,755	1630, 2100, 2230
Hungary	Budapest	11,890, 9833, 9770 9833, 9770, 7220	1900 2230
Italy	Rome	11,905, 9575	1930, 2205
Netherlands	Hilversum	9715, 6085 6035, 5985	1625 (ex. Sun.) 2030 (ex. Sun.)
Portugal	Lisbon	6185, 6025	2105, 2305
Spain	Madrid	9360, 6130	2215, 2315, 0015
Sweden	Stockholm	17,840 9605 6065	0900 2215 2045
Switzerland	Berne	11,865, 9535, 6165	2030, 2315
USSR	Moscow	9650, 9570, 7330, 7320, 7290, 7280, 7250, 7240, 7200, 7180, 7170, 7150, 7130, 6100, 6070, 5960[2]	1700, 1900, 2000, 2100, 2300, 0000, 0040
West Congo	Brazzaville	11,725	2015
West Germany	Cologne	9735, 5980 9605, 6145 9735, 6110	1530 1920 0000

1. At 2330, 11,745 kc. replaces 15,285 kc. *2. Not all channels are in use at any one time.*

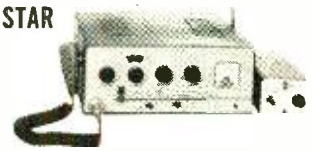
Others claimed to have selective calling systems, but Monocall by Metrotek is the only UNIVERSAL selective calling system acclaimed by the industry as the standard of excellence.

The Monocall Encoder/Decoder is the most advanced selective calling device designed and is now available for just $79.95; encoder only $39.95.

Monocall plus any Metrotek CB transceiver can provide you the ultimate in personal, point-to-point communications. Monocall may also be adapted to other transceivers. Silence the noisy chatter when you're not interested and let Monocall by Metrotek listen for you.

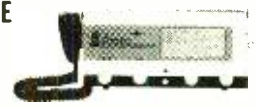
For complete information on the inexpensive selective calling system that is operational now . . . not on the drawing board or getting bugs ironed out . . . just clip the attached coupon and we'll send you complete technical data.

METROSTAR



Monocall plus Metrostar, a compact, power-packed 8 channel crystal controlled transmit-receive and a 23 channel tunable receiver, can provide you the ultimate in personal, point-to-point communications. Metrostar transceivers for base or mobile installation are just $169.95.

STARFIRE



Starfire by Metrotek is an outstanding unit because of its quality construction dependable performance and low cost. The Starfire delivers a crisp, distinctive sound. Dollar for dollar, you won't find a better CB transceiver.

METROTEK ELECTRONICS, INC.
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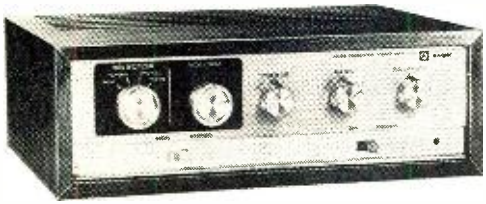
Hi-Fi Showcase

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

NEW from ***EICO*** is a three-way speaker system that's extra-small in size, extra-big in performance. Dubbed the HFS-6, it measures only 13½" x 23¼" x 5¾", yet handles up to 25 watts of audio power. There are built-in crossovers at 600 and 4000 cycles, and the tweeter is equipped with an adjustable brilliance control. Thanks to its small size, the HFS-6 can be mounted on a wall, placed on a narrow shelf, or even rested on a table top. And, because of its hand-rubbed, oiled walnut enclosure, the HFS-6 looks and feels at home in just about any decor. Prices: $52.50 in kit form; $62.50 factory-wired and assembled. . . . From Allied Radio comes a 32-watt transistorized stereo amplifier in kit form



Knight KG-320 stereo amplifier

which, through the elimination of output transformers, tips the scales to a featherweight low of seven pounds. The ***Knight-Kit*** KG-320 accepts up to five pairs of stereo inputs (including tape heads), and it features rugged printed-circuit construction. There are separate ganged bass and treble controls, two switched a.c. outlets, and a frequency response within 1 db from 25 to 18,000 cycles at full rated power. And, as a special feature, a thermal feedback circuit protects the output transistors from overload, acts as a fuse for your speakers, and helps maintain circuit stability at all times. Price: $59.95, less case; a cordovan gray metal case is available for an additional $4.95, a walnut wood case for an additional $9.95. . . . Another new Knight-Kit, the KG-50 AM/FM/FM-stereo tuner, is a perfect mate (it's actually an identical twin in styling) for Allied's KG-250 stereo amplifier kit. A pre-wired FM "front-end," pretuned i.f. coils, and point-to-point wiring make assembly a cinch; features include an FM tuning eye, an edge-lit dial, and a rear-panel channel separation control, plus a G.E. compactron which does the work of four tubes. A panel light flashes on whenever a stereo broadcast is being received, and the AM section boasts a 10-kc. i.f. bandwidth for maximum AM fidelity. The KG-50 sells for $69.95, less case; cases are available in metal for $3.95 and oiled walnut for $9.95.

A new kit from ***Lafayette Radio,*** the KT-770WX, is an AM/FM/FM-stereo tuner

Lafayette KT-770WX stereo tuner

that features pre-aligned coils throughout. Offering simultaneous AM and FM operation, the KT-770WX boasts 4-μv. usable sensitivity; a frequency response within 1 db from 20 to 20,000 cycles; and 35-db stereo channel separation (at 400 cycles) from its FM section. And, from its AM section, there's a terminal sensitivity of 5 μv., a low-impedance cathode-follower output, and a built-in ferrite rod antenna as well as provision for an external antenna system. Housed in a biege, vinyl-laminated steel case with a gold anodized, extruded-aluminum front panel and an edge-lit scale with a black dial plate, the KT-770WX carries a price tag of $109.50. . . . Three 6" speakers (complete with reinforcing struts and special ball diffusers) and a 3" tweeter provide the 45—18,000-cycle response range of ***Paco***'s new L-4 speaker system. Boasting a slim, silhouette design and a single, 5000-cycle crossover, the L-4 measures 26¾" x 20" x 6$^{3}/_{16}$", is finished in walnut, and has a nominal impedance of 8 ohms. Price: $99.95.

Another new speaker system—this one by ***Rek-O-Kut***—combines function and design so neatly that it's almost certain to keep both "she" and "he" happy. A complete "off-the-floor" stereo speaker system in one unit, the "Sonorama" utilizes four 8" woofers and two tweeters for a 40—17,000 cycle response. Ultra-compact (it measures just 5" x 67" x 12"), the Son-

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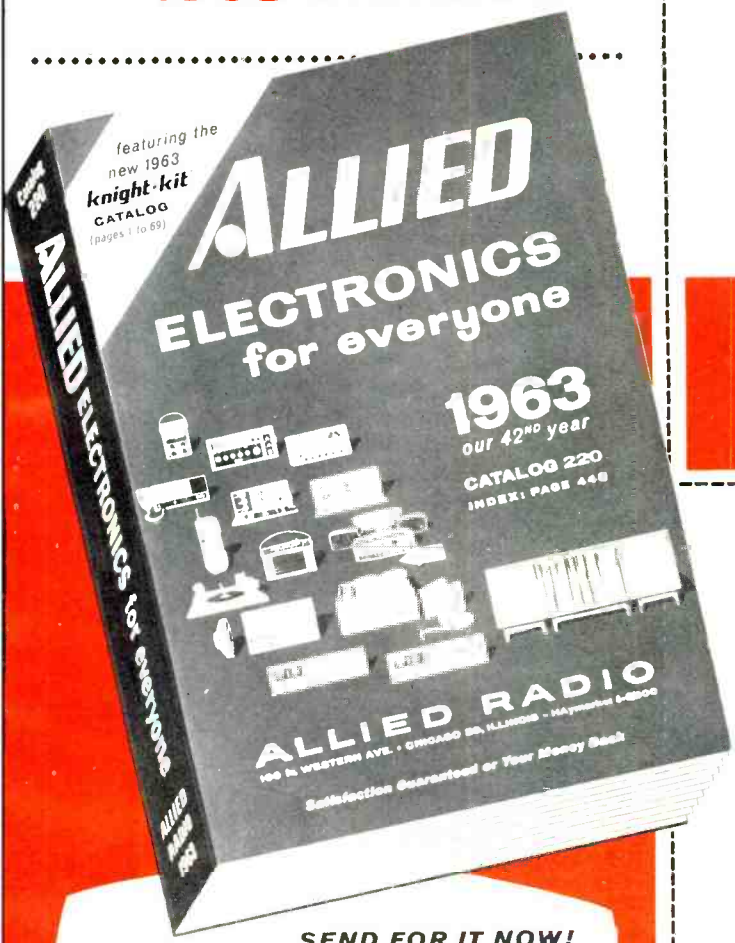

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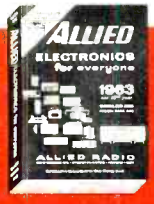
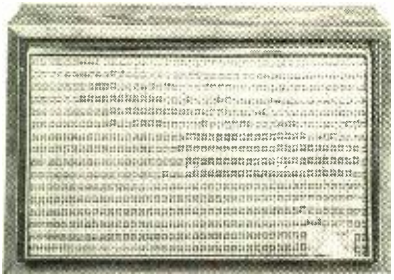


YOUR Free ALLIED 1963 CATALOG

Showcase

(*Continued from page 84*)

orama mounts flush on any wall and adds rather than detracts from room decor. Handling up to 50 watts of audio power, it is available in "contemporary-walnut" (the S-80C) for $149.95, and in "French provincial fruitwood" (the S-80P) or "early American maple" (the S-80A) for $179.95. . . . Smooth response (from 40 to 15,000 cycles), small size, and light weight combine to make ***Shure***'s new "Versadyne" microphone suitable for just about any application—from home recording to public address. An omni-directional dynamic mike, the Versadyne is unaffected by variations in temperature or humidity, and it's adaptable for hand-held, stand-mounted, or lavalier use (a stand adapter, a lavalier bracket, and a cord assembly are supplied with the microphone, which, incidentally, is equipped with a slide-to-talk locking switch). Two models are available: the high-impedance (100,000-ohm) 575S, priced at $24.00; and the low-impedance (150—250 ohm) 575SB, priced at $21.00. . . . A three-way speaker system by ***University***, the



University "Mini-Flex" speaker system

"Mini-Flex," measures a compact 9 7/16" x 15" x 5 3/16", yet handles frequencies from 40 to 20,000 cycles. A special viscous-treated woofer cone provides ultra-linear compliance for distortion-free bass, and there are individual balance controls for the 3" mid-range and 3½" tweeter. Readily adaptable for wall, floor, shelf, or table mounting, the Mini-Flex speaker system is priced at $69.95.

EICO Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, N. Y.
Allied Radio Corp. (Knight), 100 N. Western Ave., Chicago 80, Ill.
Lafayette Radio Electronics Corp., 111 Jericho Turnpike, Syosset, L. I., N. Y.
Paco Electronics Co., Inc., 70-31 84th St., Glendale 27, L. I., N. Y.
Rek-O-Kut Co., Inc., 38-19 108 St., Corona 68, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
University Loudspeakers, 80 S. Kensico Ave., White Plains, N. Y.

Me Technician, You Engineer

(*Continued from page* 55)

felt certain that he would also ask me to sweep the floor while I was soldering, or drilling holes, or making harness boards. But luckily for me, an attractive, dark-haired secretary called him back into his office to answer an important phone call.

When he returned, I had decided not to say anything. I was going to play this job by ear.

MY first assignment was to help complete the transmitter's antenna-coupling network. Flashover brought me a stack of papers with lots of equations and graphs which had been compiled by a young Ph.D. who was no longer with the company. After six months of calculating, he told me, this physicist couldn't figure out what shape the coils had to be, or to what size they should be cut.

"Mr. Flashover," I said, "may I make a suggestion? I cut the coils for my ham rig by trial and error, and checked their resonant frequency with a grid-dip meter. Couldn't we . . . . ?"

Flashover smiled at me, a bit surprised but pleased. "You're right, Orville. I don't think it would take *you* six months to design coils that way."

It didn't. But after I had been on the job for a few weeks, the 25-kw. transmitter developed a stubborn streak and started resisting us in every way.

Nevertheless, Frank persistently solved all the problems that plagued us during the construction of the model. I admired his ability to view a symptom and, if the diagnosis wasn't obvious, to sit down with pencil and paper and mathematically determine the probable cause. One day I complimented him on this ability. He took my words of praise as a matter of fact; however, his reply really stung.

"Well, Orville," he said, "that's the difference between us. You're a technician, and I'm an engineer."

The transmitter was completed almost a month late; but the government didn't

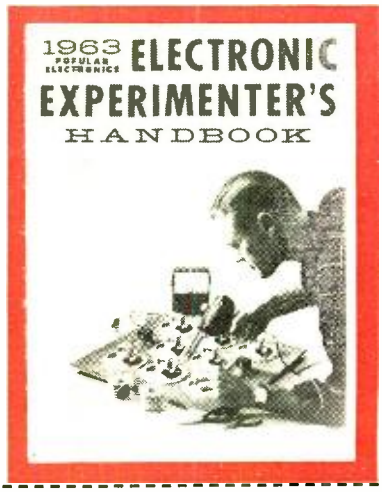
(*Continued on page* 92)

pick projects like these to work on:

- Sweet Sixteen Goes Stereo
- Sound-Actuated Switch
- Two-watt Stereo System
- Double-Sideband Ham Rig
- Code Practice Oscillator
- CB Tone Squelch
- Radiation Fallout Alarm
- Auto Temperature Gauge
- Transistor Tester Tests All
- Neon Bulb Electroscope
- Transistor/Tube Broadcast Receiver
- Automatic Diode Checker
- No-license Broadcaster
- Transistorized Public Address System
- and Emily, the Electro-Mechanical Inebriated Ladybug Robot

(seen on the Jack Paar Show!)

from the 1963 edition of



Here's the handy, compact publication edited each year especially for the electronics do-it-yourselfer and hobbyist! The 1963 edition has 164 pages of challenging construction projects, detailed charts, circuit diagrams, cutaways and photographs.

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PE 23

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NEW 3-WAY ACOUSTIC SUSPENSION SPEAKER KIT... exclusive Heathkit version of the Acoustic Research AR-2A; 10" woofer, two 5" mid-range speakers, and 3-1/2" super-tweeter. Low distortion, astounding range of ±5 db 40 to 20,000 cps. Factory built cabinet, walnut or unfinished. Shipping February.

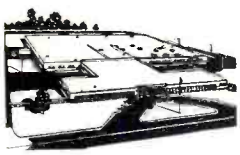
Kit AS-2AW, ... **$99.95;**
AS-2AU, ... **$89.95.**

NEW 4-TRACK PORTABLE STEREO TAPE RECORDER KIT ... exclusive Heathkit with rugged tape mechanism lauded by Audio magazine, Nov., 1962. Includes stereo amplifier and two detachable speaker wings, each with 5" woofer and 3" tweeter. Handsome tan and ivory cabinet.

Kit AD-72, ... **$198.00**

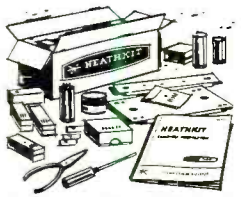
NEW LOW-COST 25-WATT MARINE RADIO-TELEPHONE PACKAGE... ideal for outboards, runabouts. 5 channels plus broadcast band receiver coverage. Factory built and tuned, just connect battery and use. Includes antenna and all accessories. Assembled ...

MWW-13S, 19 lbs., **$189.95**



who is Heathkit?

Heathkit is the pioneer and world's largest manufacturer devoted exclusively to the design and manufacture of do-it-yourself electronic kits. All our efforts are aimed at creating more kits, better kits, easier-to-build kits.



what are Heathkits?

Heathkits are electronic equipment in un-assembled form. All parts are packaged in convenient groups and a complete, easy-to-read, well-illustrated instruction manual tells you how to put them together. Heath offers over 250 kits from simple portable radios to big analog computers.

who builds Heathkits?

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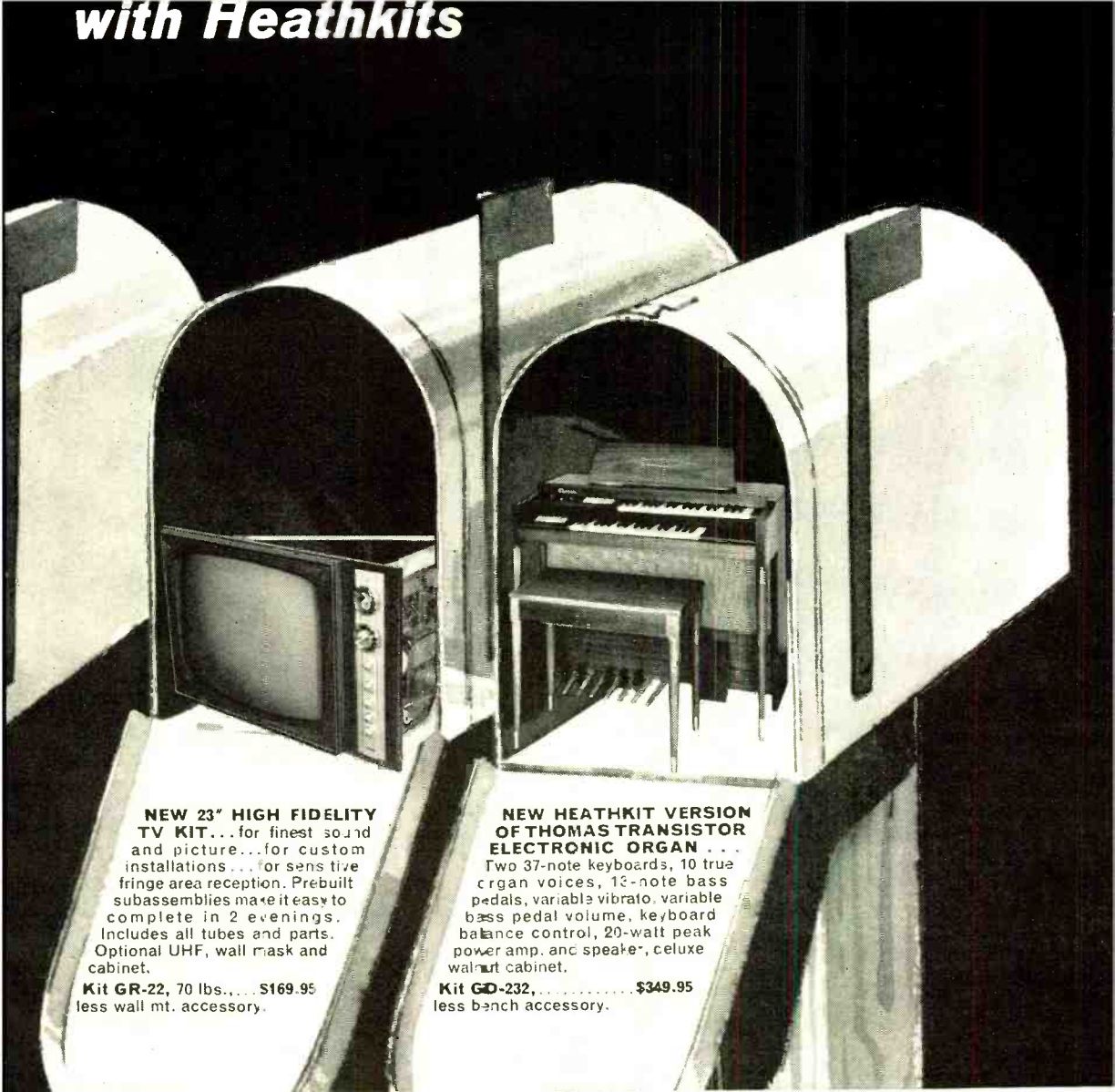
with Heathkits



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less bench accessory.

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seem to mind too much. We figured it would take three days to complete the acceptance tests, if we didn't run into any trouble. However, when the tests were ready to start, we were both very tired and, in addition, Frank was a nervous wreck.

AFTER two days of continuous testing, the transmitter held up well. But Frank was still worried.

"Orville," he said to me, "I don't like the way this machine is behaving. I think it's saving something big for the end. I only hope it doesn't blow up during the final test."

This last test was to be a frequency stability check with the transmitter operating in a large cold chamber held at 0° F. After five minutes of operation, our frequency counter showed a steady downward drift way out of specification limits.

Frank turned pale. He looked at me, and said: "Orville, I knew things were going too smoothly. The a.f.c. circuit in the master oscillator seems to have lost control."

For a while he studied the curves as recorded by the frequency counter, then he nervously reached for his pencil and notebook.

The government inspector and I waited patiently while Frank continued to make calculations. Suddenly Frank stopped writing. He threw his pencil to the floor and buried his face in the palms of his hands.

"There's nothing we can do now," he muttered disgustedly. "It will take a month to redesign the circuit so that it will work reliably."

I listened to him unbelievingly. I couldn't force myself to accept the fact that our a.f.c. circuit which had worked so well for many months before the tests began could be proved inadequate by Frank's calculations.

Rather than hang around and give up, I put on my coat and went into the cold chamber. When I opened the rear door of the transmitter to take a look inside, I noticed the plug which connected power to the crystal oven dangling in mid air. I giggled happily to myself as I plugged the socket into the oven receptacle and closed the transmitter door.

As I came out of the cold chamber,

Frank looked up at me. "Did you find anything?" he asked, but only as a matter of routine.

"I think I did," I replied. "Let's wait a few minutes."

It was obvious that Frank had not heard my reply, for he continued to inspect his calculations.

"Look! The frequency is moving back up."

Frank jumped from his chair. "What? How can it?"

"Well, it is," I replied.

Frank stared at me in amazement. "Orville, what did you do?"

"I just plugged the power into the crystal oven. We forgot to connect it when we moved the transmitter into the cold chamber."

THAT EVENING, at the plant, we celebrated the acceptance of the transmitter model with a small party. Frank was quite proud of me.

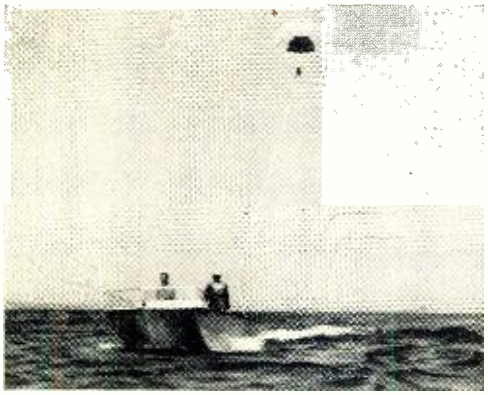
"Orville," he said happily as he put his arm around my shoulder, "what made you go into that cold chamber after I had already proved to myself that the a.f.c. circuit couldn't work properly?"

"Well," I answered a wee bit sarcastically, "that's the difference between us. You're an engineer, and *I'm* a technician." —30—

Get well soon, Mr. Frye

a message from Carl & Jerry

Because the gentleman responsible for Carl & Jerry's electronics antics—Mr. John T. Frye, W9EGV—is seriously ill and hospitalized, there is no Carl & Jerry adventure this month. We're certain that Carl & Jerry's many thousands of followers join with the entire P.E. staff in wishing Mr. Frye the speediest of recoveries. In fact, we'll be only too happy to include your "get well's" and "good wishes" with our own and forward the entire lot to him. So, if you want to cheer up Mr. Frye, address your cards and letters to John T. Frye, W9EGV, c/o POPULAR ELECTRONICS, *One Park Avenue, New York 16, N.Y. We'll take it from there.*



It's a bird? A plane? No, it's a para-kiter, 200 feet above the water and the fun-having-est person alive!

Para-Kiting:

Dawn of the Human Antenna

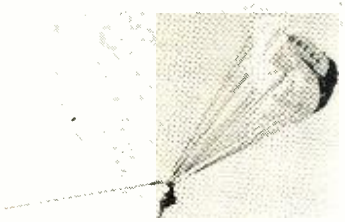
By JAMES JOSEPH

TO GAIN altitude—CB-wise, that is—you can plant your antenna atop a mountain, work from a skyscraper. or rent an airplane. Or you can try your luck at a high-flying new aerial sport —para-kiting.

Slip into the harness of a para-kite (a new-fangled "ascending" parachute that takes you and your CB transceiver up like a kite), and you become a human antenna, gaining the kind of altitude (upwards of 650 feet, depending on the length of the kite's towline) that'll more than double your transceiver's range.

"Para-kiting," explains one sky-flying enthusiast, "wasn't dreamed up solely for the CB'er. But para-kiting and CB go together like bread and butter."

And they do. Jeep- or boat-towed (at the end of a 300′ to 1000′ towline), the "first-time" para-kiter—his 28′-diameter nylon "kite" strapped to his back—is in for some surprises: the ever-increasing range that altitude brings to the average CB transceiver, and the fun-in-thin-air that's para-kiting! —30—



High above harbor tug, para-kiter rag-chews with tugmen. The transceiver's range doubled at this altitude.

Harness intact and transceiver in hand, this CB miss says only earth-bound squares stay on beaches!

Many para-kiters take off from a convenient beach, rely on skill of boatmen to plant them back on the beach when the para-flight is over.

On the Citizens Band

(*Continued from page 72*)

maximum stability. Twenty-one tube performance using two triple-purpose tubes, three dual-purpose tubes, and nine single-purpose tubes helps put the "Globe Master" in the "front line." The receiver also has an S-meter for measuring relative signal strengths, and for "zero-beating" with the spot switch.

The iridite plating of the "Globe Master" chassis makes this "all-new" transceiver ideal for marine applications or for use wherever moisture problems arise. It's priced at $229.95, net.

"Crystal Caddie." Rather than have you mix crystals with pocket change, and end up trying to plug a nickel into a mobile unit some dark evening, Hawco Electronics (P.O. Box 205, Hawthorne, N.J.) has created a neat holder called the "Crystal Caddie." Compact, and made of durable polystyrene, the caddie is available in two models; an 11-crystal holder for $1.49; a 22-crystal holder for $1.98. Each has a hinged cover, and will cushion your crystals in protective styrofoam.

"Big Mike." A new, high-output, transistorized, variable microphone designed for mobile or base CB and ham transceivers has just been introduced by Communications, Inc. (33 Danbury Rd., Wilton, Conn.). The "Big Mike" Mark I microphone has a built-in transistor amplifier with adjustable controls for varying output level and tone, and a "squeeze-to-talk" bar. Net price is $29.95.

Constructed of rugged, anodized aluminum, the microphone is less than 4½" long by less than 1½" in diameter. A miniature mercury cell battery pack, located inside the unit, is good for many months of normal operation (price of the battery pack, $1.44). A permanent magnet (optional) allows the microphone to be hung on any metal surface.

The "Big Mike" Mark I is easily and quickly installed on any CB or amateur transmitter, but its variable output and tone make it suitable for many other uses as well, including commercial, marine, and recording applications. It comes

More on CB Docket 14843

On November 16, the Federal Communications Commission released a "Notice of Proposed Rule Making" which, if put into effect, would completely revamp Part 19 of the FCC Rules dealing with the Citizens Radio Service. The substance of these proposed changes was outlined on page 98 of our January issue.

As we go to press this month, the FCC has NOT been "deluged" with comments —as we would have predicted. Many CB'ers are apparently still unaware of their rights to protest such sweeping changes. Other CB'ers may suffer from the mistaken impression that their licenses, once issued, can't be changed, and that their operation practices can't be curtailed.

The release of Docket 14843 occurred just as POPULAR ELECTRONICS January issue was closing and press makeup was interrupted to permit insertion of the material mentioned above. Unfortunately, comments regarding this Docket must be filed on or before January 15th —some days before publication of our February issue. Thus, extensive printed remarks on our part at this time would be anti-climactic—unless the filing-of-comments date should happen to be moved into February or March.

The Christmas and New Year's holidays have no doubt slowed down the mailing of comments on this Docket by CB'ers. However, considering that some 350,000 CB'ers will be affected, the number of comments filed with the FCC (as of December 17) is woefully small. Of those received, the greatest number have centered around the proposal to eliminate phone patches—that is, broadcasting directly from the telephone lines.

As mentioned last month, the Editors of POPULAR ELECTRONICS filed a counter-proposal to Docket 14843 that would permit intercommunications on more channels than were listed in the original proposal.

with full operating and installation instructions; average connection time is only about ten minutes.

Texas Jamboree. Jim Cumby, president of the Galveston County (Texas) Citizens Band Radio Association clued us in on their successful jamboree dance and picnic held last September for the benefit of a crippled children's hospital. Everything from flowers for the ladies to the big door prize (one large door!) contributed to a good time being had by all.

The GCCBRA held the jamboree picnic on the day following the dance, with approximately 800 in attendance. Outstanding events included CB and ham equipment displays and demonstrations, continuous music supplied by Jack Krepser, and plenty of good barbequed chicken. Kiddie rides, mobile cars, a ferris wheel, and a cruising fire truck held the attention of the younger set, not to mention the cotton candy, popcorn, and peanuts. There was even a "twist" contest for teen-agers with music supplied by "Johnny and the Road Runners," and the "Velvet Tones." It was a swinger!

Tech Tip. In answer to many requests, and through the courtesy of "The Carrier," excellent monthly of the 5 Watt Wizards of San Bernardino, Calif., here's a tip on eliminating TV interference.

The following manufacturers will supply a free TVI filter to anyone requesting it, provided that the proper information accompanies the request. If some of your close neighbors are troubled with TVI, have them (not you) write to their TV set manufacturer giving the following information: (1) call-sign of the station causing the TVI; (2) the date the TV set was purchased, and whether it was new or used when purchased; (3) model number and serial number of the set. They should, of course, ask for a free "high-pass" filter in their letters.

Admiral
497 Railroad Ave.
Newark, N.J.

C.B.S.
Hygrade Electronics,
9216 Church
Brooklyn 36, N.Y.

Magnavox
Fort Wayne, Ind.

Montgomery Ward
19 Watching Ave.
Plainfield, N.J.

Motorola
540 Burgen Blvd.
Cliffside Park, N.J.

Philco
Fineberg's
750 Doud Ave.
Elizabeth, N.J.

R.C.A.
(see local dealer)

Sylvania
700 Elliot St.
Batavia, N.J.

Westinghouse
528 Ferry St.
Newark, N.J.

Zenith
6001 Dickens Ave.
Chicago, Ill.

If the manufacturer of the TV set in question isn't listed here, try writing to the address given on the set. Most man-

ufacturers will cooperate in supplying the needed filter.

Club Chatter. The very neat and informative efforts of the staff of "CB News & Views," the official voice of the Citizens Radio League (Chicago), recently told of two well-handled emergency assists by James Kaminski, KHA-4705, and Ed Slattery, 18W5743. Jim directed traffic in pouring rain at an accident scene after a 10-33 call from his mobile unit; and, two nights later, Ed handed a relay to the authorities when a car crashed through a guard rail and dropped down to ground level on the Congress Expressway in Chicago. In both instances a "breaker" was involved, with each of the men receiving prompt cooperation. Quick thinking and proper handling averted the possibility of further tragedy in each case. Hats off to both gentlemen!

Among the huge stack of well-written CB newspapers received this month was a copy of the 15-page jam-packed "Moniter" put out by the Allegheny Kiski 5 Watters of New Kensington, Pa. Besides the latest CB news, the paper handles wedding bells, birth announcements, birthdays, "wife savers," a laugh corner, an editor's column, and several illustrated ads—paying, no doubt! . . . If the appearance of a club publication is any indication of the club's growth and progress, the Hudson Essex Chapter of the Citizens Band Radio Relay League, Inc., must be on its way to a long and happy existence. Their compact news bulletin has the professional touch that makes CB information easy to understand and enjoy.

The interesting Illini (Illinois) Class "D" Radio Club bulletin recently reported another instance of quick thinking on the part of a commercial CB user. Lynn Crook, KHA4945, of Bement, Ill., a gentleman who has all of his school buses and trucks CB-equipped, was returning an injured football player to his home one evening when the lad became quite ill. Calling ahead on his mobile unit, Lynn found a doctor and an ambulance on hand upon his arrival at Bement. Emergency aid was given, after which the boy was taken to a nearby hospital.

"The Chatter Box," monthly publication of the C.B. Socialites, Plaistow, N.H., reported the search for a seven-year-old boy lost in the woods near Candia, N.H. In addition to local and state police, sheriff's personnel, and fire departments from the surrounding area, the C.B. Socialites Radio Club Emergency Unit (SEMU) was quick to join the search, complete with emergency equipment, portable walkie-talkies, lights, and first aid gear. Within a short time they, in turn, were joined by over 200 CB mobile units representing the Old Towne Newbury Radio Club; units from Manchester, Lowell, Portsmouth, Dover, Concord, and several other towns. After thirteen hours, the boy was carried out of the woods, rainsoaked, cold, and frightened—but safe! (He told rescuers he had seen a bobcat and didn't dare make a sound.) The Socialites say that their mobile emergency unit is available to anyone in the area that may need it; club members with emergency equipment in their cars are ready to go at any time. Another "hats off," well deserved! —30—

TD/RFG Generator

(*Continued from page 47*)

the way up and attenuate the r.f. for a minimum but still detectable signal.

Beginning with the converter, adjust each i.f. slug or trimmer for maximum output while keeping r.f. input at a minimum. Repeat each adjustment until no further improvement is obtained.

Next, remove the grid connection and simply allow the lead to come close to the antenna. Tune the generator and receiver to 600 kc. Adjust the oscillator slug and then the antenna slug for maximum output while keeping r.f. at a minimum as before. If there is no antenna slug adjustment, rock the tuning capacitor while adjusting the oscillator slug. If there is no oscillator slug either, you'll simply have to omit this adjustment.

Finally, tune the generator and the receiver to 1400 kc. and adjust the oscillator trimmer and then the antenna trimmer as above. Repeat the 600-kc. and 1400-kc. adjustments for best "balance" between the two, and your alignment is completed. —30—

Transistor Topics

(*Continued from page* 80)

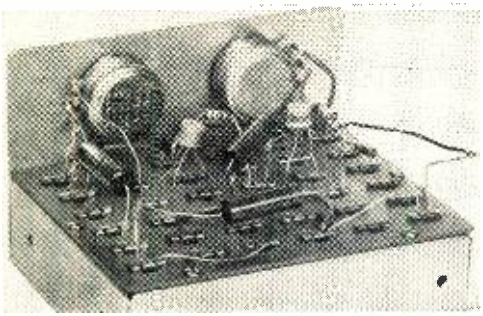
battery, such as a Burgess 2N6 or 2U6, or it can be made up of six penlight cells connected in series. Finally, a slide or toggle switch can be substituted for push-button switch *S1*, if you wish.

With neither layout nor lead dress critical, the project can be assembled on a metal chassis, fiber circuit board, or on a small scrap of wood. Carl used a wooden "chassis" in his original model.

As is necessary with most wireless microphones, this instrument should be adjusted to an operating frequency falling at a "dead" spot within the AM broadcast band, to prevent interference from local broadcast stations. Care should be taken, too, to use as short an antenna as will give acceptable results. Don't try for excessive range, since this could conflict with FCC regulations covering operation of unlicensed equipment.

Breadboards, Anyone? In our July 1962 column, we discussed the importance of minimizing the number of times that semiconductor components are soldered (and unsoldered) when wiring experimental circuits. At that time, too, we brought to your attention a useful "breadboard" kit offered by the Sheatz Electrode Company in which coil springs served as terminal points, permitting solderless wiring.

Today, a number of firms are producing experimental breadboards fitted with solderless terminals. A variety of designs



Specifically designed for assembling experimental semiconductor circuits, Vari-L's new "Develoboard" brings convenience-plus to the "solid-state" hobbyist. It's equipped with 35 pre-mounted connectors.

A walkie-talkie for Willie? Sure—and for Tom, Dick, and Harry, too! This transistorized Knight-Kit made by Allied Radio—the C-100—will diminish the contents of junior's piggy bank by less than ten dollars.

are available, but one of the newest and most effective units we've seen is a breadboard introduced recently by the Vari-L Co., Inc. (207 Greenwich Ave., Stamford, Conn.).

Dubbed the "Develoboard," the Vari-L unit is equipped with 35 patented, solderless connectors, each of which will accept up to four leads, permitting up to 140 junctions. Each connector is made up of a four-pronged, spring-tempered outer clip formed around a solid metal core. Holes in the top of the clip line up with grooves in the core and serve as points of entry for leads; wires can be of the same or different sizes, from #30 to #17. The connectors are pre-mounted on an insulated board measuring 3¾" x 5", and this, in turn, is assembled on a small metal chassis.

The "Develoboard," shown in use in the accompanying photograph, is supplied with a metal accessory panel suitable for mounting potentiometers, rotary switches, pilot lamps, and similar components. Current selling price is $18.50 each (FOB Stamford, Conn.), with discounts available to quantity purchasers.

Product News. The International Rectifier Corp. (233 Kansas St., El Segundo, Calif.) has introduced a series of 1000-ma. silicon rectifiers so small that more than 200 units (less leads) could be contained in a cubic inch. These new devices are suitable for use at temperatures up to 50°C, and are available with PRV ratings from 200 to 1000 volts, depending on type. Prices range from 90 cents to $3.25 each in small quantities. Full

specifications are given in the manufacturer's Bulletin SR-222.

A new, all-transistor, two-way "walkie-talkie" priced at less than $10.00 has been developed by Allied Radio Corp. (100 N. Western Ave., Chicago 80, Ill.). Designed for operation within the standard Citizens Band, the Knight-Kit C-100 contains three transistors and is powered by a 9-volt transistor battery; operating range is up to ¼ mile. Measuring approximately 5 11/32" x 2 7/8" x 1 3/4" overall, the C-100 weighs only 9 oz., yet is equipped with a built-in 2" speaker which also serves as a microphone. The unit carries a net price of $9.95, plus postage, with an optional leatherette carrying case available for 98 cents. For most two-way applications, a pair of C-100's would be required.

That does it for now, fellows. Back next month, as usual. —*Lou*

R.F. Power Capsule

(*Continued from page 59*)

with a close-fitting washer or plug. Be sure that the "U"-shaped negative contact touches the negative terminal of the mercury cell near it and that the whole assembly is wedged tightly in place. You may have to bend open the negative contact a bit to increase the tension. To finish the job, install the alligator clips on the leads provided for them.

Before using the "R. F. Power Capsule," connect your 0-1 ma. meter across the alligator clips (positive meter terminal to collector clip—see schematic diagram). If you get a reading (it will be about 750 ma.), it's a good sign that all cells are making contact and that the unit is working properly.

Instructions for operating the unit have already been given (see Preliminary Check-Out section). It should be noted, however, that no "on-off" switch has been provided because current drain is negligible except when a tank circuit is connected across the clips. But be sure that these clips do not touch each other while the "power capsule" is in storage—otherwise, the mercury cells will soon run down. -30-

Across the Ham Bands

(*Continued from page 77*)

coaxial cable. Although a length under 12″ is recommended for highest gain on the 50-mc. band, cables up to five feet long can be used without too much loss.

Set the receiver and booster band switches to the desired frequency range, and advance the booster's gain control, *R2*, full on; then, tune in a signal on the receiver dial, and peak capacitor *C1* for maximum signal strength, retarding gain control *R2* as necessary to prevent receiver overloading. Set coil *L3*'s slug to place 3500 kc. near maximum capacitance on capacitor *C1* and 7300 kc. near minimum. Now you are set up to pull in those weak ones.

Coils *L2* and *L1* for the 20-15 meter bands and the 10-6 meter bands, respectively, may need some pruning to put them right on the bands you want. But before cutting off any wire, reposition the coil slightly—the change in stray capacitance to ground may do the job for you.

Certificate Hunter's Club

When the average ham gets his license, he wants to exchange QSL cards with every station he works. Later, however, he usually tapers off a bit and QSL's routine contacts only upon receipt of the other station's card. And he sends his own card first only to confirm a new state, continent, etc., required to qualify for a WAS or WAC award. But don't get the idea that QSL-swapping necessarily becomes a sometimes thing with *all* old-timers.

Who says you can't pull in those states with an "inexpensive" receiver? Stan Johnson, WNØAQC, Ridgeway, Iowa, worked 45 of them during his first four months on the air—using a Hallicrafters S-38D. Stan's transmitter is a Globe-Chief 90.

About 15 years ago, a few hams (notably Howy, W2QHH) began collecting ham awards and certificates intensively but rather informally. Then, in 1960, Clif, K6BX, organized the Certificate Hunter's Club. To earn the basic CHC award (a beautiful 11″ x 14″ gold certificate), the applicant must submit proof of having earned a minimum of 25 bona fide amateur operating awards; additional seals are issued for earning 50, 100, 150, and 200 awards.

With over 650 eligible awards from over 50 countries available, there are certainly enough of them to go around. To date, close to 1000 hams have qualified for CHC at all levels. It's impossible, of course, to guess how many more hams are working towards this goal—but the total must be in the high thousands.

And since January 1, 1963, SWL's who concentrate on the ham bands can also try for CHC on a "heard" basis. Anyone who qualifies for it will indeed be an outstanding SWL.

For more data on the Certificate Holder's Club, write to Clif Evans, K6BX, Box 385, Bonita, Calif. Be sure to enclose a stamped, business-size reply envelope (or one International Postal Reply Coupon), if you want a reply.

News and Views

Gene, WN4HHP, 3206 Kent St., Richmond 28, Va., worked Canada for his first contact. Since this auspicious beginning, he has added 26 states (17 confirmed) and two more Canadians to his total. Gene agitates the ionosphere mostly on 80 and 40 meters, feeding an 80-meter dipole with a Heathkit DX-20 transmitter; a National NC-156 receiver does the receiving. A member of the Rag Chewers Club, Gene will be glad to nominate anyone who qualifies—by a ½-hour rag-chew with him—for membership in the RCC. . . . **Michael Bronoski, WN9BRV,** 4302 Judd Ave., Schiller Park, Ill., has been splitting his operating time between 80 and 15 meters. A home-brew transmitter using a pair of 6L6 tubes and a "surplus" Scott CZC receiver share time on 80- and 15-meter doublets and a "1-element, 15-meter beam." Twenty-six states and Puerto Rico—18 confirmed—make up his "brag" list. . . . **Richard Maietta, KN3SIE,** 2050 Roosevelt Ave., Williamsport, Pa., operates on 7160 kc. with an EICO 723 transmitter running 60 watts and a Knight-Kit "Span Master" receiver. An audio filter sharpens the receiver's selectivity. Dick has

When Bob Herron, WN9EER, Springfield, Ill., started to study for a Novice license, his dad decided to join him. Their mutual equipment includes a Heathkit "Apache" transmitter (held down to 75 watts for Novice work), a Hammarlund HQ-150 receiver, and a multi-band "trap" antenna.

three antennas, a "long wire," a 40-meter dipole, and the shortened vertical described in our October, 1962, column. Fourteen of his 17 states worked are confirmed.

Larry Snyder, WN8BZT, 645 Portland Way S., Galion, Ohio, will soon be WA8BZT. As a Novice, he has worked 23 states—21 confirmed. The Hallicrafters twins, the HT-40K transmitter and SX-140 receiver, and a 40-meter inverted-V antenna have battled the 40-meter QRM curtain for 23 states. When his Tech ticket arrives, Larry plans to work both 6 and 2 meters. . . . **Frank C. Meduna, WAØAHX,** 2607 White Bear Ave., St. Paul 9, Minn., worked about 40 stations with an AMECO AT-1 15-watt transmitter feeding a 12'-high antenna. The day he finished putting together his new EICO 723 transmitter, his "big" ticket arrived. If you need a Minnesota contact or want to be nominated for the RCC, try Frank. . . . **"Stick," VE2BLO,** 221 Tait St., Ville St. Laurent, Quebec, Canada, made 350 contacts in 30 states and five countries in his first four months on the air. His "tools" are a Heathkit DX-40 transmitter, a Lafayette KT-200 receiver, and a homemade "ground-plane" antenna.

Bill Thomas, WAØBND, and his father, Dave, WNØBNG, 6420 W. 45th, Wheat Ridge, Colo., share the same equipment—an EICO 720 transmitter, a Hallicrafters SX-99 receiver, and dipole antennas for 40 and 15 meters. Bill has 17 states worked and his General Class ticket is on the way. Dave wants to study a bit more before visiting the FCC, and he's not talking about his states-worked total. . . . **John Hammelman, KØJZQ,** 921 Wisner Drive, Waterloo, Iowa, reports that when he first built K3GHI's 15-meter ground-plane antenna described in our April, 1962, column, his ham friends teased him about his "fish pole antenna." But his first contact with it (as a Novice) was with WP4BBN, Puerto Rico. Then, when his General ticket came and he worked six countries on 15-meter phone over the weekend with his EICO 720 transmitter/730 modulator combination, the same friends tried to borrow his copy of the April, 1962, issue.

Donald Berger, KN1VSK/WPE1DXL, 591 Hope St., Providence 6, R. I., is really getting maximum mileage out of his Novice station. He has worked 13 countries (nine confirmed) in five continents (four confirmed) and 31 states. Don's magic wand is a Hy-Gain vertical antenna connected to a Johnson Viking Ranger-II transmitter running 70 watts, and a Hammarlund HQ-145 receiver. . . . **Bob Di Gregorio, WV2ZDK,** 161 Norman Rd., Newark 6, N. J., runs a "Novice gallon" (75 watts) to a Heathkit DX-40 transmitter feeding a 40-meter folded dipole antenna. A Lafayette HE-20 does the receiving. Bob's log lists contacts with 28 states, three Canadian provinces, and England, France, Puerto Rico, and Brazil. Most of the DX was worked on 15 meters, and many of the states were worked on 40 meters. . . . Another "2" who

Keep those pictures, "News and Views," and suggestions for construction projects coming. Address all mail to: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana. 73,

Herb, W9EGQ

New Products

(*Continued from page 32*)

tional $27.95. Other accessories include the GRA-22-1 TV cabinet ($89.95), and the GRA-22-2 all-wood "custom" TV wall mount ($25.95). (*Heath Co.*, Benton Harbor, Mich.)

BUDGET-PRICED HI-FI SPEAKER

First in Electro-Voice's "Michigan Line" of speakers, the MC8 is a budget-priced hi-fi unit. Its many features include extra-slim styling, a rugged die-cast frame, and an edge-wound voice coil that is 18% more efficient than ordinary coils. Rated at 12 watts on program material and 24 watts peak, the MC8 reproduces frequencies from 50 to 13,000 cycles. The 8" speaker is finished in an attractive Mayan gold baked-on enamel. Price, $15.00. (*Electro-Voice, Inc.*, Buchanan, Mich.)

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Measuring only 4⅝" x 6¼" x 13¼" and weighing 7½ lb., the new "Realistic" 3" scope is both compact and portable when assembled. A front panel switch allows selection of either a.c.- or d.c.-coupled vertical amplifiers. The d.c.-coupled sensitivity is one volt peak-to-peak per inch and a.c. sensitivity is 25 mv. r.m.s. per inch. Other features of the 3" scope include blanking, push-pull vertical and horizontal amplifiers, a silicon diode power supply, and direct access to deflection plates for amateur use. The price of the kit is $44.50. (*Radio Shack Corp.*, 730 Commonwealth Ave., Boston 17, Mass.) —30—

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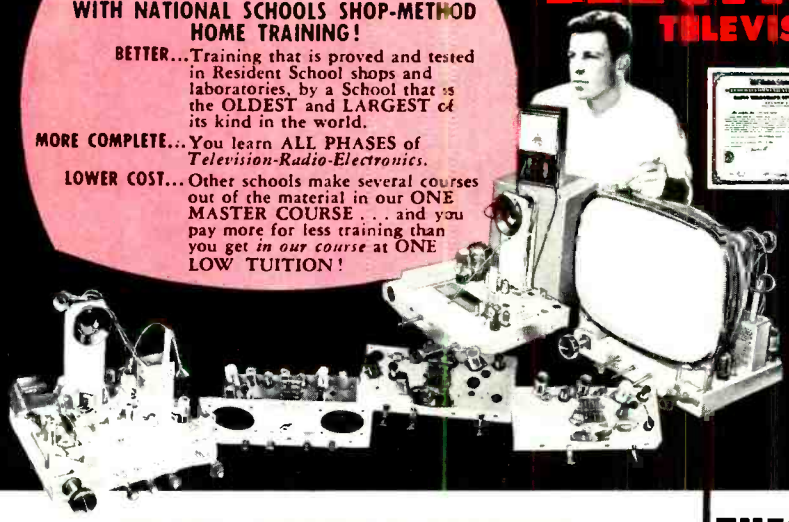

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Rev. Enoch P. Sanford

Thanks to N.T.S. I have a business of my own right in my home. I have 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

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Automate Rear View Mirror

(*Continued from page 67*)

3 and 4 of the control unit—route the cable carefully, so that it won't interfere with your vision while driving.

Now mount photocell *PC1* in a piece of ¼"-i.d. x 1½"-long metal or fiber tubing. Recess the cell about ¼" from the end of the tubing to shield it from street lamps and other extraneous sources of light. The cell and tubing assembly should then be mounted on an appropriate base and installed on the rear shelf of the car—with the photocell pointed out the rear window. Finally, run a cable from *PC1* to terminals 1 and 2 of the control unit, following the most convenient route. This completes the installation.

To use the system, leave *S1* open, close *S2*, and adjust *R2* so that the headlights of a car behind you will just flip the mirror to the "dim" position. If *R2* is set for too great a sensitivity, the mirror may respond to sources of light other than auto headlights. To hold the mirror in the "dim" position, close *S1*; to shut off the unit (holding the mirror in the "bright" position), open *S2*. —30—

Curves Quiz Answers

(*Quiz on page 51*)

1 — I	Triode vacuum-tube plate characteristic curves.
2 — F	RL circuit current-growth curve.
3 — G	Microphone unidirectional cardioid polar pattern.
4 — J	Tunnel diode voltage-current characteristic curve.
5 — D	RC circuit current-decay curve.
6 — A	Transistor common-emitter characteristic curves.
7 — C	Zener diode current-voltage characteristic curve.
8 — H	Parallel LC circuit resonance curve.
9 — B	Series LC circuit resonance curve.
10 — E	Transformer core hysteresis loop.

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The following satellites, launched by the United States, were reported to have beacon and telemetry transmissions as of December 17, 1962. The satellites are listed by their code names, according to frequency; because some transmit on more than one frequency, they appear more than once.

Explorer VII*	19.990 mc.
Discoverer XXXVI	20.005 mc.
Transit IVA	54.000 mc.
Courier IB	107.970 mc.
TIROS I	107.997 mc.
TIROS III	108.000 mc.
Vanguard I*	108.024 mc.
TIROS III	108.030 mc.
Telstar	136.050 mc.
Explorer XV	136.101 mc.
Transit IVA	136.200 mc.
Explorer XVI	136.200 mc.
TIROS IV	136.230 mc.
TIROS V and TIROS VI	136.235 mc.
Ariel	136.408 mc.
Explorer XIV	136.440 mc.
Injun SR-3	136.500 mc.
Alouette	136.590 mc.
Traac*	136.650 mc.
OSO I	136.744 mc.
Transit IVB	136.800 mc.
Anna	136.815 mc.
Explorer XVI	136.860 mc.
TIROS IV	136.920 mc.
TIROS V and TIROS VI	136.922 mc.
Alouette	136.979 mc.
Transit IVA	150.000 mc.
Transit IIA	161.990 mc.
Transit IIA	215.990 mc.
Midas IV	228.200 mc.
Midas IV	232.400 mc.

*Signal may be very weak

There are several more satellites in orbit and may be transmitting. However, these are so-called "secret" satellites launched by the U.S. Air Force.

If you're interested in eavesdropping on satellites, and missed our June 1962 article on the NASA-136 converter, we recommend that you look it up. Easy to construct, this sensitive converter can intercept the satellites operating in the 136-137 mc. band.

Eavesdropping on Satellites

(*Continued from page 53*)

(5) Most satellites are modulated by telemetry equipment. This modulation may be quite weak, and audible only on near overhead passes.

Now that you know how and where to listen, you'll also want to know what satellites to listen for. There are at least six, as we mentioned, of which the Tiros group are especially good bets. Here they are, listed in order of ascending frequency.

Telstar. Frequency, 136.050 mc.; period, 157.7 minutes; altitude, 590-3500 miles. Telemetry on several very weak subcarriers. Long period and high altitude make Telstar difficult to catch.

Tiros IV, V, VI. Frequencies, (IV) 136.230 and 136.920 mc., (V and VI) 136.235 and 136.922 mc.; period, (IV and V) 100.5 minutes, (VI) 98.7 minutes; altitude, 420-520 miles. Telemetry on weak subcarriers 1 kc. above and below carrier. Tiros satellites are moderately strong and pass frequently. Weather map pictures are transmitted on a higher band.

Ariel. Frequency, 136.408 mc.; period, 100.8 minutes; altitude, 247-750 miles. Telemetry sounds like clanking chains, out to ±15 kc. Ariel's modulation is keyed from the ground and is not always present. Ariel is believed to have suffered major solar cell damage from radiation belts and is transmitting erratically.

Alouette. Frequencies, 136.590 and 136.979 mc.; period, 105.5 minutes; altitude, 600 miles. Telemetry on multitone subcarriers out to ±20 kc. A wide assortment of beeps and clanks makes Alouette one of the most interesting satellites to log.

Other satellites in the NASA band are probably commanded from the ground and are very elusive. But get Alouette, Ariel, Telstar, and Tiros (IV, V, *and* VI!) in your log before you start thinking about snatching any of the hard ones! —30—

Wanted: Electronic Paul Revere

(*Continued from page 43*)

ceiver would make a loud buzzing noise or actuate a visual alarm in case of emergency. Since electrical utilities serve 96% of the population, and 99% of the people in heavily populated areas, the NEAR system would solve the coverage problem.

But modern electronic technology has created some new, unexpected problems for NEAR. The Michigan tests were conducted with a 240-cycle warning signal, the fourth harmonic of the 60-cycle system frequency. However, ambient voltages at the signal system frequency must be at minimum levels of 0.3 volt or less for successful operation of the NEAR system.

Fortunately, the fourth harmonic of 60 cycles—240 cycles—is rarely found on power systems. But when silicon-controlled rectifiers are used for load control purposes, a source of fourth harmonic voltages exists. In one instance, two residential light dimmers (using SCR's) were found capable of producing sufficient 240-cycle voltage to activate a NEAR receiver on the same circuit.

Because of the widespread use of SCR's, NEAR must go to non-harmonic generation—a system requiring a basically different means of signal generation. Extensive tests involving ten new NEAR transmitters are already under way, with several utilities participating, and are scheduled for completion this year. The attack warning frequency being considered for the non-harmonic system is 255 cycles.

One method of producing a 255-cycle frequency is to use a static inverter to generate a three-phase balanced output. And, interestingly enough, the inverter-type generator uses SCR's as its basic frequency-producing element.

If the technical problems of NEAR seem fairly well under control, the problems of system financing, operation, and maintenance remain to be solved. The Office of Civil Defense (OCD) prefers to assign the whole procurement and management responsibility to the utility

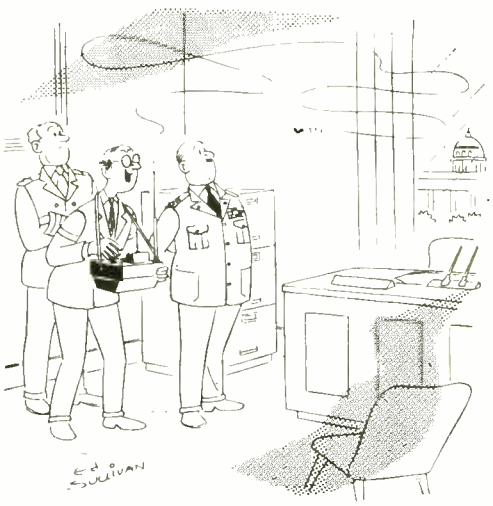
companies—have them procure, install, and maintain the generating equipment and the home receivers.

Conceivably, the Federal Government could purchase and provide the generative equipment to utilities, and the receivers to individual families. If the householder were asked to procure his own "black box," then he might be exposed to all kinds of gadget offers of varying value and reliability.

The utilities themselves, while anxious to cooperate on NEAR, are not wholly ready to undertake the procurement and management role. They envision ticklish problems of rate adjustment, charges of profiteering and consumer exploitation, and the troublesome matter of liability for injury and damage resulting from false or premature signals.

Considering that the receivers will account for 80 to 85% of the system cost and possibly 90% of the reliability problem, the key to the organization and management of the NEAR system will be at the receiving end—the control, handling, inspection, and maintenance of the "black boxes."

Then, of course, the question comes up: "What happens when I get the warning signal? I don't have a fallout, blast, or thermal shelter. Where do I go?" Needless to say, countless problems remain to be solved before we can all rest assured that we really have an "Electronic Paul Revere." —30—



"... And when they hit it with a fly swatter—BOOM—it blows them to smithereens!"

Short-Wave Report

(*Continued from page 82*)

Current Station Reports

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

Australia—Melbourne has a new xmsn to N.A. at 0715-0815 on 9580 kc.; the DX program is aired on Sundays at 0800. Other Eng. xmsns were noted recently at 0314-0415 on 11,710 and 9570 kc. to the British Isles and Europe, with the DX show on Sundays at 0400; and at 0500-0714 on 9570 kc. to Eastern Asia and the N. W. Pacific Islands area.

Brazil—A new station is *R. Itatiaia*, 3315 kc., Belo Horizonte. It was noted from 1707 with popular Brazilian music and Portuguese language, frequent ID's and time checks. Power is 500 watts.

Canada—A new DX program from Montreal is being broadcast to Africa at 1332-1415 and to Europe at 1545-1630, both xmsns on 15,320, 11,720, and 9630 kc.; to the Caribbean at 1800-1830 on 15,190, 11,720, and 9625 kc.; and to Australasia at 0330-0400 on 9630 and 5970 kc. The German version will be aired at 1315-1330 on 15,320, 11,720, and 9630 kc. The Eng. version will be on every other Saturday, the German every other Sunday. *R. Canada*'s Northern Service is now broadcast at 2000-0200 on 6120 kc., replacing 5970 kc.

China—Peking, 5320 kc., has been noted with a fair signal at 1735, with Chinese music and native language. China Press Agency, Peking, 5525 kc., has been noted "good" at 0720 with Chinese, weaker by 0730. The 11,975-kc. outlet is heard on Saturdays to N.A. at 2000-2055 with native language lessons, and at 2100 and 2200 with Eng. news; this channel duals 11,945, 11,780, 9945, 9480, and 7480 kc.

Curacao—Continental Electronics of Dallas, Texas, has been awarded the one-million dollar contract for construction of the new Trans-World Radio transmitters to be located in this country. The contract calls for two 250-kw. xmtrs and one 50-kw. unit, plus allied equipment. The 50-kw. xmtr will be for medium-wave service.

Ecuador—A station on 6260 kc. with the possible call-sign of HCMM6 is noted from 2345 to 0000 s/off. They sign off with the "March From the River Kwai"; the ID seemed to be *Radio Centinen*. At each quarter hour, the letters "CNF" and

"BFBH" were announced, and many references were made to Ecuador.

Ethiopia—*R. Addis Ababa* is heard on 15.295 kc. at 1300-1330 in Eng., and to 1350 in French—with French news at 1345; they sign off with a march. The 11,955-kc. outlet is also heard at 1510-1530 in Eng. to W. Africa. Reports are welcomed; their QSL shows a picture of the Nile River. Address reports to P. O. Box 1364, Addis Ababa.

Germany (East)—The current schedule for *R. Berlin International* is 0700-0800 and 0900-1000 (hours may vary on Sundays) on 15.280 kc., and 1100-1130 on 11.765 and 15.340 kc.

Germany (West)—The winter Eng. schedule from Cologne remains as given last month with the exception of the 1530-1610 xmsn to the West Coast which is now on 5980 kc. (replacing 11.795 kc.) and 9735 kc. Other Eng. xmsns: to Africa at 0100-0130 on 11.795 and 15.275 kc., and at 1235-1315 on 15.285 and 17.815 kc.; to Australia and the Far East at 1620-1700 on 6015, 7235, and 9735 kc. and at 0350-0430 on 15.410, 17.845, and 21.705 kc.; to Indonesia at 0800-0830 on 15.275, 17.845, and 21.705 kc.; to the Middle East at 0230-0340 on 17.845 and 21.705 kc., and at 1040-1110 on 9545 and 11.905 kc.

Ghana—The most recent schedule from Accra shows the following xmsns in English: on 6070 kc. to W. Africa at 0945-1030, 1200-1245, 1500-1545, and 1630-1715; on 9545 kc. to W. Africa at 1630-1715; on 11.800 kc. to Sudan and Ethiopia at 1330-1415 and to Europe at 1550-1635; on 15.190 kc. to Sudan and Ethiopia at 0900-0945; on 15.287 kc. to S. Africa at 1500-1545; on 17.910 kc. to E. Africa at 0945-1030 and to the Congo and Central Africa at 1130-1215; and on 21.545 kc. to S., S.W., & S.E. Africa at 0945-1030. Reports should go to P. O. Box 1633, Accra.

Greece—Athens has Eng. to W. Europe on 17.745 kc. and is heard at 1215-1245.

Guinea Republic—Conakry has been testing on 5978 kc. around 0300 with W. African music and French anmts. The 11.970-kc. outlet is heard well at 1730-1930 with French and mostly African music but with some American and Latin American tunes.

Iraq—Baghdad is heard on a new frequency of 3240 kc. at 2130 with ID in Kurdish, then chanting; news is given at 2200. English was noted on 9635, 6095, and 6030 kc. at

The listening post of Robin Martin, WPE2GEH, Glen Head, N. Y., is equipped with two Hallicrafters receivers, an SX-62A and a S-107, plus a Philco amplifier. With 46 countries heard, Robin has 16 veries. His antenna is a 20-meter dipole.

1630-1700; on 9635 kc. at 1745-1756; and on 6095 kc. at 1830-1855.

Japan—The latest schedule released by *R. Japan* shows these native language xmsns, all of which also include English: to N.A. at 1830-1930 on 11,705, 11,780, and 15,135 kc. (Japanese); to N.A. and LA. at 2100-2300 on 9525, 11.705, 11,780, and 15,235 kc. (Spanish and Japanese); to Hawaii at 0030-0200 on 11,815 and 15,235 kc. (Japanese); to Europe at 0115-0345 on 11,705, 11,780, and 15,135 kc. (Russian, German, French, Italian, Swedish, Japanese); to Australia and New Zealand at 0430-0530 on 11,875 and 15,235 kc. (Eng. only); and to the Philippines and Indonesia at 0730-0930 on 9525 and 11,780 kc. (Indonesian).

Luxembourg—According to a schedule from *R. Luxembourg*, this station is now using 15,175 kc. for their 1530 xmsn. Has anyone heard it?

Netherlands—There are a few changes in the schedule given last month. English is now being broadcast from Hilversum to Australia and New Zealand at 0200-0250 on 11.730, 9715, and 9630 kc.; to Europe & N.A. at 1625-1720 on 9715 and 6085 kc. (also 6020 kc. to Europe); to N.A. at 2030-2120 on 6035 and 5985 kc. (alternate frequency is 9590 kc.); and to Europe and Africa at 1430-1520 on 9715 and 6020 kc. The "Happy Station" program is beamed to N.A. on Sundays only at 2100-2230, and the "DX Juke Box" show is aired on Thursdays. There are also two special Eng. xmsns to N.A. on Tuesdays and Fridays only at 1030-1045 on 17,810 and 15,445 kc. and at 1415-1430 on 11,710 and 9630 kc.

Nigeria—A new station is Kaduna, on 6090 kc., noted at 1620 with Hausa chanting. An ID was given at 1630.

Pakistan—Those who need this country might try listening for Karachi at 1400-1430 on 11,672 kc., at 2100-2115 on 11,885 kc., or at 0835-0850 on 17,885 kc. English news is given at the times indicated, with dictation-speed news on the latter xmsn.

Peru—OAX10, reported last month as being on 5680 kc., has not been heard in recent weeks and may have returned to 3380 kc. *R. Atlantida*, Iquitos, 9625 kc., has opened their 5180-kc. counterpart, although it is not shown in their latest QSL; rated at 500 watts, it was noted around 2132 in Spanish. *R. Juliaca*, Juliaca, has moved to 5081 kc., and has been around 2241-2303 with commercials and request programs in Spanish; even in Brazil, this station is very difficult to hear due to a number of local c.w. xmtrs.

Portugal—Lisbon is again using 6185 kc. (replacing 9740 kc.) in dual to 6025 kc. at

"ABBREVIATIONS" LEAFLET

Your Short-Wave Editor is pleased to announce that a new leaflet is now available for distribution. Entitled "Radio Abbreviations," it lists many of the abbreviations commonly used in short-wave listening, and a few used in ham radio. Ask for Leaflet O, and please enclose five cents in stamps or coin. Send your request to: Hank Bennett, Short-Wave Editor, POPULAR ELECTRONICS, P. O. Box 254, Haddonfield, N. J.

SHORT-WAVE ABBREVIATIONS

anmt—Announcement	m.w.—Medium-wave
c.w.—Morse code	N.A.—North America
db—Decibels	QSL—Verification
DX—Distance	R.—Radio
Eng.—English	s/off—Sign-off
ID—Identification	s/on—Sign-on
IS—Interval signal	VOA—Voice of America
kc.—Kilocycles	xmsn—Transmission
kw.—Kilowatts	xmtr—Transmitter

2100-2145 (Sundays to 2130) and at 2245-2330 (Sundays to 2315) to N.A. in English.

Rumania—English is scheduled from Bucharest as follows: to Europe at 1430-1500 on 9510, 7195, and 6190 kc. and at 1600-1630 and 1730-1800 on 7195 and 5990 kc.; to N.A. at 2030-2130, 2200-2230, and 2330-0000 on 15,380, 9590, 9510, 7225, 7195, and 6190 kc. (also at 2200-2230 and 2330-0000 on 9570 kc.); to the Near & Middle East at 1400-1430 on 9510, 7195, and 6190 kc.; to Asia at 1000-1030 on 15,250 kc.; and to Africa at 1000-1030 on 15,380 and 11,810 kc.

Sarawak—*R. Sarawak*, Kuching, is now scheduled in Eng. at 1755-1915 on 4950 and 7160 kc., at 2300-0030 on Wednesdays on 7270 kc., and at 0930-1000 Saturdays on 4835 and 4950 kc.

South Africa—Paradys has been noted on these channels: on 7295 kc. at 2230-2300 in Eng. & Afrikaans Commercial Service, with ads, music, time checks, and with Afrikaans news at 2245 and s/off at 2300; on 9525 kc. to S. & S.W. Africa with Eng. news at 1530; on 9720 kc. in the Commercial Service at 0105-0110 with music, ads, and acknowledgment of requests, all-English; on 15,085 kc. at 1200-1210 with news in native language, music to 1215, Eng. news to 1225, music to 1230, "Preview Time" to 1245, then native language. The signal is also good from 1515 to 1527/close. *Springbok Radio*, on 21,690 kc., has Eng. news at 0600.

Spain—Madrid is presently scheduled for broadcasts to England at 1520-1550 and to the U.S. at 2215-2300, 2315-0000, and 0015-0100 at 6130 and 9360 kc.; all-English.

Spanish Guinea—*R. Ecuatorial*, Bata, Rio Muni, 7850 kc., now uses 5 kw. and runs to around 1700, but it may still be on to 1720 at times; all-Spanish. It has been noted as early as 1400. S/off is with "Viva Franco! Arriba Espana."

Sudan—Omdurman has been found on 9512 kc. with Arabic chants from 1415; Arabic news at 1555; s/off at 1600.

Swan Island—*R. Americas* is operating on 1165 kc. (a move from 1160 kc.), irregularly on 6005 kc. (a move from 6000 kc.), and on 11,800 kc. (new) with the same schedule given here last month. Your Short-Wave Editor has noted a large increase in the signal on 1165 kc., which reaches 70 db over S9 at times. Early reports indicate that the 11,800-kc. outlet may only be used at 1230-1400.

Switzerland—The DX program from *R. Switzerland* is now being broadcast on Saturdays at 2100-2115. The schedule now reads: to N.A. at 2030-2145 (Sundays to 2215) on 6165, 9535, and 11,865 kc.; to S. E. Asia & Japan at 0745-0900 (Sundays to

0930) on 17,795 kc. (replacing 21,520 kc.), 15,315 and 9665 kc.; to Australia, New Zealand, and the Far East at 0400-0515 (Sundays to 0545) on 17,795 kc. (replacing 21,520 kc.), 15,315 and 11,865 kc.; to the Middle East at 1145-1300 (Sundays to 1330); to India and Pakistan at 0945-1100 (Sundays to 1130) on 15,305 kc. (replacing 15,315 kc.), 11,865 and 17,795 kc.; to the United Kingdom and Ireland at 1345-1500 (Sundays to 1530) on 6055 and 9665 kc.; to Africa at 0200-0315 (Sundays to 0345) on 11,715, 15,305, and 17,795 kc., and at 0945-1100 (Sundays to 1130) on 21,520 kc.

Tunisia—According to a schedule from *R. Tunis*, they now use 6095 kc. at 2330. Has anyone heard this xmsn?

USA—During the recent Cuban crisis, the *VOA* used numerous m.w. stations for beaming their programs to Cuba. One reportedly was WCKY, 1530 kc., Cincinnati.

Point Barrow Radio. Point Barrow, Alaska, has a weather report at 2150 on approximately 2500 kc.

WINB, Red Lion, Pa., will operate on 17,735, 11,920, and 9610 kc., plus another undisclosed channel, according to an unofficial statement by a member of the station personnel. Also unofficial was the time of operation, which was said to be 1000-1700.

WRUL has been sold, subject to FCC approval, by Metromedia, Inc., to the International Educational Broadcasting Corp., a major stockholder of which is the Morman Church. The station plans to continue its commercial format.

USSR—*R. Ulan Bator*, Mongolia, 10,886 kc., opens at 1755 with an IS on a fluted instrument. Another report indicates reception from 1702 s/on, with semi-classical music noted from 1717, talks at 1704 and 1727.

Tchita has been noted with a weak signal on 15,160 kc., opening at 2000 with Russian news.

Vatican City—New broadcasts to North and South America are heard at 1950-2005 daily on 7250 and 9675 kc. Another test program has been noted at the same time on 9645 kc. The 11,740-kc. outlet is still heard well, with Eng. at 1000-1015 and 1320-1330.

Venezuela—YVKO, Caracas, 6170 kc., has an Eng. newscast at 2050-2100 on Sundays. YVSC, Caracas, 9640 kc., listed as inactive, has been heard from 0500 to 0520 at good level; all-Spanish.

Windward Islands—The latest schedule issued from St. Georges reads as follows: at 1030-1230 on 5010, 6080, and 9520 kc., at 1458-1740 on 5010 and 15,085 kc., and at 1740-2115 on 3280 and 9499 kc.

Medium-Wave Station. PJA6, *R. Victoria*, Aruba, Netherland Antilles, listed in December, 1962, as being on 920 and 940 kc., has moved to 905 kc. and is now being widely reported. The best time to hear it seems to be from about one hour after sunset to about 2100. —30—

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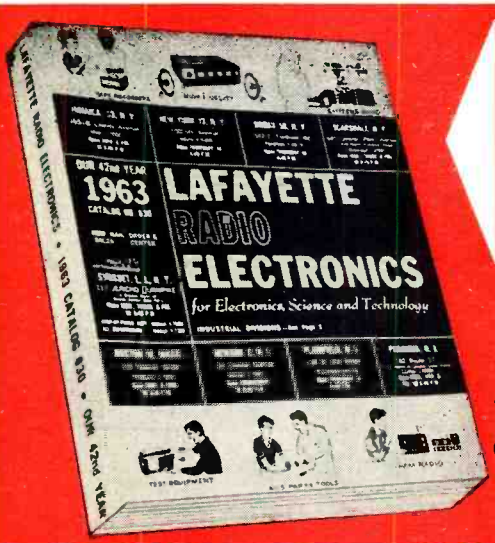

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