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JULY 1965

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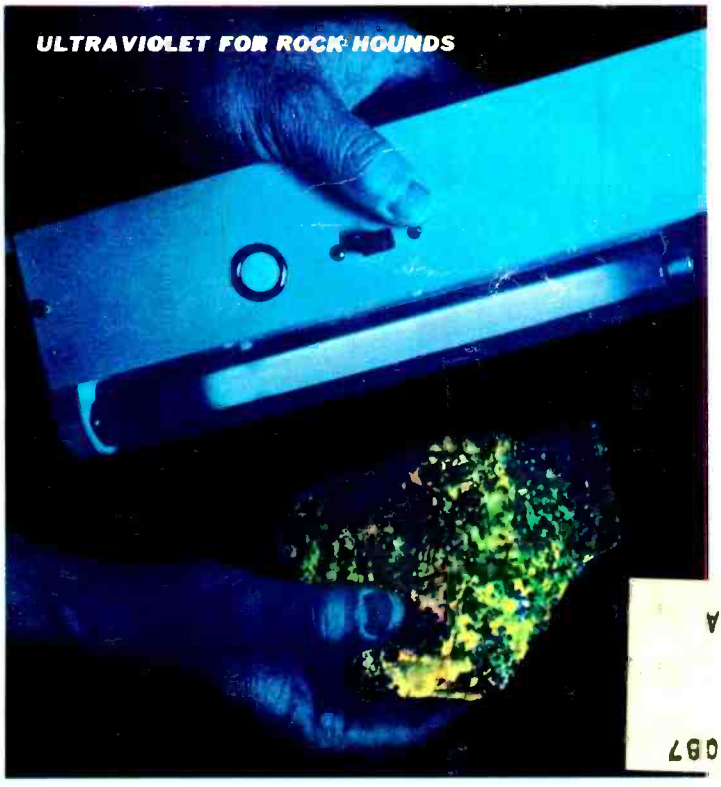

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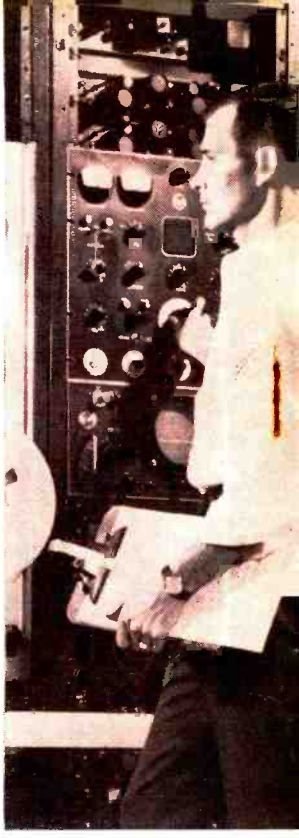

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CIRCLE NO. 3 ON READER SERVICE PAGE

POPULAR ELECTRONICS

ZIFF-DAVIS PUBLISHING COMPANY

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

This month's cover photo by Bruce Pendleton

VOLUME 23 JULY, 1965 NUMBER 1

Electronic Construction Projects

Amateur, CB, and SWL

Electronic Features and New Developments

Departments

POPULAR ELECTRONICS

World's Largest-Selling Electronics Magazine

POPULAR ELECTRONICS is published monthly by Ziff-Davis Publishing Company at 307 North Michigan Avenue, Chicago, Illinois 60601. July, 1965, Volume 23, Number 1. (Ziff-Davis also publishes Skiing, Flying, Popular Boating, Car and Driver, Popular Photography, HiFi/Stereo Review, Electronics World, Modern Bride, and Skiing Trade News.) One year subscription rate for U.S., U.S. Possessions and Canada, $4.00; all other Foreign, $5.00. (Schedule for payment in foreign currencies may be found elsewhere in this issue.) Second Class postage paid at Chicago, Illinois, and at additional mailing offices. Authorized as second class mail by the Post Office Department, Ottawa, Canada, and for payment of postage in cash.

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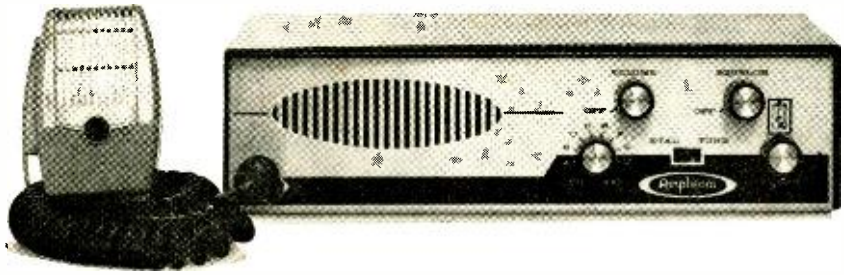


The most important feature of the new Amphenol 510-B doesn't appear on its spec sheet.

Many things will impress you about Amphenol's first entry into CB—the Model 510-B. Our literature tells you all about the single-ended transmitter which exceeds 3½ watts. Our spec sheet will describe the latest planar epitaxial silicon transistors used for the first time in a CB unit. Sensitivity of the receiver. 5 microvolts; 40 db selectivity at 10 kc and dual conversion IF will be also covered.

The literature goes on to tell about a speech clipper which permits full voice power short of over-modulation; the use of reliable solid-state switching in the push-to-talk microphone and the full range squelch control. Also covered are 8 crystal-controlled channels and a crystal-correlated 23-channel tuner.

You'll soon realize the fully transistorized 510-B is a dependable, no-nonsense transceiver. In a compact housing it can be mounted anywhere for AC or DC operation. Sensibly priced at $199.95.

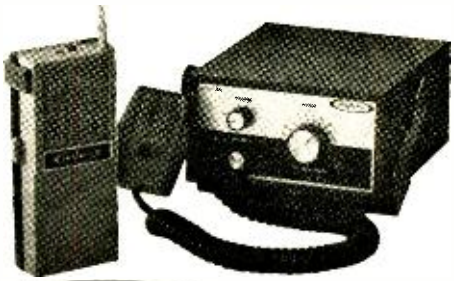
So what important feature isn't covered in the spec sheet? *It's the Amphenol name*—your assurance of equipment you can lean on in emergencies, a guarantee of honest specifications, of full compliance with FCC requirements in an American-made device. It's the mark of engineering leadership that combines maximum performance with reasonable price.

The new Amphenol "600" series offers two top quality transceivers. Both feature 10 crystal-controlled channels & 3.5 watts power output and a receiver that rates tops in sensitivity, selectivity and stability.

The 625 has a built-in AC/DC power supply. It is priced at $189.95. The 600 is a mobile version of the 625 for 12 volts DC only at $179.95. Prices include power cords, push-to-talk microphone, universal mounting kit.

Rounding out the line are two solid-state, 2-channel hand-held transceivers: C-75 1.5 watt model at $114.50; C-60 100 mw, $89.50. Selective Call, portable battery pack and other accessories are available.

See the most advanced CB line at your Amphenol communications distributor.



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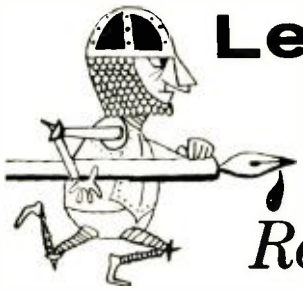

Letters *from our Readers*

Address correspondence for this department to: Letters Editor, POPULAR ELECTRONICS One Park Avenue, New York, N. Y. 10016

Parts—Available and Unavailable

■ The "FM Wireless Microphone" (May, 1965) is another example of an interesting project turning out to be a dud because the parts are not available. Several times in the past I have noticed transistor projects calling for material which is unavailable in this area.

JOHN CLOYD
Hamilton, Ohio

We were surprised by your letter, John, because we made every possible effort to insure that our readers could get all the parts for this particular project from one source. We agree that many projects use parts that cannot be purchased in every radio store. However, we can't survey all stores and then publish projects using only parts that every store has in stock. Somewhere, John, there has to be a compromise. Our readers want interesting and useful projects, and this occasionally means special parts. In such instances, we always list a reputable source.

Auto Light Minder

■ Perhaps your readers would like to know that we can supply all components for the "Simple Auto Light Minder" (May, 1965). A kit including the buzzer, diode, etc., is sold postpaid for $1.49. The assembled equipment, ready for installation, is $2.49.

Light Minder
P. O. Box 233
West Milton, Ohio 45383

Auto Analyzer Improvement

■ I made a simple addition to the Knight-Kit auto analyzer (February, 1965). I drilled a hole in the right-hand side of the cabinet for a 25-ohm, 25-watt rheostat, and use this rheostat to control generator or alternator field current. Most factory manuals and some general auto repair books fully explain the use of this control in testing auto electrical systems. By the way, I added a handle on the top of the cabinet—it sure needs it.

VICTOR E. KELLY
Redondo Beach, Calif.

From South of the Border: Save Forty

■ "Shoot a Radio Wave Into the Air" (February, 1965) certainly hit a sore spot with us hams down in this country and in countries farther south, too. Your article was translated at our local radio club for those who do not read English. This use of the 40-meter band down here is especially annoying to us: DX work in the evening is impossible—*Radio Vatican*, Russia, the BBC, Prague, and Africa are all on, and, I must say, so is the *VOA*. But, while we cannot use much of 40

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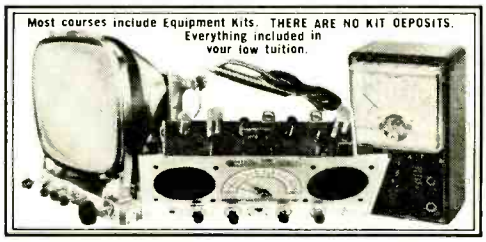

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Letters

(*Continued from page 6*)

for DX, we can use it for *local contacts*. If there are enough stations operating on a local level, and it becomes known to the international stations that the hams have banded together to use their allotted frequencies, we feel that the broadcasters will eventually get the idea that they are putting out a heck of a lot of kilowatts for darn little return. Just an occasional call by *all* of us to a fellow local ham on these frequencies should certainly be noticed. We would like to have your permission to use all or part of the translation of your article, with credit to POPULAR ELECTRONICS, to help us launch a program to SAVE FORTY.

A. L. GONTHIER, XE2GGL
Radio Club Potosino
San Luis Potosi, S.L.P., Mexico

Permission granted, OM. Other radio clubs that would like to use this article in whole or in part are invited to do so, giving due credit to the source.

The "Hoop" Is Back

■ About two years ago you published plans for a "Hoop" antenna (July, 1963) that I have modified for VHF reception. Although in the photo it looks just like another halo-style antenna for mobile reception,

the tubing is a continuous spiral winding. I feed it with coax cable and use a trimmer capacitor paralleling the "Hoop" to tune it to 30-50 mc. This simple antenna is superior to others I have tried.

RONALD L. WARD
Wichita Falls, Texas

You Forgot Us!

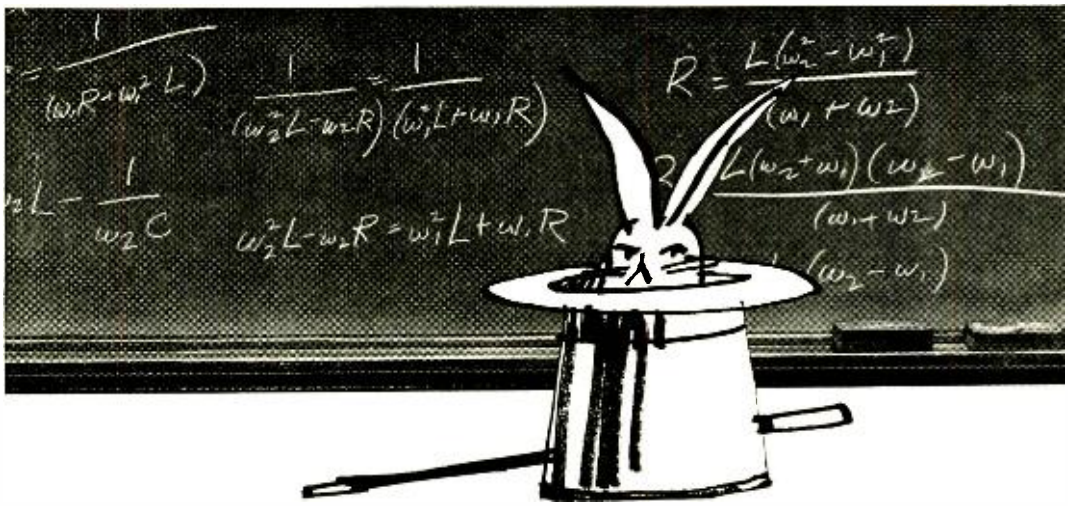
■ I am disappointed that LTV University was passed over in "Bantam Hi-Fi Speaker Systems Ride On Air Cushion" (May, 1965). The LTV University Mini-Flex is one of the innovators of small bookshelf speaker systems. It is a 3-way system, measuring 15" x 9½" x 6", and sells for $69.95. A second model (Mini-Flex II) is a 2-way system and sells for $49.50. Both employ air suspension and are certainly excellent contenders in their field.

IRVING GREENE
LTV University
Oklahoma City, Okla.

You're right, Irv; the Mini-Flex should have been included in the table and price listing. Our apologies for the unintentional pass.

Tape Correspondence

■ I am a sophomore at Fairleigh Dickinson University and would like to correspond by tape with someone in a foreign country. Being a political science



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Letters

(*Continued from page* 8)

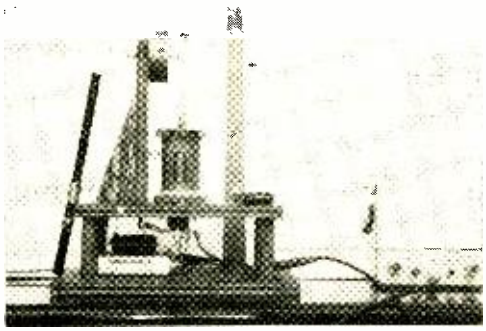
major, I am very much interested in world affairs. I have had a ham license for four-and-a-half years, and am also an SWL.

RICHARD C. FORCE, WA2OCK
51 Tanglewood Lane
Berkeley Heights, N.J.

Although we keep no permanent listing of clubs or individuals seeking tape correspondents, we are pleased to publish your request here. If readers would like to see such a listing of clubs appear in the magazine, please let us know.

Repulsion Coil Wins Again

■ The "60-Cycle Repulsion Coil-Resonance Engine" (March, 1964) was well worth the price of my subscription. When last September rolled around, I decided to enter a duplicate of it in my school's Science



Fair. I wrote a lecture to explain the principle of resonance and used the engine as a demonstration. It won First Prize!

GARY CHIRLIN
Buffalo, N.Y.

Congratulations, Gary. You're numbered among the dozens of readers that adapted Walter Ford's resonance engine and came up with a winner.

Some Thoughts on SWL'ing

■ I'm sure that all BCB DX'ers were gratified by the recent appearance of several articles on our favorite hobby. I hope this means that you will take the next step and publish a regular monthly column on BCB DX'ing.

ROY POSAS, WPE2KKX
Brooklyn, N.Y.

■ I find that different SWL's use different reporting codes. Is there any standard RST system?

ALBEE MESSING
Roslyn Heights, N.Y.

■ Congratulations on a really fine publication—the 1965 COMMUNICATIONS HANDBOOK. This is one of the most informative publications on SWL'ing on the newsstands.

R. M. DUGGAR, WPE4IFF
Ft. Eustis, Va.

Reader Messing will find the answer to his question on codes in the 1965 COMMUNICATIONS HANDBOOK. *Copies are still on the newsstands for $1.00. More information on BCB DX'ing is scheduled for insertion in the 1966* COMMUNICATIONS HANDBOOK, *but no monthly column in* POPULAR ELECTRONICS *on BCB DX is scheduled at this time.* —30—

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

GET THE FACTS. Write for free descriptive folder on either the Mark VIII or Mark Nine to: Commercial Engineering, Department G133R, RCA Electronic Components and Devices, Harrison, N. J.

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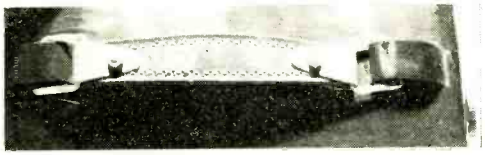
CIRCLE NO. 22 ON READER SERVICE PAGE

Tips and Techniques

PORTABLE RADIO HANDLES REPAIRED WITH METAL STRIPS

Broken leather or plastic handles on radios or luggage can be repaired with aluminum or copper strips. Cut two identical strips and drill holes in the ends of each. Fold the metal over and loop it through the han-

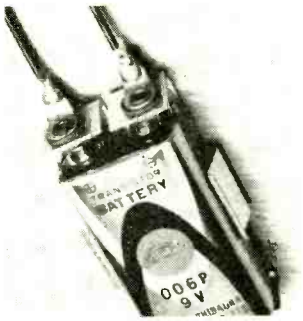


dle supports. Then bolt the assembly as shown. Smooth off all rough edges to prevent cuts and abrasions.

—Homer L. Davidson

TRANSISTOR BATTERY HOLDER MADE FROM TWIN PENLIGHT CLIPS

You can easily construct a holder to accommodate the popular 9-volt transistor battery by modifying a twin AA holder. With just a pair of pliers, bend and break off the inside prongs of the holder's U-clips to make room for the larger battery. Then bend the outside prongs inward so they can get a good grip on the battery. When inserting the battery in the holder, be careful not to short the terminals against the frame of the holder.



—Art Trauffer

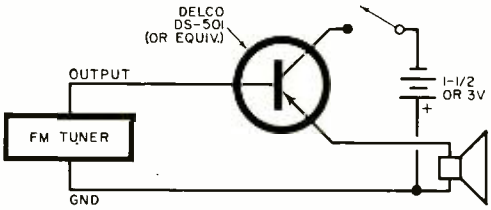
SINGLE-TRANSISTOR AUDIO MONITOR

Designed for low-level monitoring of tuners and tape decks whose output signal requires an external amplifier to be heard, this

Tips

(*Continued from page* 12)

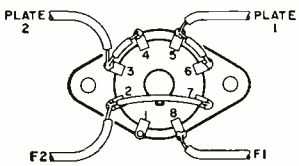
simple "audio monitor" doesn't provide much gain, but will match an 8-ohm speaker to the program source. A power transistor is used in an emitter follower circuit as



shown. The amplifier runs on a 1.5- to 3-volt battery and no heat sink is necessary. —*Carl Dunant*

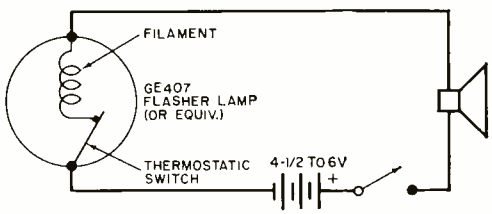
REWIRE RECTIFIER SOCKETS FOR QUICK TUBE SUBSTITUTION

The rectifier tube sockets in your power supply can be modified to accommodate different tubes by wiring them as shown in the diagram. Be careful not to exceed transformer and tube ratings when substituting tubes. The tubes that can be used include: the 5AR4, 5AS4, 5AT4, 5AU4, 5AW4, 5AX4, 5AZ4, 5CG4, 5R4, 5T4, 5U4, 5V3, 5V4, 5W4, 5X4, 5Y3, 5Y4, 5Z4, 5931, 6087, and 6106. —*Jim Vasbinder*



AUTOMATIC SPEAKER "PICKER-PUCKER"

Not only does this flasher bulb and speaker circuit entertain and educate, it can be used to predict front-to-back pressure balance of a speaker mounted in a cabinet. For best response, the "thump" heard in



one direction should match the "thump" heard in the other direction; an unbalanced condition might result in a sound like "pick-puck." When the switch is closed, current

(*Continued on page* 20)

POPULAR ELECTRONICS
PRODUCT SERVICE PAGE

You can get additional information promptly concerning products advertised or mentioned editorially in this issue

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VOID AFTER AUGUST 31, 1965 7

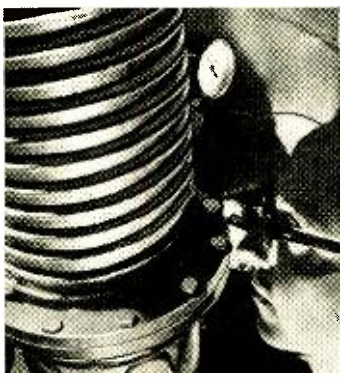
696,000 TECHNICIANS NEEDED BY 1970!

Government Report* Points Out Rapidly Growing Job Opportunities: Need for Trained Electronics Technicians An Important Factor

By Bill Gordon, RCA Institutes, Inc.

President Johnson Emphasizes Need. In his 1964 annual manpower report, President Johnson indicated that the demands for manpower are expanding most in, among other fields, service and technical (including technician) occupations. This expansion is the result of a handful of causes underlying today's big changes in the occupational picture: (1) increasing complexity of modern technology, (2) trend toward automation of industrial processes, (3) growth of new areas of work, such as in the field of atomic energy, earth satellites and other space programs, and (4) data systems analysis and data processing. Indicative also of the growing importance of the use of technicians is a recent revision of the "List of Critical Occupations" published by the U.S. Department of Labor in which technicians are listed for the first time by the U.S. Government.

Salary Levels for Trained Technicians Rising Fast. Beginning salaries for graduates of top level technician education programs have continued to go up during the past five years, at a faster rate than salaries of similar types of jobs. In fact, a U.S. Labor Department projection based on the figures shows that by 1970, technician salaries will average an all-time high.

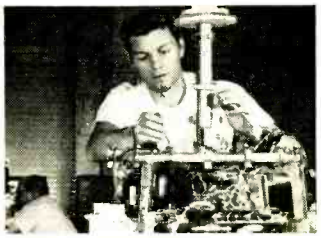


Nuclear Instrumentation

Technical Education is One of Today's Best Investments. Today, a person interested in becoming a technician can choose Home Training or Classroom Training to begin building his career. One of the nation's largest schools devoted to training electronics technicians, RCA Institutes, offers a wide variety of courses in both categories. In addition, the RCA "AUTOTEXT" Programmed Instruction Method is helping people learn faster and easier so they can get started on their careers in the shortest possible time. Dramatic proof comes from the success stories of countless graduates who find profitable positions in government, industry, or in their own businesses.

Of the total 696,000 technicians needed by 1970, it can be estimated that electronics technicians at all levels will form a vital core in today's major job picture.

*"Scientists, Engineers, and Technicians in the 1960's" U.S. Department of Labor, Bureau of Labor Statistics.



Nuclear Instrumentation

RCA DEVELOPS AN EASY WAY TO LEARN ELECTRONICS AT HOME

New "Career Programs" Help Train You For Expanding Job Opportunities. RCA "AUTOTEXT" Instruction Method Speeds Learning

Choose an RCA "Career Program" that will train you for the job you want in Electronics! No time wasted learning things you'll never get to use. "Career Programs" answer the need for today's growing job opportunities for trained Electronics Technicians. They can help you get the job you want faster and easier than you ever dreamed possible! And each "Career Program" starts with the amazing "AUTOTEXT" Programmed Instruction Method—the scientific way to learn that's almost automatic! "AUTOTEXT" helps even those who have had trouble with ordinary methods of home training in the past. This is the "Space Age" way to learn everything you need to know with the least amount of time and effort!

Choose a "Career Program" now. Each one is designed to train you for a specific, rewarding career in one of the following exciting fields:

- TELEVISION SERVICING
- FCC LICENSE PREPARATION
- AUTOMATION ELECTRONICS
- AUTOMATIC CONTROLS
- DIGITAL TECHNIQUES
- TELECOMMUNICATIONS
- INDUSTRIAL ELECTRONICS
- NUCLEAR INSTRUMENTATION
- SOLID STATE ELECTRONICS
- ELECTRONICS DRAFTING

In addition to these "Career Programs" RCA Institutes offers a wide variety of separate courses on many subjects—from Electronics Fundamentals to Computer Programming.

VALUABLE EQUIPMENT INCLUDED

And, with your RCA Training, you receive top-quality equipment to keep and use on the job. When you train with RCA Institutes, you never have to take apart one piece to build another. You'll get the new Programmed Electronics Breadboard which provides limitless experimentation . . . and, with which you construct a working signal generator and a superheterodyne AM Receiver.

SPECIAL BONUS — OSCILLOSCOPE and METER KITS

Valuable Oscilloscope and Multimeter Kits are yours at no additional cost when you enroll in any one of the RCA Career Programs . . . "must" equipment for electronics technicians in almost all jobs.

LIBERAL TUITION PLAN

Only RCA offers you this most economical way to learn. You pay for lessons only as you order them. No long term contracts. You may stop your training at any time without owing a cent.

CLASSROOM TRAINING ALSO AVAILABLE

If you prefer to learn in a classroom, RCA Institutes maintains one of the largest schools of its kind where the latest classroom and laboratory training is available in day or evening sessions. You may be admitted without any previous technical training. Preparatory courses are available if you haven't completed high school. Coeducational classes start four times a year.

FREE PLACEMENT SERVICE

RCA Institutes records prove that in a recent class 9 out of 10 Resident School students who used the Free Placement Service had their jobs waiting for them when they graduated. And, many of these jobs were with top companies in the field—IBM, Bell Telephone Labs, General Electric, RCA, and radio and TV stations, and other communications systems throughout the world.

SEND THE ATTACHED POSTAGE PAID CARD FOR COMPLETE INFORMATION WITHOUT OBLIGATION. NO SALESMAN WILL CALL. VALUABLE FREE BOOK INCLUDED. CHECK HOME STUDY OR CLASSROOM TRAINING.

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A Service of Radio Corporation of America
350 West 4th St., New York, N. Y. 10014

The Most Trusted Name In Electronics

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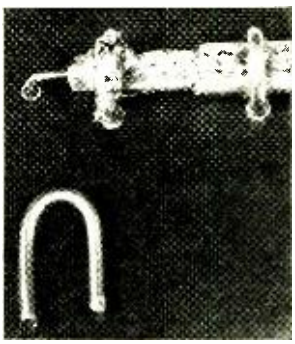
Tips

(*Continued from page* 14)

goes through the voice coil of the speaker —pushing it forward or backward, depending on its polarity –and lights the lamp. When the thermostatic switch in the lamp heats up, it opens the circuit and the speaker voice coil returns to its normal position. Upon cooling, the thermostatic switch closes the circuit, and the process is repeated. In building this circuit, use the lowest voltage that will cause flasher action. —*Art Trauffer*

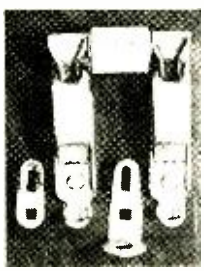
U-SHAPED CLAMPS HOLD COAX TO CIRCUIT BOARD

To connect a coaxial cable to a printed circuit board securely, form two U-shaped clamps of heavy-gauge wire. Make one U-clamp wide enough to fit snugly over the insulation; make the other one slightly narrower to hold and connect the braid. Position the coaxial cable and drill five holes in the board as shown. Then insert the cable and clamps, and solder the clamp in contact with the braid to the braid and to the circuit board. —*Don Lancaster*



TOOLBOX GIMMICK HAS 1001 USES

This handy gimmick for your toolbox can replace a fuse holder, hold a cartridge rectifier, connect an antenna lead-in to a TV set, and serve as a heat sink or as a third hand for soldering. It can even be used to hold construction notes or a schematic near a project being worked on. The gimmick is made with two clips and a small (3-4) terminal strip. To secure the clips to the strip, remove the fastening screws from the clips and pass them through two terminals. Hold the clips in place while you tighten the screws. —*Albert Koehler*



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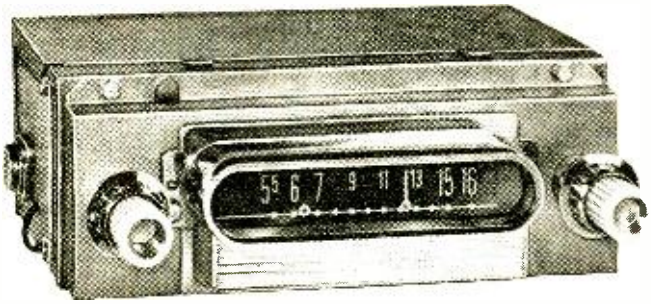

Nat. Adv't. $38.82
Dealer Net:

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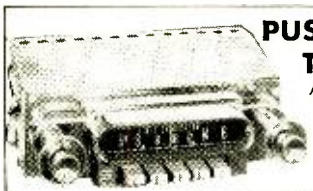

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SAN DIEGO (La Mesa) — Grossmont Shop. Ctr.
LONG BEACH — 127 W. 7th St.
LONG BEACH — 3976 Atlantic Ave.
OAKLAND (San Leandro) — Bay Fair Shop. Ctr.
SACRAMENTO — 600 Fulton Ave.

CONNECTICUT
HAMDEN — Hamden Mart. Shop. Ctr.
MANCHESTER — Manchester Shop. Parkade
NEW HAVEN — 92 York St.
NEW LONDON — New London Shop. Ctr.
STAMFORD — 29 High Ridge Rd.
WEST HARTFORD — 39 So. Main St.

ILLINOIS
CHICAGO — Evergreen Plaza at 95th St.

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BOSTON — 167 Washington St.
BOSTON — 594 Washington St.
BOSTON — 110 Federal St.
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BROOKLINE — 730 Commonwealth Ave.
CAMBRIDGE — Fresh Pond Shop. Ctr.
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ARLINGTON — Washington-Lee Shop. Ctr.

WASHINGTON
SEATTLE — 2028 Third Ave.
SEATTLE — 837 N.E. 110th St.

CIRCLE NO. 23 ON READER SERVICE PAGE

New Products

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

HIGH-INTENSITY LAMP WITH MAGNIFIER

Need a high-intensity lamp with a magnifier for close detail work? The *Roxter* Model 7175 miniature lamp is said to give concentrated, glare-free light which is the equivalent of daylight. Through the use of its Hi-Lo switch, it provides 500 footcandles of light in "high" and 250 footcandles in "low" at normal working distances. The 2X magnifier, which has a focal length of 7 inches, can be swung out of the way when it isn't needed. The magnifier arm swivels vertically and extends to 12 inches; friction joints on the arm permit an infinite number of positions.

Circle No. 75 on Reader Service Page 15

FM WIRELESS MICROPHONE

Unlike the familiar AM "wireless broadcasters" popular many years ago, the *Amphenol* "Consort" is a high-fidelity instrument with a frequency response of 20-20,000 cycles. Actually a miniature, high-stability FM transmitter, the dynamic microphone emits a signal which can be detected up to 200 feet away by conventional FM tuners with properly oriented antennas. Small enough to be easily concealed in a pocket, the "Consort" uses a single mercury battery for up to 300 hours of operation.

Circle No. 76 on Reader Service Page 15

MARINE CB ANTENNA

Citizens Band boating enthusiasts: lend an ear. *Mosley Electronics* says they have designed an 8-foot, 5-inch half-wave antenna especially for you—the "Silver Dolphin." It's streamlined, all brass parts are chrome-plated, and the aluminum sections are anodized for complete rust- and corrosion-proofing. A simple adjustment of the durable stainless steel whip permits peaking of desired frequencies. The SWR is 1.5:1 or better over 23 channels. Special feature: a convenient hinge-type brake-over which allows the antenna to he laid parallel to the deck. A "Swiv-L-Mount" accessory, designed to mount on the waterproofed base of the antenna, swivels to give a perfect vertical installation.

Circle No. 77 on Reader Service Page 15

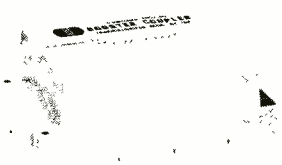
STEREO SPEAKER SYSTEM

The *Empire* 8000P "Grenadier" speaker system is said to represent the most significant advance in stereophonic reproduction. For the first time, a listener is able to adjust the bass and treble response to suit individual room acoustics. You can literally sit anywhere and hear everything. Frequency response of the 8000P is 25-20,000 cycles; nominal impedance, 8 ohms. The exclusive Empire sonic column is totally rigid without resonance. A downward-facing woofer, close to the reflecting floor surface, feeds through a front-loaded horn with full-circle aperture throat, providing 360° sound dispersion.

Circle No. 78 on Reader Service Page 15

TRANSISTORIZED BOOSTER COUPLER

No smear, no line ghosts, no interference between sets. The transistorized BC-107 Booster-Coupler announced by the *Winegard Company* offers linear frequency response across both TV and FM bands, and an exact match into 300 ohms. It's capable of delivering a minimum of 7 db gain to each TV and FM set. An extra set of terminals makes possible its use as a booster only with a single TV or FM set, providing a minimum of 12 db gain. The BC-107 can also be used to extend rabbit-ear range in medium signal areas or to boost signals to a 4- or 6-set coupler.



Circle No. 79 on Reader Service Page 15

"GLO-BUTTON" FOR PUSH-BUTTON SWITCHES

Called the new third dimension in buttons, the *Switchcraft* "Glo-Button," Series X, looks and functions like a non-illuminated button but provides a clearly visible color legend display like an illuminated button—without a lamp or electrical power of any kind. It's intended for use on all push buttons with

New Products

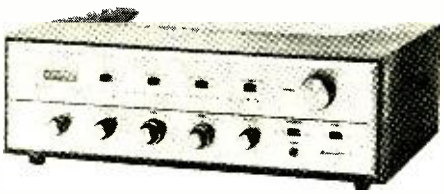
(*Continued from page 22*)

standard .050" x .187" plungers, such as the Switchcraft Series 7000 and 8000 "Multi-Switches." The design legend, which can be anything from "A" through "R" or "0" through "18" as well as "ON" and "OFF," is marked in an opaque color on a translucent front screen. The opaque color—black or white—provides a background for the legend, which is orange-red.

Circle No. 80 on Reader Service Page 15

80-WATT STEREO AMPLIFIER KIT

A unique circuit testing system that protects the kit builder against accidental transistor blow-out is incorporated in the *H. H. Scott* LK-60 solid-state stereo amplifier kit. If a wiring error has been made, an ordinary light

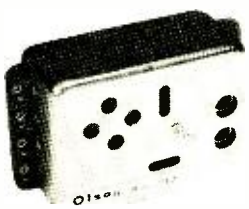


bulb glows brightly, warning the kit builder that the wiring must be rechecked. But wiring errors are hard to make with the full-size, full-color charts in the Scott instruction book. All difficult circuits come factory-tested on preassembled modular circuit boards. Harmonic distortion of the LK-60 is less than 0.8%; frequency response, 10-40,000 cycles.

Circle No. 81 on Reader Service Page 15

TRANSISTORIZED FM CONVERTER

Olson Electronics' transistorized 88- to 108-mc. FM front end, known as Model RA-713, was designed as the converter section for an AM/FM receiver. Its output is 10.7 mc., and it requires an i.f. strip and detector when used in a tuner or radio. With proper accessories, the converter could be built into a field strength meter to optimize an FM antenna installation. Measuring 2½" x 1⅝" x 1", it operates on 9 volts d.c.



Circle No. 82 on Reader Service Page 15

VERY-LOW-FREQUENCY REPRODUCER

Representing a breakthrough in low frequency sound reproduction, *Aladdin Electronics'* "Octavium" sound reproduction "complement" extends the range of speaker systems to below audibility. According to the manufacturer, its range begins where the response of quality speaker systems starts to fall off, adding a dimension of depth to music reproduction. The "Octavium" reproduces fundamentals through the two lowest audible octaves—from 70 cycles down to 15 cycles per second. Measuring 20¾" x 20¾" x 37" high, it can be used with any stereo speaker system.

Circle No. 83 on Reader Service Page 15

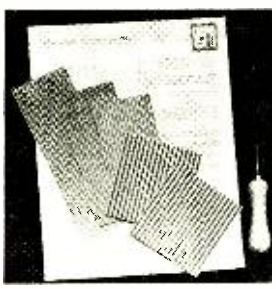
SENSITIVE VHF CONVERTER

You can convert your auto or home radio into a sensitive VHF short-wave receiver by inserting *Scientific Associates'* VHF converter into the existing antenna system—no special tools are needed. Two models of the transistorized converter are available: a fixed-frequency unit which permits dial tuning through any 1-mc. segment of the 108-170 mc. range; and a tunable unit (illustrated) which provides for continuous tuning across an entire band of frequencies within this range. Both models feature a built-in audio squelch circuit which can be internally connected by the user, if desired. Complete installation instructions are included.

Circle No. 84 on Reader Service Page 15

BREADBOARD KIT

Want to save time and labor on your construction projects? With the Veroboard breadboard kit Model BK-6, there is no need for chassis, brackets, terminals, tools, or wires. Announced by *Vero Electronics, Inc.*, the kit consists of six assorted universal wiring boards, a spot face cutter, and complete instructions on how to design a component layout directly on a board. You can use the kit either to breadboard experimental and training circuits or to make finished circuit boards.



Circle No. 85 on Reader Service Page 15

SOLID-STATE MODULES

Modules might be said to be the current fad in electronics these days. *I.E.H. Manufacturing Co., Inc.*, has just announced 12 of them: a flasher for use on cars, bicycles, etc.; a power amplifier; a "super" amplifier (you can hear through walls with it); a tone-modulated oscillator; metronome; full-wave bridge and filter; electronic filter for ripple-free d.c. power; preamplifier; power transformer; p.a. amplifier; guitar amplifier; and intercom

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For unmatched quality and dependability – GO JOHNSON!

The most popular CB transceiver in the world—the "Messenger III" offers everything you ever wanted in a CB transceiver . . . compact size, a husky signal, extreme sensitivity, razor-sharp selectivity—and complete flexibility for base station, mobile, public address, or battery powered portable use! Double conversion receiver—set-and-forget "Volume" and "Squelch" controls—11 channel coverage—"Tone Alert" Selective Calling System available as accessory.

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MESSENGER TWO
Ten channels and tuneable receiver. Excellent receiver sensitivity and selectivity. Plenty of features. Delivers a penetrating signal with solid punch!

PERSONAL MESSENGERS
100 Milliwatt and 1½ Watt hand-held units. Twice the sensitivity and 40% more range than similar units with conventional circuitry!

MESSENGER
To date—one of the biggest sellers in the Citizens Band field! 5 channels—long on performance, short on cost.

New Products

(*Continued from page 24*)

amplifier. Some of these solid-state modules can be used in conjunction with each other. All of them are easy to mount, with no soldering required.

Circle No. 86 on Reader Service Page 15

CB AUDIO COMPRESSOR AMPLIFIER

A new CB accessory introduced by *Lafayette Radio Electronics*, the Model HA-115 audio compressor automatically increases the average modulation of a CB transmitter without overmodulating the carrier. An illuminated meter directly reads modulation percentage. The HA-115 works with all popular 6- or 12-volt d.c. or 117-volt a.c. CB transceivers, and comes complete with operating and installation instructions.

Circle No. 87 on Reader Service Page 15

RECHARGEABLE FLASHLIGHT—PLUS

Two inches in diameter by two inches long, the "Star Fire 2000" available from *Puritron Corporation* is actually three units in one. It's a portable flashlight said to contain the power of flashlights more than five times its size. When put on its special stand which has a 360-degree swivel base, it can serve as a work light. And when attached to the forehead by means of a headstrap which is provided, leaving both hands free, it becomes a convenient headlight. The sealed unit comes with an external recharger, and is backed by a five-year guarantee. Made of plastic, the "Star Fire 2000" is ideal for sportsmen—it floats.

Circle No. 88 on Reader Service Page 15

HANDY GREASE GUN

A grease gun in an Aerosol can is the latest thing in greasing agents. Being produced by the *Injectorall Electronics Corp.*, "Slide E-Z" grease contains "anti-oxidant" to prevent corrosion and to extend part life. Although it is specially designed for electrical contacts and controls, it can be used safely on any mechanical parts.

Circle No. 89 on Reader Service Page 15

NEW!
19 Piece POWER TOOL ATTACHMENT SET

WITH **FREE** POLYSTYRENE **TOOL BOX**

CONVERTS ANY DRILL into

- POWER SCREWDRIVER
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- POWER SANDER and POWER BUFFER

with **2 SPEED ANGLE DRIVE**

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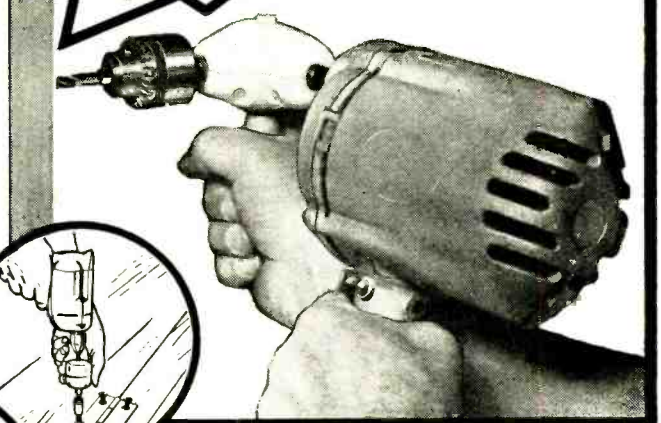

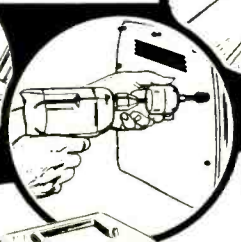

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Converts any drill to a Power Screw Driver and Power Nut Driver. Contains deluxe Power Screwdriver attachment, 2 slotted and 2 Phillips type screwdriver blades, a screwfinder, power nut driver adaptor and 8 square drive machined sockets.

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A PERFECT SET FOR EVERY POWER DRILL OWNER!

This 100% AMERICAN MADE kit is made of hardened steel with DuPont Zytel nylon housings which eliminate overheating and minimize drill load. Includes: 3 screwdriver blades, a screwfinder, 8 machined sockets and adaptors. 2 SPEED ANGLE DRIVE doubles or halves the speed of any drill. With 1 ¼" shank adaptor; 1 spindle adaptor; 1 chuck adaptor.

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ENERGY, ELECTRICITY AND ELECTRONICS

by Rex Miller and Fred Culpepper

This title applies to four separate books which the publisher calls "Course One of Three Courses in Electricity and Electronics." Of the four books, three are of possible interest to POPULAR ELECTRONICS readers. One, *Applied Activities*, outlines 36 very basic experiments in electricity and electronics; it has some possibilities as a pre-teen introduction to this field. The second and third are a students' and a teachers' textbook, respectively, covering a gamut of subjects from Ohm's law to job opportunities in electronics; a high school embarking on a new basic electronics course might want to examine these two items. The fourth book details some 100 experiments involving the publisher's 3-E circuit boards and is relatively valueless to experimenters without the boards. However, all of the material in the four books is excellently prepared.

Published by McKnight & McKnight Publishing Co., Bloomington, Ill. 61702. Applied Activities: *104 pages, cloth cover, $4.00. The students'* Textbook: *235 pages, cloth cover, $5.20. The teachers'* Professional Edition: *243 pages, cloth cover, $6.00. The* Laboratory Manual: *152 pages, soft cover, $1.80.*

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An unusual and worthwhile effort by an electronic parts manufacturer has resulted in a book that promises to entertain, teach, and provide experimenters with useful electronic devices and gadgets. The book describes 50 easy-to-build transistor projects, including a sun-powered radio, electronic megaphone, appliance tester, tachometer, code transmitter, short-wave converter, burglar alarm, and hi-fi accessories. The book is easy to read and well illustrated. Introductory material explains

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

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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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CIRCLE NO. 21 ON READER SERVICE PAGE

Bookshelf

(*Continued from page 28*)

the use of tools and how to recognize electronic parts. Chances are that the electronics dealer who sells this book will also stock and sell the manufacturer's parts.

Published by Semitronics Corp., 265 Canal St., New York, N.Y. 10013. 96 pages. Soft cover. $1.95.

TECHNICAL WRITER'S & EDITOR'S STYLEBOOK

by Rufus P. Turner

Experienced writers and editors are well aware of the number of subtle differences that creep into the "King's English" when used to convey technical, as opposed to nontechnical, information. The question is: what is good style when it comes to writing technical articles? While there can be no universal style which will satisfy everyone, Rufus P. Turner (who happens to be an assistant professor of English as well as the author of numerous technical books and articles) has outlined in this volume the essentials needed for writing in any scientific field. Especially helpful are the chapters on abbreviations and the use of numbers.

Published by Howard W. Sams & Co., Inc., 4300 West 62 St., Indianapolis 6, Ind. Soft cover. 208 pages. $3.95.

Free Literature

Every item in the entire EICO line of kits and wired electronic equipment is described and illustrated in this company's 1965 Full-Line Catalog—well over 200 products. For your free copy of the 36-page, 2-color new-format catalog, write to EICO Electronic Instrument Company, Inc., 131-01 39th Ave., Flushing, N.Y. 11352 . . . The latest edition of the Amperex Condensed Electron Tube Catalog contains a numerical index, descriptions and basic specifications on the complete line of Amperex tubes, including the new cathode-ray and vidicon tubes. To obtain a copy, write on company stationery to Amperex Electronic Corp., Advertising Department, Hicksville, L.I., N.Y. 11802 . . . Now available upon request from the Clairex Corporation, 8 West 30th St., New York, N.Y. 10001 is the first 4-page issue of a new periodical entitled "Photocell Forum." It discusses the uses of light in operating contactless relays. Subscription to the Forum is open at no cost to engineers interested in photoconductivity. —30—

SWL QSL BUREAU

THE SWL QSL Bureau is a non-sponsored organization operating with the cooperation of the ARRL QSL Bureau and Newark News Radio Club. Its purpose is to handle incoming overseas SWL and QSL cards destined for W, K, and VE SWL's. When cards arrive with a complete address, the short-wave listener is notified by post card and requested to send a $9\frac{1}{2}$ x $4\frac{1}{4}$ inch SASE (self-addressed, stamped envelope), with an extra stamp, to the Bureau so that the cards may be forwarded to him. Many SWL and QSL cards arrive incompletely addressed, however, or addressed only to a WPE identification. Such cards are being held for the WPE'ers listed below.

WPE1CLX
WPE1DKB
WPE1EGU
WPE1EJT
WPE1EZZ
WPE1FDW

WPE2ECR
WPE2EUD
WPE2IPH
WPE2KBK
WPE2KOP
WPE2KXG
WPE2LNI
WPE2LVF
WPE2MAV
WPE2MLI
WPE2MLZ

WPE3CIM
WPE3DST
WPE3FFJ
WPE3FRQ

WPE4FJT
WPE4HDX
WPE4HOM

WPE5CNK

WPE6CYP
WPE6DZO
WPE6ECV
WPE6FRJ
WPE6HQD

WPE7AWQ
WPE7BGH
WPE7BLZ
WPE7BQW

WPE8CMK
WPE8DBX
WPE8EUJ
WPE8FFB
WPE8FSK
WPE8GCR
WPE8GQB
WPE8IHL

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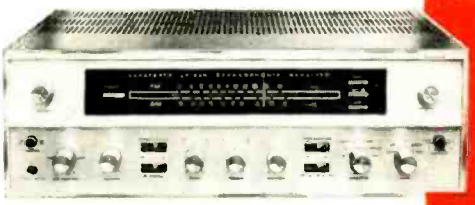

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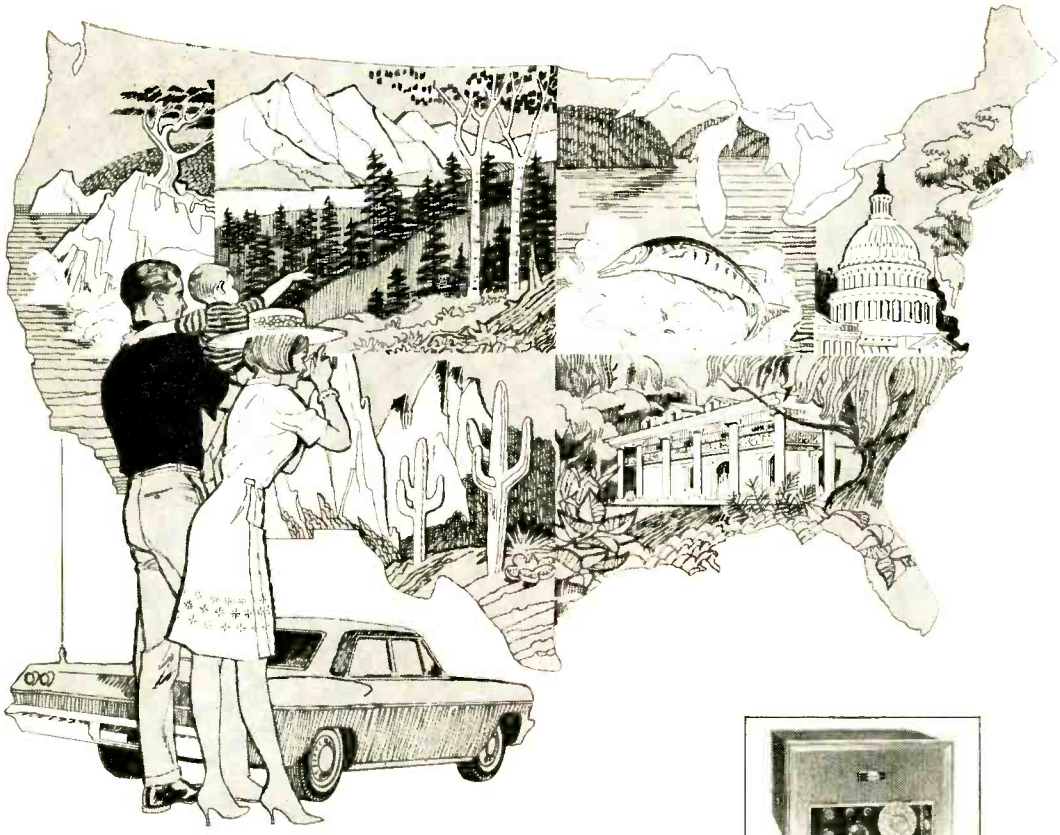

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CIRCLE NO. 12 ON READER SERVICE PAGE

NO STICK ON A SWIVEL

By HANS FANTEL

Tone arms are the most misunderstood hi-fi component—take a peek at quality 12" arms and the part they play

NOT TOO long ago, a tone arm was no more than a stick on a swivel. All the tone arm did was hold the phono cartridge over the record. But the best of today's stereo cartridges are so sophisticated that tone arms *had* to improve. The stylus in a high-compliance stereo cartridge is so flexible that it could be "squashed" by a clumsy tone arm.

Cartridge designers are pushing design limits close to the theoretical optimum. But even the best cartridge can't live up to its promise if the tone arm won't "play along." The arm is an active working partner of the cartridge. Only with the assistance of a capable tone arm can the cartridge trace every detail of the musical waveform embossed on the record.

This goes double for stereo because on stereo records the cartridge must trace the groove vertically as well as horizontally. It needs a tone arm that can virtually float the cartridge across the record without tugging, dragging, or bouncing. In effect, the modern tone arm must act as a sort of outer space platform, isolating the cartridge from all extraneous influences, such as shaky floors, gravity changes due to turntable tilt, friction, and inertia. The tone arm must neutralize all these factors so that the cartridge responds only to the wiggles in the record groove, unaffected by anything else.

Any tone arm that can satisfy all of the above requirements is far from a simple piece of hardware. It has to be a cleverly designed piece of precision equipment. Most arms in this class are sold separately and custom-mounted on professional-type turntables. But lately even the arms furnished on some high-

Price Tags

With tone arm prices scattered over a 1:5 range (from about $25 to $125), you'll want to know just what you get for your money in the different price groups. It's good news for budget buyers that the performance gap between the cheapest and the most expensive tone arm listed in the table on the next page is surprisingly small. Each of them will let a modern high-compliance cartridge do its stuff.

What, then, can top-price models offer to justify such an investment? The difference in tonal quality is generally so slight that it takes a highly educated ear to notice it at all. Besides, any difference would only be apparent with the most compliant cartridges and only if the signal were reproduced through top-grade amplifiers and speakers. But to the serious hi-fi hobbyist who likes to experiment with many different cartridges, the de luxe tone arm offers an important advantage: the many possible adjustments allow him to make sure that any cartridge he may choose works under optimum conditions.

quality record changers have been designed to the highest standards. Changers equipped with such arms are sometimes called "automatic turntables" to tell them apart from ordinary changers. In addition, several combinations of high-quality tone arms and single-play turntables (all preassembled) are now on the market.

A quality tone arm must meet four main requirements: (1) stable balance, (2) tracking accuracy, (3) low resonance, and (4) minimum friction. Before you judge any given model in terms of these four points, it will be helpful to know the theory behind each.

Stable Balance. To keep just the right amount of downward force on the stylus during every moment of record playback, the tone arm must be balanced in a special way. In this respect, hi-fi tone arms differ radically from the ordinary low-fi arms. On cheap phonographs the arm is usually balanced by a spring pulling upward to counteract the weight of the arm and cartridge pressing on the record. But that's like trying to keep a firm footing on a set of bedsprings. The upward pull of the spring makes the arm jumpy. Heavy footsteps, passing traffic, or a loud note on the record itself will jerk an ordinary tone arm right up and out of the groove. A moment later, it will come crashing down on the record again with an impact that can do permanent damage to a compliant stereo stylus.

Quality tone arms, by contrast, are never balanced by an upward-pulling spring. Instead, they use a counterweight. Many modern arms employ a principle known as "dynamic balancing," which uses the counterweight to render the arm totally weightless with respect to the cartridge. By adjusting the counterweight, stylus pressure can be reduced to nothingness. The arm literally floats. Then a small spring is adjusted (usually on a calibrated dial) to provide exactly the amount of *downward* force required for proper cartridge tracking. Stylus pressure and overall balance in these arms remain constant regardless of turntable slant, floor vibration, or accidental jolts. Thanks to a clever arrangement of their front and rear centers of gravity with respect to the pivot, dynamically balanced arms become independent of the earth's gravity. One will play even if the whole turntable is upside down.

The tone arm must also be balanced so that the stylus pushes against both groove walls with equal force. Otherwise the stereo output would be lopsided. The basic geometry of modern tone arms makes them lean a little harder against the inner groove wall than against the outer wall. To counteract this imbalance, high-quality arms have side-thrust compensators, also called "anti-skating" devices. They neutralize the inward pull of the arm with an equal force in the opposite direction. In some models, these thrust compensators take the form of those queer little "outriggers" you see dangling from the side of the arm, or small weights zooming up and down like elevators on a cable. Other designs achieve the same effect by off-center counterweights.

Tracking Accuracy. Ideally, the tone arm should travel across the record in a straight line. That would keep the cartridge properly lined up with the record grooves (at an exact tangent to each groove) all the way from the beginning to the end of a record. But the arm can't travel in a straight line because it turns on a pivot. Its path is necessarily curved. As a result, the cartridge changes its angle with respect to the grooves as it scans the face of the disc. The number of degrees by which the actual cartridge angle differs from a true tangent is called the "tracking error." The trick is to

Today's Top Tone Arms

MAKE	MODEL	DESCRIPTION	PRICE
Audio Dynamics Corp (ADC)	"Pritchard" ADC-40	Walnut arm body in gimbal mounts; plug-in cartridge shell; side-thrust compensator; overall length, 10⅝ inches	$44.50
EMI-Scope Electronics Corp.	Castagna Model A	Adjustable tracing angle and overhang; calibrated stylus pressure adjustment; friction-free magnetic suspension for lateral motion; sapphire knife-edge bearing for vertical motion; side-thrust compensator; hand-machined aluminum parts; exchangeable cartridge mounting plate	125.00
Empire	Model 980	Calibrated stylus pressure adjustment; maximum tracking error, ± 0.65 degree; resonance, 6 cycles; micro-ball bearings in both lateral and vertical plane; adjustable overhang; automatic "Dyna Lift" raises tone arm from record at end of play; exchangeable cartridge shells	50.00
Grado	Laboratory Series	Gunstock walnut body with aluminum fittings; dynamically balanced; side-thrust compensator; exchangeable cartridge mounting plate; needle-point bearing	45.00
Gray	Model 212-TN	Viscous damping; resonance to 10 cycles; exchangeable cartridge mounting plate; viscous oil prevents accidental dropping of arm on record; maximum tracking error, 2 degrees	49.50
Ortofon	Model RMG-212	Ball-bearing gimbal suspension; dynamic balancing; rubber resonance damper calibrated stylus pressure adjustment; resonance, 8 cycles; claimed maximum tracking error, 1.19 degrees; overall length, 12 inches; exchangeable cartridge shell	55.00
	Model SMG-212	Similar to RMG-212 but without dynamic balance	30.00
Rek-O-Kut	Model S-320	Dynamically balanced; calibrated stylus pressure adjustment; side-thrust compensator; resonance-damped counterweight; exchangeable cartridge shell; resonance, below 12 cycles; tracks at less than 1 gram	34.95
	Model S-340	Similar to S-320 but without dynamic balancing feature	24.95
Shure	Model SME-3009	Suspended on precision ball races and knife-edge bearings; stylus pressure adjustable from ¼ gram upward; resonance below audible range; adjustable overhang; side-thrust compensator; lever-operated hydraulic control for lowering arm onto record surface and lifting it after completed play; exchangeable cartridge shell	100.50
	Model M232	Ball-bearing pivots; calibrated stylus pressure adjustment; adjustable overhang	29.95
Stanton	Model 200 "Unipoise"	Single-point, needle-bearing suspension; calibrated stylus pressure adjustment; lightweight construction for minimum inertia; overall length, 11⅜ inches; cartridge shell not exchangeable	24.00
Weathers	MT-66	Wooden arm body; viscous damping to lower resonance and prevent accidental dropping of arm on record; micrometer stylus pressure adjustment; no spring loading; exchangeable cartridge mounts; overall length, 11½ inches	31.50

Automatic Record Changers with Quality Tone Arms

These record changers are a select group. They differ from ordinary changers in that they meet stringent high-fidelity standards in the design of both their turntables and tone arms. Because their performance is comparable to that of professional-type turntables and tone arms, these units are also known as "automatic turntables." All models listed here can track high-compliance cartridges and can be conveniently used for single-play operation. Prices do not include base.

MAKE	MODEL	DESCRIPTION	PRICE
Dual	Model 1009	Four-speed changer equipped with dynamically balanced arm capable of tracking at ½ gram; calibrated stylus pressure adjustment; exchangeable cartridge shell	$99.50
	Model 1010	Similar to Model 1009, but without dynamic balancing feature	69.50
Garrard	Lab 80	Four-speed changer with wooden (low resonance) arm; dynamic balance; side-thrust compensator; calibrated stylus pressure adjustment; exchangeable cartridge shell; lever control to raise and lower arm	99.50
	Model A70	Four-speed changer with arm similar to that in Lab 80, but made of metal and without lever control for raising and lowering arm	84.50
Miracord	Model 10H	Four-speed changer with tone arm capable of tracking high-compliance cartridges at 1 gram; exchangeable cartridge shell; pin-bearing suspension; lateral micro-ball bearings	99.50
	Model PW40	Similar to Model 10H but with dynamically balanced tone arm; calibrated stylus pressure adjustment; exchangeable cartridge mounts	89.50

keep it as small as possible. In a well-designed arm, it should not exceed 2 degrees at the maximum.

Audio designers have come up with some fancy geometry to keep the tracking error down to a minimum. Take, for instance, the offset angle of the cartridge. That slight crook just above the cartridge holder is carefully calculated to shave down the misalignment. Other designs achieve the same purpose by curving the entire arm.

Another gambit for improved tracking is to aim the tone arm path not directly at the center spindle but a fraction of an inch ahead of it. The distance by which the stylus overshoots its apparent goal is called the "overhang"—or, as some hi-fi'ers keep insisting, "the hangover." This bit of clever geometry practically cuts the tracking error in half.

Is accurate tracking worth all this effort or are we splitting hairs? To form your own conclusion, just visualize what happens when the cartridge rides in an inferior arm with plenty of tracking error. Being held askew rather than tangential to the groove, the stylus can't respond equally to both sides of the groove. The result is a rasping kind of distortion, especially in those heavily scored orchestral climaxes that ought to be the most thrilling moments in hi-fi. This gets most bothersome on the inside grooves, where the signal waveforms are more tightly crammed together. A top-quality arm helps the music stay sweet and clear right up to the last note.

Low Resonance. Even if you're playing a lullaby, as far as your stereo cartridge stylus is concerned the joint is jumping —up, down, and sideways—anywhere from 30 to 15,000 times per second. But the tone arm mustn't get carried away by the frantic dance of the stylus in the groove. If the arm resonated with the vibrations of the stylus, it would beat its own unscored counterpoint to the music. The arm vibrations would be piled on top of the musical signal.

Turntable/Tone Arm Combinations

Turntables with pre-mounted top-quality tone arms

MAKE	MODEL	DESCRIPTION	PRICE
Acoustic Research	AR-TX	Two-speed (33⅓ and 45 rpm) turntable with viscous-damped tone arm; adjustable overhang; damping mechanism prevents accidental dropping of arm, but releases arm in playing position; floating suspension of interlinked turntable and arm; exchangeable cartridge shell; base	$78.00
Bogen	Model B62	Turntable has continuously variable speed from 29 to 86 rpm with preset stops; tone arm tracks at 1.5 grams; lever control for lowering and raising arm; exchangeable cartridge shell	64.95
Empire	Model 488 "Troubador"	Combination of 3-speed turntable with Empire Model 980 arm	159.95
Grado	Laboratory Standard	Single-speed turntable (33⅓ rpm) with Grado tone arm; base	169.50
Rek-O-Kut	R-34H	Dual-speed turntable combined with S-340 tone arm; base	89.95
Stanton	Model 800B Stereotable	Single-speed turntable riding on an "air cushion" magnetic suspension to minimize rumble; combined with Stanton Model 200 "Unipoise" arm; base	99.00
Thorens	TD-135	Four-speed turntable with adjustable speed combined with Thorens arm featuring needle-point bearings; calibrated stylus pressure adjustment; exchangeable cartridge shell	99.75
Weathers	Model 66	Single-speed turntable combined with Weathers tone arm; floating turntable suspension; base	75.00
	"The Townsend"	Similar to Model 66 but with different styling and without floating turntable suspension; base	59.95

Picture what this would do to the sound. After all, the stylus can trace the groove contour with accuracy only if its own moorings are steady. If the tone arm insisted on adding its own song and dance, you would no longer hear the signal from the record alone but a confusing, distorted cross-breed of vibrations. To put it in engineering terms: arm resonance intermodulates with signal frequencies.

A good arm resists the temptation to swing along with Mitch, or with whatever you happen to be playing. In short, it's nonresonant.

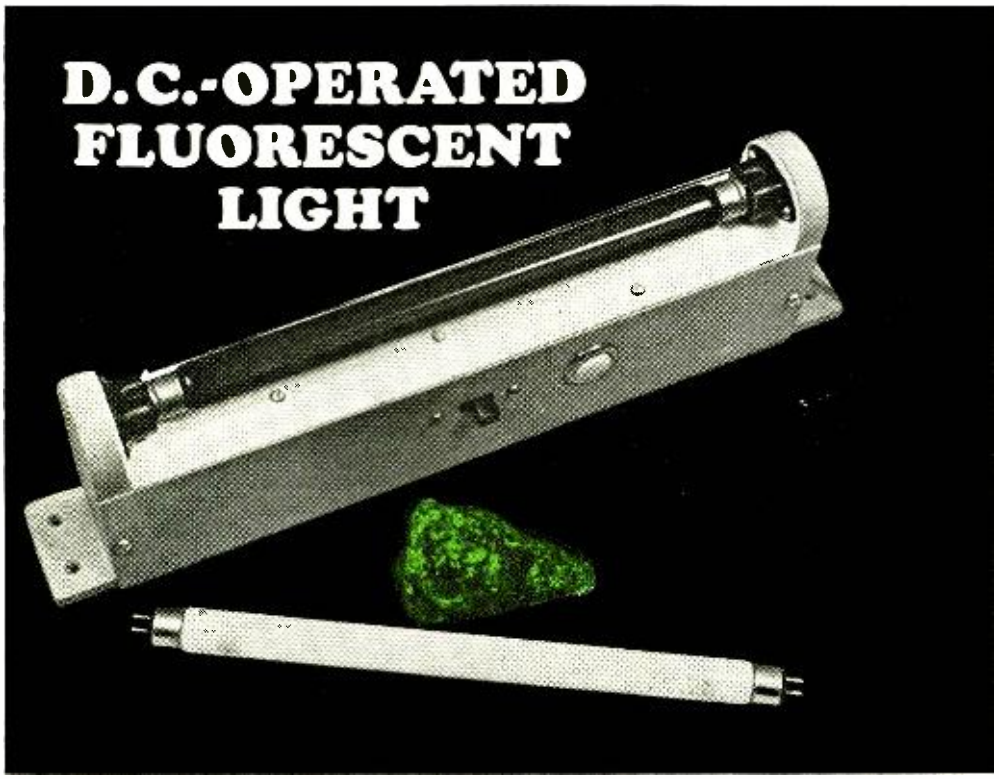
Audio designers differ in their methods for insuring nonresonance. Grado, ADC, and Weathers, for instance, make their arms out of wood—an inherently near-nonresonant material. Others put a plastic shock absorber between the arm and its rear counterweight. This works just like the shock absorbers on a car—it soaks up unwanted vibrations. In many cases the whole arm is designed to keep its natural resonance below 25 cycles—about the lowest frequency on records.

Minimum Friction. The tone arm should move almost without drag. Any kind of mechanical resistance, binding, or pulling would act on the stylus and cause distortion of the signal—especially in stereo playback. Besides, the more energy that is needed to overcome friction, the higher the stylus pressure required to keep the stylus from climbing out of the groove. To make use of modern cartridges tracking at featherweight pressure (2 grams or less), the arm has to be virtually frictionless.

To achieve minimum friction, engineers resort to various methods. Some balance their arms on a sharply pointed needle bearing to reduce the friction surface. Others suspend the arm in gimbals fitted with precision ball bearings or employ knife-edge jewel bearings similar to those in a chemical precision balance. One re-

(*Continued on page 77*)

D.C.-OPERATED FLUORESCENT LIGHT



COVER STORY

By **BEN RICHARDS**

Portable emergency light doubles as luminescence detector

MADE TO ORDER for wherever a portable light is needed, this battery-operated fluorescent light will find favor with sportsmen, hobbyists, and rock collectors alike. The light works off a 12-volt battery and uses a 6-watt tube. By substituting a "black light" for the white tube, rock hunters can use it to locate mineral specimens.

Since the light can be used in many different ways, construction should be tailored to satisfy your needs. For instance, those rock hunters may find it desirable to enclose the unit in a light-tight box with a tray and viewing hood to permit daylight sorting of rocks. Motorists will find it advantageous to use a cigarette lighter type of plug to obtain a quick power connection in the event of an emergency. Sportsmen and campers may want to add a watertight battery compartment to the unit to hold a lantern-type battery.

How It Works. Operating fluorescent lamps from d.c. usually presents a problem: the supply voltage must be higher than the "striking" voltage of the lamp and power is wasted in the resistive ballast which must be used to limit lamp current. Not so if an efficient transistorized inverter steps up low voltage d.c. to high voltage and high frequency a.c. —a simple series capacitor can then serve as a reactance-type current limiter. The circuit used here produces more than half again as much light output as an incandescent bulb drawing the same battery power, a feature which campers and boaters who are concerned with conserving their batteries will appreciate.

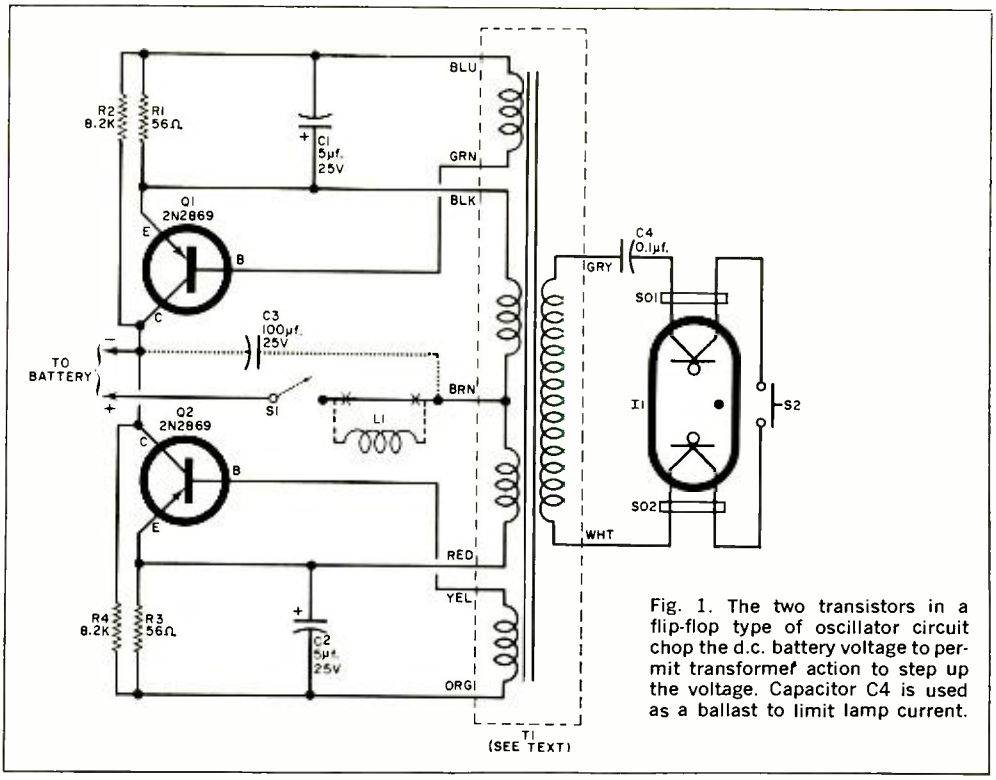


Fig. 1. The two transistors in a flip-flop type of oscillator circuit chop the d.c. battery voltage to permit transformer action to step up the voltage. Capacitor C4 is used as a ballast to limit lamp current.

The circuit, shown in Fig. 1, incorporates two transistors and a saturable core transformer with feedback windings to produce an audio oscillation at a frequency determined primarily by the transformer. The a.c. output voltage is connected to the fluorescent lamp (*I1*) through capacitor *C4*, which serves to limit load current.

The type of lamp employed has filaments at both ends of the tube to "preheat" the gas in order to facilitate lamp ignition. Note that the function of *S2* is to allow current to flow through both filaments as long as it is closed. The hot filaments heat and ionize the gas in the lamp, so that current can flow through the gas from one end of the lamp to the other. The hotter the gas, the more current that can flow; the more current that flows, the hotter the gas becomes. The external current limiter prevents "runaway" and destruction of the lamp and other circuit components.

Capacitor *C3* and coil *L1* are optional and are used to cut down radio interference. If you do not use *C3* and *L1*, connect the switch directly to the brown lead on *T1*. Do not connect the brown lead to the negative side of the battery. A 2- or 3-ampere fuse can be placed in series with the switch. However, the fuse may not act fast enough to protect the transistors if you apply too much voltage or fail to observe polarity.

PARTS LIST

C1, C2—5-μf., 25-volt capacitor
C3—100-μf., 25-volt electrolytic capacitor—optional
C4—0.1-μf., 10%, 600-volt tubular capacitor (Sprague 6PS-P10 or equivalent)
I1—6-watt fluorescent lamp (Sylvania F6T5/CW cool white or F6T5/BL black light, or equivalent)
L1—45 turns of #15 enameled wire, two layers wound evenly on ¾"-O.D. dowel—optional
Q1, Q2—2N2869 transistor
R1, R3—56-ohm, ½-watt resistor
R2, R4—8200-ohm, ½-watt resistor
S1—S.p.s.t. switch
S2—Momentary-contact, push-to-close switch
SO1, SO2—Miniature two-pin fluorescent lamp socket (GE 95X276 or equivalent)
T1—Type EC-0104-1P saturable transformer (available from Milwaukee Electromagnetics, P. O. Box 4476, Milwaukee, Wis. 53207, for $3.60 postpaid)
Misc.—Wood parts, aluminum, celluloid shield

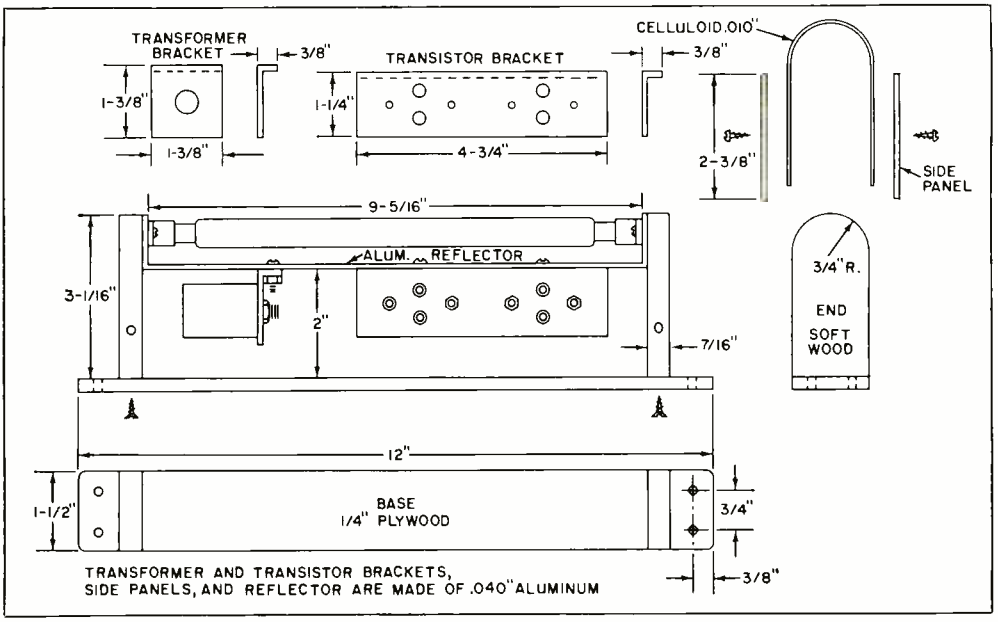


Fig. 2. Celluloid shield forms a window and insulates the side panels from the aluminum chassis. The unit can be fastened to a container built to hold two 6-volt lantern-type batteries connected in series.

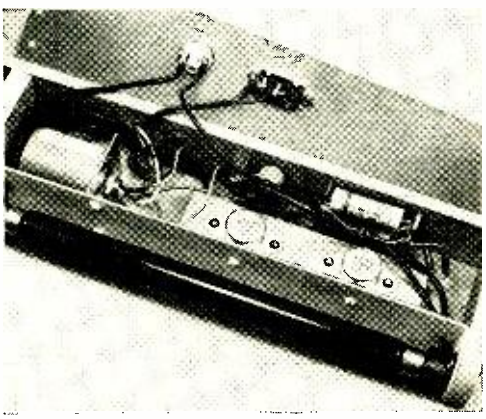


Fig. 3. Layout is not critical, but space transistors as far apart as possible to dissipate the heat.

Construction. Assemble the base, ends, aluminum reflector, and sockets as shown in Fig. 2. Note that the same screws hold the lamp sockets and reflector to the soft wood ends. The transistors are mounted on an aluminum bracket which in turn is mounted on the reflector. The transformer is mounted on another bracket and attached to the reflector in the same manner. The on-off switch and starter button can be installed on either aluminum side panel. Most of the components are connected between terminal strips mounted on the wood base.

Connections to the two transistors can be made by soldering directly to the pins. Care must be exercised not to damage the transistors with excessive heat; use a pair of long-nose pliers as a heat sink when soldering. Transistor layout is not critical, but they should be spaced as far apart as possible to allow for dissipation of heat when in operation.

If the small amount of audible noise from the unit is disturbing, pack some foam rubber, styrofoam, or other acoustic absorbent material around the transformer. When installing the celluloid (or plastic) shield, be sure it insulates the aluminum side panels from the reflector in order to isolate and completely enclose the electrical circuit.

Testing and Use. If you are sure of your wiring and supply voltage polarity, turn the unit on and depress the starter button for a few seconds. The lamp should operate with normal brilliance if battery voltage is about 12 volts. Current drawn should be around 0.9 ampere. The circuit should work on 9 to 15 volts with lamp brightness corresponding to voltage; higher voltage levels tend to shorten lamp life. —30—

2-COMPACTRON STEREO AMPLIFIER

By **PHILIP E. HATFIELD,** W9GFS*

Build this handful of twin power to fill your room with music from your low-cost record player

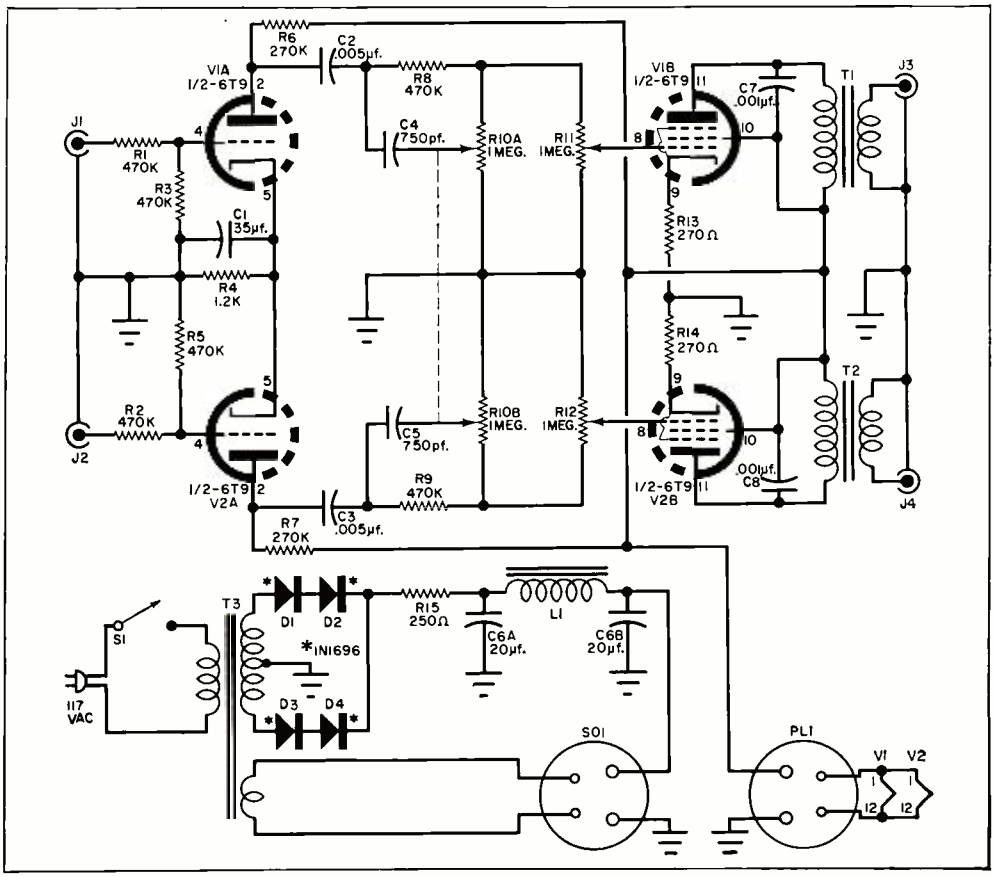
WOULD YOU LIKE to put together a stereo amplifier which is simple, low-cost, and easy to build? Then the Two-Compactron Stereo Amplifier is for you. Designed for one purpose, to play stereo records, it has a minimum of controls and features an uncomplicated circuit. This palm-sized unit has a power output on the order of 5 watts, and a maximum harmonic distortion of 2%.

Two tubes do the work of four in the basic amplifier unit; and, in the power supply unit, full-wave connected diodes eliminate still another tube. The power supply is also small in size and because it is assembled on a separate chassis, can be tucked away in a convenient spot.

The two compactrons produce enough power to fill a room with stereo music. In spite of the small size, assembly and wiring are easy because of the two-chassis layout and the relatively small number of parts used.

How It Works. A 6T9 compactron triode-pentode is used in each channel of the amplifier, as shown in the schematic diagram. The triode sections are hooked up as resistance-coupled voltage amplifiers and the pentode sections as power amplifiers. A ganged tone control (*R10a* and *R10b*), in conjunction with *R8*, *C4*, and *R9*, *C5*, allows a desired tonal bal-

*Tube Dept., GE, Owensboro, Ky. Project from revised edition of GE Hobby Manual.



Triode sections accept the output of an inexpensive stereo cartridge and drive pentode portion of the compactrons to full rated power. A separate control in each channel maintains desired level and balance.

ance to be passed from the triode to the pentode stages. No balance control is needed since balance can be achieved simply by adjusting the individual gain controls (*R11* and *R12*).

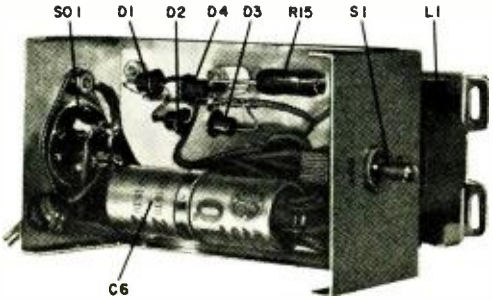
The amplifier is designed to be driven by a crystal stereo cartridge having an output of approximately 3 volts. A voltage divider in the input of each channel (*R1* and *R3* in one channel, and *R2* and *R5* in the other) prevents overloading of the input stages. If lower output cartridges are used, modify the circuit by omitting *R1* and *R2* and connecting *J1* and *J2* directly to the grid of *V1a* and *V1b*, respectively.

Unbypassed cathode resistors *R13* and *R14* in the pentode circuits tend to reduce the overall gain slightly while improving fidelity. Capacitors *C7* and *C8* tend to attenuate some of the highs to give the amplified sound a mellower tone and minimize the effects of needle scratch. Changing the value of these two capacitors will change the apparent overall tonal balance of the amplifier.

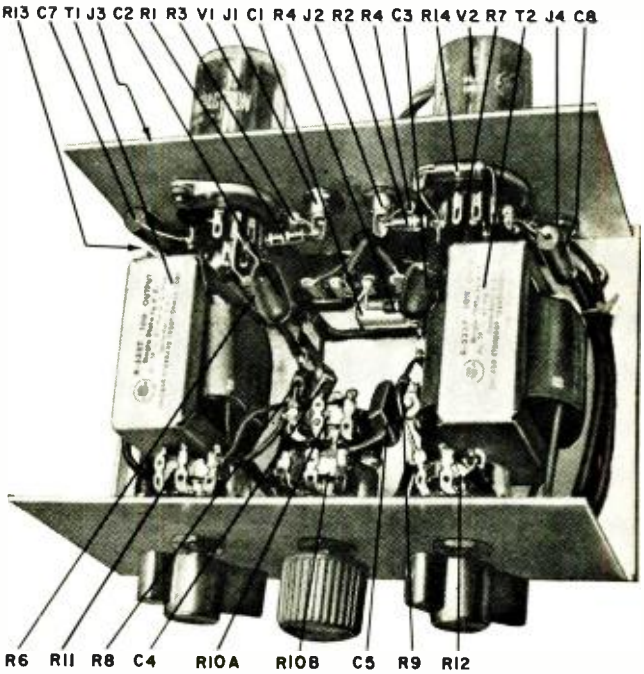
The power supply is a conventional full-wave silicon diode type using a capacitor-input filter consisting of *L1* and *C6*. Resistor *R15* serves as a current surge protector for the silicon diodes. The use of two diodes in each leg of the rectifier circuit nominally doubles the peak inverse voltage rating of the circuit.

Construction. Drill all holes in the metal boxes housing the amplifier and power supply. Mount all parts including three 5-terminal strips in the central portion of the amplifier box. Terminal strips near *T1* and *T2* could have as little as three terminals each.

Be sure to orient the compactron sockets as shown, in order to have very short



If the separate power supply (above) is located in an inaccessible place, you can mount another switch on the amplifier chassis and connect it in series with S1, or you can use the automatic shutoff switch on your record player. Switch S1 can then be left on all of the time.



Wire the tube sockets in amplifier before mounting the transformers. The relatively small number of parts offers several advantages, including low cost and ease of construction. Locate parts as shown.

leads to the grids of the two input stages. Wire the amplifier before mounting the transformers. When installing the resistors and capacitors, leave enough space for the transformers. When mounting the transformers, you can leave the leads long enough to allow the transformers to be moved aside for future access to the compactron sockets.

In constructing the power supply, mount the four diodes in the clear on a 5-terminal strip. The terminal strip is mounted on a ½" ceramic standoff; avoid contact with the metal cabinet.

Amplifier's low silhouette and finished appearance is achieved by mounting tubes on the rear apron.

PARTS LIST

C1—35-μf., 6-volt capacitor (General Electric MT1-13 or equivalent)
C2, C3—0.005-μf., 600-volt capacitor
C4, C5—750-pf. mica capacitor
C6—20/20 μf., 450-volt, dual-section electrolytic capacitor
D1, D2, D3, D4—1N1696 silicon diode, 500 PRV, 600 ma.
J1, J2, J3, J4—Phono jack
L1—8-h., 75-ma. choke (Stancor C1355 or equivalent)
PL1—4-pin plug (to fit into SO1)
R1, R2, R3, R5, R8, R9—470,000-ohm, ½-watt resistor
R4—1200-ohm, ½-watt resistor
R6, R7—270,000-ohm, ½-watt resistor
R10—1-megohm dual potentiometer, linear taper
R11, R12—1-megohm potentiometer, audio taper
R13, R14—270-ohm, 1-watt resistor
R15—250-ohm, 5-watt resistor
S1—S.p.s.t. toggle switch
SO1—4-pin tube socket
T1, T2—Output transformer, 5000 ohms to 6-8 ohms (Stancor A-3337 or equivalent)
T3—Power transformer: primary, 117 volts, 60 cycles; secondaries, 6.3 volts, 3 amperes, and 480 volts, 70 ma., center-tapped (Stancor PM8419 or equivalent)
V1, V2—6T9 compactron
1—3" x 4" x 6" amplifier chassis box (LMB 141 or equivalent)
1—2⅛" x 3" x 5¼" power supply chassis box (LMB 780 or equivalent)
Misc.—Wire, ½" ceramic insulator, terminal strips, grommets, knobs (3), compactron sockets (2)

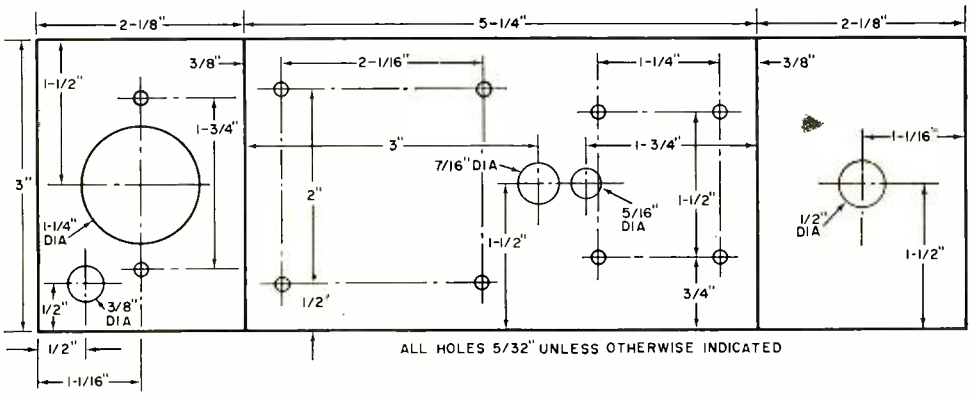
Mount *R15* between the 5-terminal strip and a 2-terminal strip.

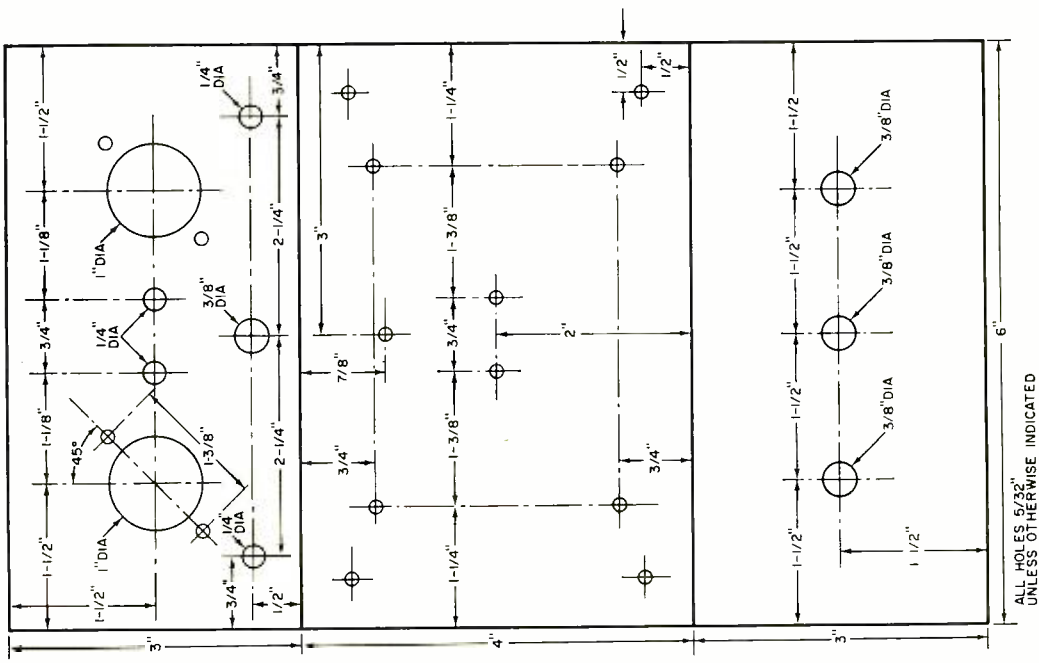
The cable between amplifier and power supply can be made by twisting together four 6′ lengths of stranded hookup wire. The wires that carry the heater current (pins 1 and 4 on *PL1*) should be 18 gauge; the other two wires may be of lighter gauge.

As with most audio amplifiers, input connections between the phono cartridge and the amplifier should be made with shielded wire. The outputs of the amplifier should be fed to speakers having 6- to 8-ohm voice coils. Although phono-type jacks are used for the speaker outputs, it is not necessary to employ shielded wire; twisted pair or parallel cord can be used.

If you find that the channels are reversed, i.e., right-side sound coming from the left side, switch speaker connections to *J3* and *J4*. Make sure that the two speakers are in phase by listening to a mono program, then reversing the connections to one speaker and listening again. Generally, speakers in phase sound louder or seem to have more presence than speakers out of phase.

For mono listening with one speaker and for maximum power, you can connect both outputs together. —30—





Layout of power supply cabinet (top) and amplifier cabinet (bottom) is easy to follow. Verify dimensions of your sockets, terminal strips, transformer mounting, etc., and modify the dimensions if necessary.

FIND THE COMPONENTS

By A. JANSON

Twenty-two electronic components are listed below. See if you can find them among the letters in color—they can read forward, backward, up, down, or diagonally. Circle each word as you find it. There is also one unlisted item that is quite well known to electronics enthusiasts—it has 18 letters!

T R A N S I S T O R E H C T I W S O S D
D R A M E L I O C E W A O R G I O A I F
E O H B L O B N T S S R L I L R G A I S
W M O E E C H E R I O U I M U D R U B T
O R M L O A H S A S O U F M M B A C E E
P A L A T S T O G H R M I E K O H C L K
M A C J R O T C A I O T L R A C O T O C
O S A X A P R A T E R E E P L A T I C O
Q C C S I R O T T L I L M O R T S O E S
K N O B S O L E E D A L L E C O T O H P
I R P K C A L K L Y G L A M P O H R O H
T M H E T D E C L O W M L A I E E R O S
C O O S O B R O O T P R T T A S R O M T
H C Y I T E R S O L E P I T I O G L A A
B R O N X E R E I N G O S S J A R U S L
C O S O A R I B U O O I T O U S O O L A
B O O D O N G U D I N O S T N O C K E T
A T R O C O A T A K R A D R K E E N O C
O S C I N O R T C E L E R A L U P O P O

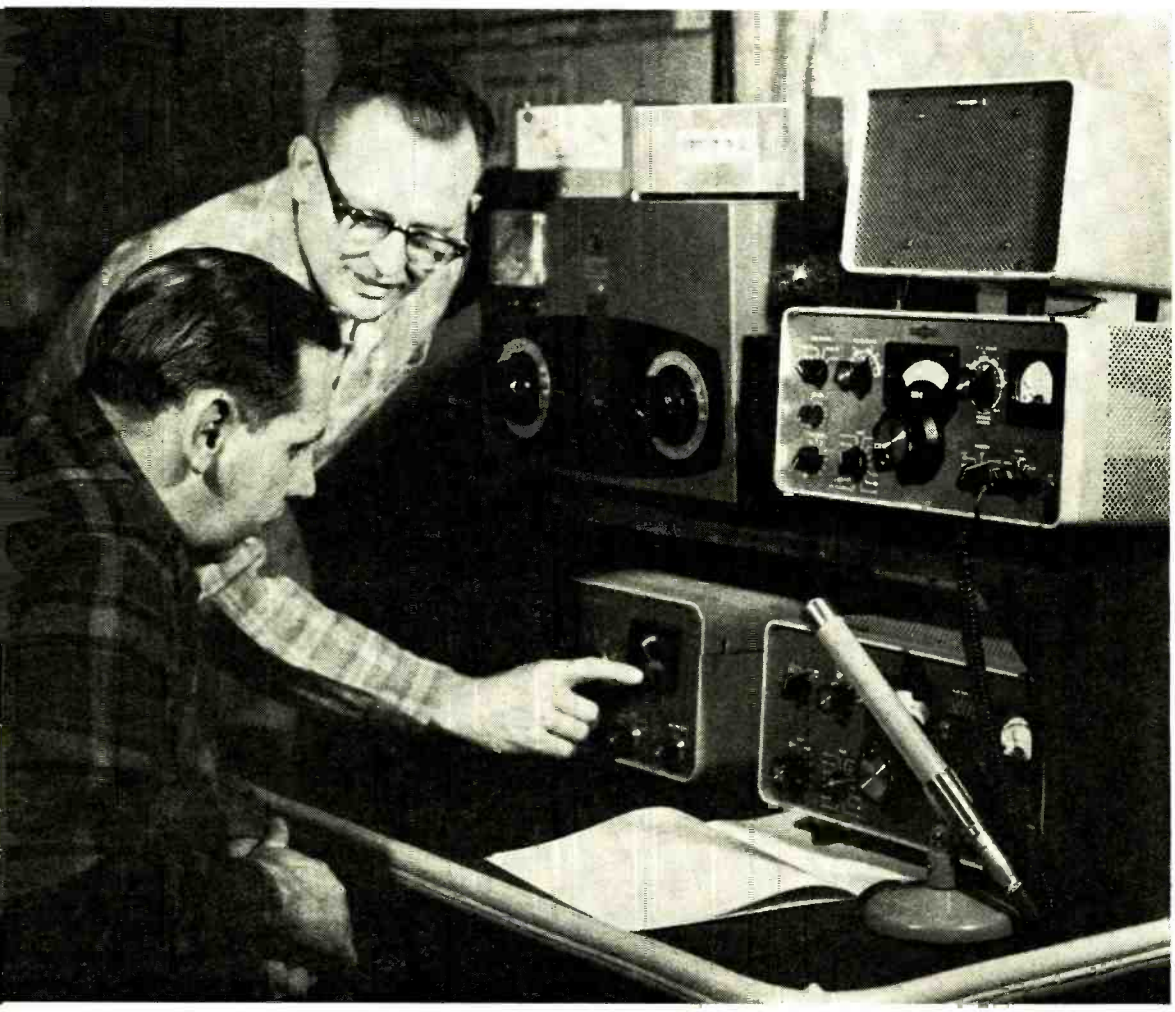
1 TRANSISTOR
2 RESISTOR
3 SWITCH
4 COIL
5 CRYSTAL
6 SOCKETS
7 LAMP
8 FUSE
9 TUBE SOCKET (one word)
10 KNOBS
11 JACK
12 TRIMMER
13 RHEOSTAT
14 HEAT SINK (one word)
15 PHOTOCELL
16 COAX
17 PROBE
18 CHOKE
19 RELAY
20 SHIELD
21 LUGS
22 BRAID
23 ???

(Solution on page 78)

HAM RADIO
Plan now for your license

By **EDWARD J. WESTLUND,** WAØEDV

Before you crack a book or learn the code,
there are things to do
that will make it easy for you
to enjoy this fascinating hobby



. enjoy the challenge electronics
rs and would like to make the ac-
tance of fellows living in far cor-
of the world, then you're a candi-
for the fraternity of amateur radio
rators.

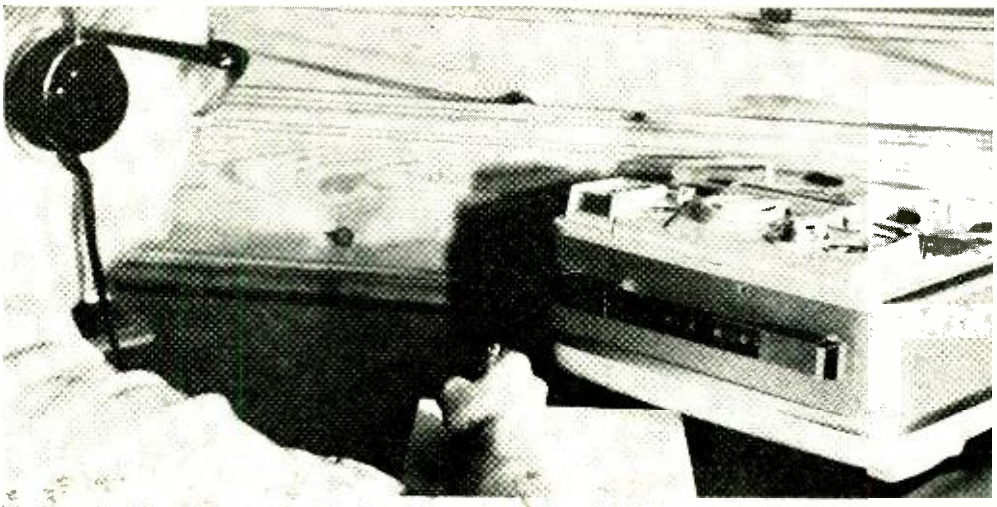
Ham radio can turn a lazy Sunday
ternoon or a quiet evening into an ex-
iting adventure. For example, a couple of weeks ago I spent a good part of such an afternoon on 15 meters talking with a fellow stationed at a satellite tracking station north of the Arctic Circle. We hashed over the merits of certain antennas, and as a bonus I learned a lot about the Eskimos that live near there. That's one Sunday afternoon I'm glad I didn't spend watching TV!

This fascinating hobby can be yours; all you have to do is demonstrate a certain amount of skill and knowledge to an FCC examiner by passing tests in Morse code and electronic theory, and learn the FCC rules and regulations. Practically anyone can master the code well enough to pass the 5-word-per-minute test required for a Novice or Technician license, and then reach the 13-wpm speed needed for a General Class ticket. And you don't have to be an electronics engineer or a wizard at mathematics to pass the theory exams either. But you will have to devote a good part of your spare time to study and practice.

In this article, I have outlined six steps that every ham-to-be would be wise to take before he cracks a book or even gets near a code-practice key. Too often an aspiring ham gets bogged down, becomes discouraged and never recovers, all because he didn't take the time to set up a definite program for earning his license. It's a good idea to spend at least several weekends in preparation for your task before learning the code symbol for the letter "e" (one dot) or memorizing Ohm's law.

No attempt has been made here to present details on assembling a station or to explain the FCC requirements for any of the five classes of licenses—there are many books on amateur radio that contain this information.

Here, then, are the six steps:



It's important to set up a schedule for study and practice. A half hour a day spent listening to taped code sessions is a sure-fire way to build up code speed quickly. Allow another half hour for studying theory.

Set up a study schedule. Studying for a ham license is quite different from attending a formal course in electronics. You have no instructor to guide you, and your only motivation is your desire to get on the air. The need for a study schedule, then, is obvious.

Don't attempt to cram all your studies and practice into weekends. It's far better to spend an hour or so on them each day of the week. A good way to start is to set aside a half hour a day for code practice and a half hour for studying theory. This may mean getting up an hour earlier each morning or giving up an hour of TV, but it pays off.

As you progress, you can divide the time spent between code and theory as you see fit, but start out with the fifty-fifty plan. The important thing is to stick to your schedule until it becomes a habit.

Budget, and save your money. Considering the hours of enjoyment to be obtained for the dollars invested, ham radio is not an expensive hobby. However, it does take a certain amount of cash to get started. Some hams manage to operate on a shoestring, but most have at least $200 invested in their equipment, $500 isn't uncommon, and there are many stations sporting price tags that compare with the cost of a new car.

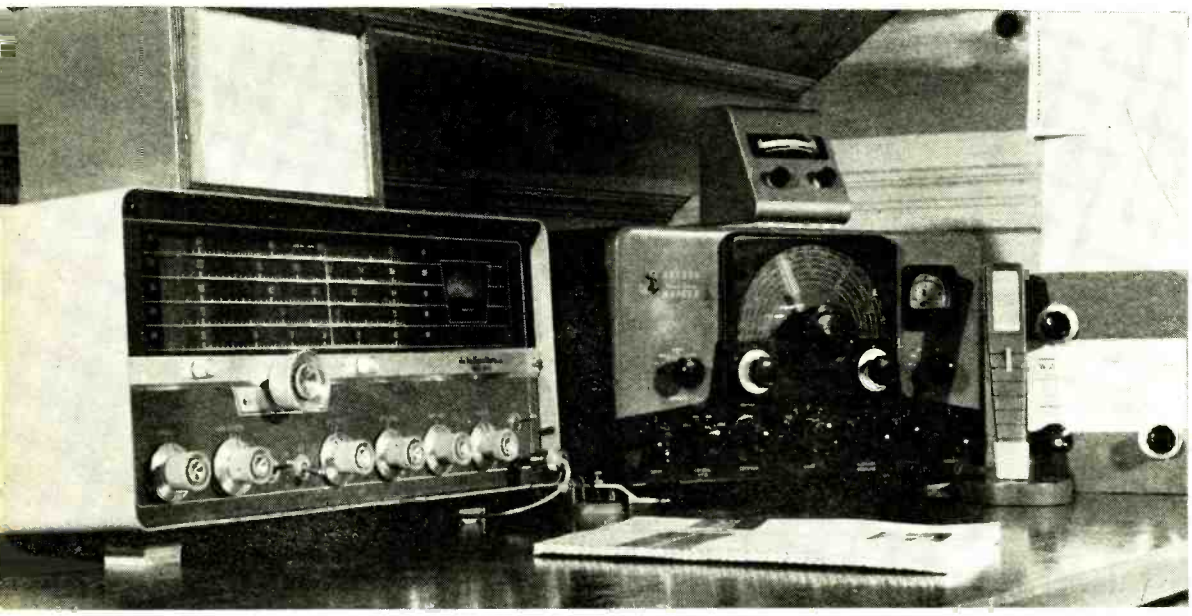
But if money is a problem, that's no reason to be discouraged; many hams are getting acquainted with the world using "peanut whistles" made from parts salvaged from old TV sets. Your goal here is to have enough money on hand to set up a station by the time your ticket arrives.

Know the electronics market. Whether you plan to buy commercial equipment, assemble kits or build your gear from the chassis up, you'll first want to learn what's available. Visit the local electronics stores and ask for their catalogs. And send for at least two mail-order catalogs (Lafayette Radio Electronics, Allied Electronics, Radio Shack, Burstein-Applebee, etc.), and several surplus listings.

If you plan to build any of your gear from scratch, get to know several local TV repairmen; ask them to save for you TV sets that they would normally scrap. Also, some large electronics companies have surplus outlet stores which sell parts for a fraction of their retail cost—check to see if there is such a store nearby.

Build up a ham library. Before you say hello to the world over the air waves, you'll have to spend many hours reading books on amateur radio. You'll need a ham library.

You can start out with *Understanding Amateur Radio, Learning the Radiotelegraph Code*, and the *Radio Amateur License Manual*, all published by the American Radio Relay League. (The latter two are available for 50 cents each or as a package together with *How to Become a Radio Amateur* and *Operating*



Some hams operate on a shoestring, but most have at least $200 invested in their equipment. Start saving now so you'll be able to set up your own station. The one above is worth $300 if purchased secondhand.

an Amateur Radio Station for $2; the complete package is called "Gateway to Amateur Radio.")

After you have mastered *Understanding Amateur Radio* ($2), you should acquire a copy of the ARRL's *Radio Amateur's Handbook* ($3.50) or the *Radio Handbook* by William Orr, or both. (The latter is published by Editors and Engineers, and is priced at $9.50.) You'll also find it worthwhile to have in your ham library an up-to-date copy of the COMMUNICATIONS HANDBOOK which is revised and published on an annual basis by POPULAR ELECTRONICS.

Other books that you may want to investigate include: *So You Want to Be a Ham, Revised* by Robert Hertzberg (Howard A. Sams, $2.95); *The Radio Amateur's Handbook* by A. Frederick Collins, revised by Robert Hertzberg (Thomas Y. Crowell, $4.95); *Getting Started in Amateur Radio* and *Building the Amateur Radio Station* by Julius Berens (Rider Publications, $2.35 and $2.89) and *Novice & Technician Handbook* by William Orr and Donald Stoner (Radio Publications, $2.85). It's to your advantage to read as many books as possible and diligently study the ones you like the best.

Make friends with licensed hams. Nothing is as helpful to the newcomer as a good friend who already has his license. He can improve your code sending by giving you honest criticism, and he can clear up some of the more difficult electronic concepts. In return for your friend's cooperation, offer to assist him with his projects. You don't have to be an expert to help him put up a new antenna or lend a hand when he's testing his rig. And you'll learn by helping.

How do you meet hams? Start out by looking for ham antennas on roofs and in yards in your area. When you find one, simply walk up and introduce yourself. You'll be surprised how willing most hams will be to help you. Also, check to see if there is a radio club in your community, and if there is, join it. You'll meet many hams at the meetings and you may be able to enroll in code and theory classes sponsored by the club.

Visit electronics stores that sell new and used amateur gear. A wide selection is always available.

Your first transmitter can be a simple rig built from surplus gear and parts taken from old TV sets.

Start collecting equipment. To learn the code, you'll need a key, a headset, and a code-practice oscillator. It's a big

(*Continued on page* 80)

BUILD A 144-MC. Swiss Quad ANTENNA

By HERBERT S. BRIER, W9EGQ

All-metal, 2-meter cubical quad uses new ideas proposed by HB9CV—front-to-back and front-to-side ratios are over 25 db

ALTHOUGH the "Cubical Quad" directional antenna has several obvious advantages, including high gain and economy of construction, the mechanical strength to cope with high winds is not an outstanding feature of the Quad constructed of bamboo and wire. The *all-metal* "Swiss Quad" described in "Across the Ham Bands" in the April, 1965, issue of POPULAR ELECTRONICS (page 74) has generated great interest among the ham fraternity.

The Swiss Quad retains the electrical advantages of the usual Quad, but adds strength and durability. A 144-mc. Swiss Quad can be built in a few hours at a cost of less than $4.00. It will give a real *hop* to your signals.

Design. If the centers of the horizontal members of a two-element Quad are pushed in until they touch, they may be joined—both electrically and mechanically—to the central support pipe. If the horizontal members are metal tubing, the Quad becomes a self-supporting structure without an auxiliary framework.

Coupling the centers of the horizontal members of the Quad together and to the support pipe is permissible, because these points are at zero r.f. potential. But, because a portion of the elements are partially bent back upon themselves, the overall dimensions of the antenna should be approximately 10% greater than for a conventional Quad cut for the same frequency.

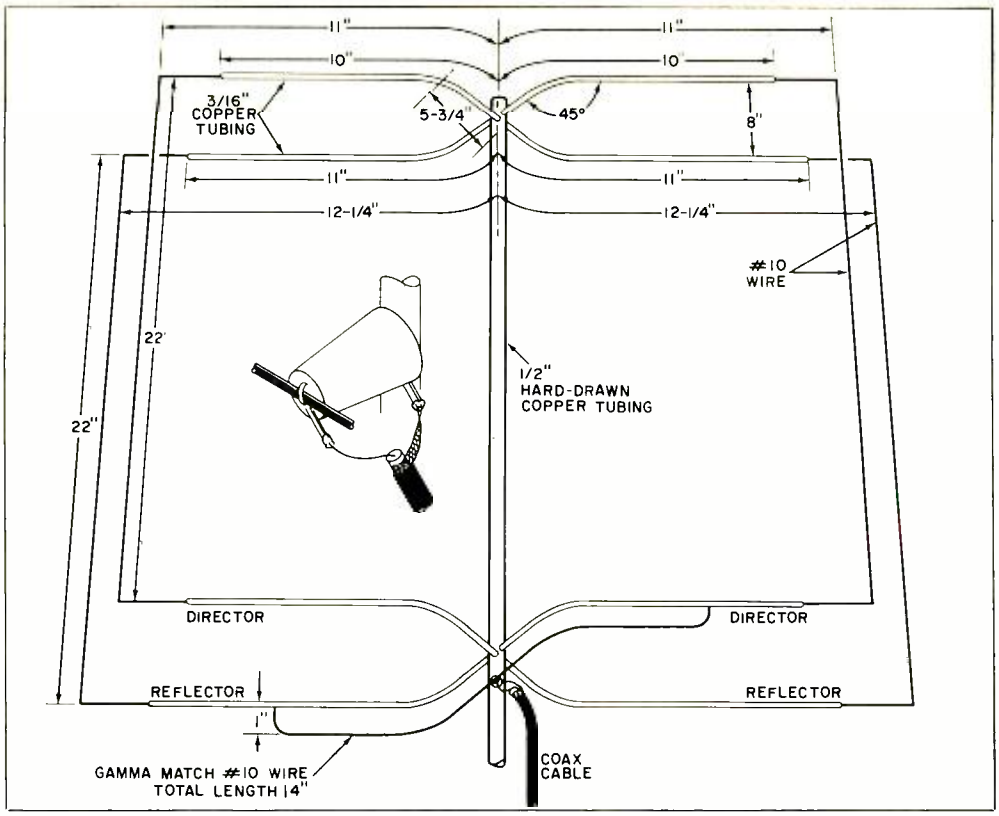
The designer of the Swiss Quad, Rudolf Baumgartner, HB9CV, accommodated this increased size by adding to both the horizontal and vertical dimensions. I have found, however, that there is no significant difference in results if either the horizontal or vertical dimensions are kept the same as in a conventional Quad, and the other dimensions are increased sufficiently to restore resonance at the desired frequency.

Construction. The 144-mc. Swiss Quad is made of copper wire and tubing which is available in hardware and plumbing supply houses. To build a duplicate of my Swiss Quad, first straighten the 3/16" copper tubing by rolling it on a flat surface while tapping it lightly with a wooden mallet. Cut off four 21" lengths.

Now take the hard-drawn ½"-diameter copper tubing and drill a 13/64" hole a half inch from the top end. Line up the drill so that the bit passes through the diameter of the tubing and comes out on the opposite wall. Drill another pair of 13/64" holes 22" below the first pair in the same manner. Then rotate the tubing a quarter turn, and drill a third pair of 13/64" holes ¾" from the top end and at right angles to the first pair; and drill a fourth pair 22" below the third pair. Finally, drill a 9/64" hole a half inch below the bottom 13/64" hole and in line with the first and second pairs.

Mount the standoff insulator in the 9/64" hole on the supporting rod. Place a solder lug under and on top of the insulator. You may have to do a bit of juggling to line up the screw through the 9/64" hole from the inside to catch the insulator. but it can be done.

Slide the four pieces of 3/16" tubing through the 13/64" holes, and position them so that they all extend 10" from the center of the ½" supporting rod to one side and 11" from the center to the



You can build a Swiss Quad in a few hours using readily available copper wire and tubing. The mast can be any convenient length. Sweat elements to the support pole with a heavy soldering iron or butane torch.

BILL OF MATERIALS

1—7′ length of 3/16″ copper tubing
1—3′ length of ½″ hard-drawn copper tubing
1—12′ length of #10 plastic-insulated copper wire
1—⅝″ cone-type standoff insulator (E. F. Johnson #135-501 or equivalent)
2—Solder lugs

other side. Solder them in place, using a husky soldering iron (250 watts or larger) or a small torch.

Measure 5$^{3}/_{4}$″ from the center of the supporting rod along the $^{3}/_{16}$″ tubing, and bend the $^{3}/_{16}$″ tubing horizontally 45° so that the end sections of each adjacent 10″ and 11″ length are parallel and spaced eight inches apart. It is not necessary that the bends be sharp; slightly rounded corners are preferred.

Remove the plastic insulation from a 14″ length of #10 wire which serves as the *gamma* matching rod. The rod is approximately 12″ long and soldered at each end to the radiating elements; it is spaced an inch away from the elements. Do not solder the ends of the *gamma* rod until you have had an opportunity to adjust it, as described below. Cinch the solder lug on top of the standoff insulator around the center of the *gamma* rod, and solder it and the center conductor of the 50-ohm (nominal) coaxial feed line to the *gamma* rod. Solder the cable shield to the other solder lug.

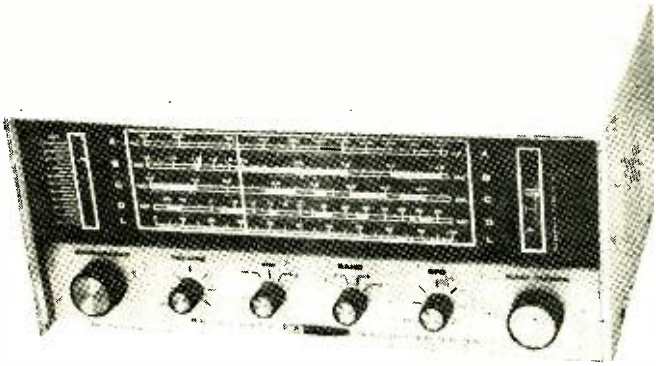
Slice the insulation off the remainder of the #10 wire, and cut four 30″ lengths. Four inches from each end of these lengths, bend the wire at right angles to form shallow U's 22″ wide. Slip the ends of these U's into the corresponding top and bottom $^{3}/_{16}$″ copper tubing to the dimensions shown in the drawing.

Adjustment. Place an SWR bridge in the coax line and feed a small amount of r.f. into the line. Slide the wire U's

(*Continued on page* 86)

Equipment Report

HEATHKIT MODEL GR-64 SHORT-WAVE RECEIVER



ONLY one weekend and about $40 are all that is needed to open up the radio spectrum from 550 kc. to 30 mc. That's about 0.0014 parts of a dollar per kilocycle. Frequency coverage is complete, without gaps, and subdivided into four bands. A flip of the bandswitch and a turn of the flywheel-loaded main tuning knob quickly lets you go from station to station on this superheterodyne short-wave receiver kit, Model GR-64, made by the Heath Company. An electronic bandspread control helps you separate closely spaced stations.

Bringing in a station is made easier and done with greater precision by observing a tuning meter on the front panel which indicates relative signal strength. The illuminated front panel is good-looking, easy to read, and highlights the WWV stations; marine and weather frequencies; ham, foreign broadcast, and CB bands; and, of course, the local broadcast band. A headphone jack enables you to plug in a set of headphones and automatically disable the built-in loudspeaker for private listening.

Code and single-sideband reception are made possible by a unique BFO control in the suppressor grid circuit of the 455-kc. i.f. amplifier. A noise limiter circuit permits you to switch in a diode clamp across the audio signal path to cut down those high-amplitude short-duration noise pulses that manage to get into most radio signals.

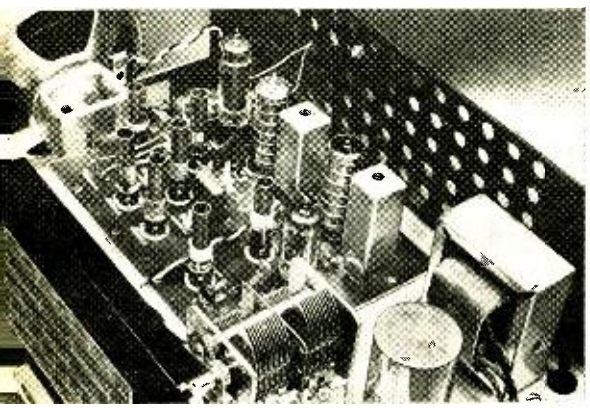
The i.f. and mixer-oscillator stages are controlled by an a.v.c. circuit, when the function switch is in the *AM* position. The a.v.c. circuit is disabled for c.w. and SSB reception, as it should be, when the function switch is set in the *CW* position.

The power supply is a transformer-fed voltage-doubler circuit employing silicon diodes. Tube line-up in the receiver consists of a 12BE6, 12BA6, 12AV6, and 12AQ5; the tube heaters are connected in parallel.

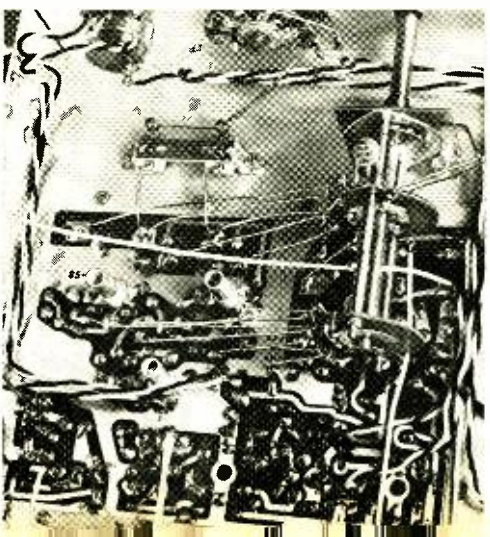
Ample room, a printed circuit board, and step-by-step instructions simplify construction. Our assembled unit brought in stations loud and clear when first turned on, even before alignment adjustments were made. There's good stuff packed into this kit, and it gives you probably the most stations you can tune in for the money. —30—

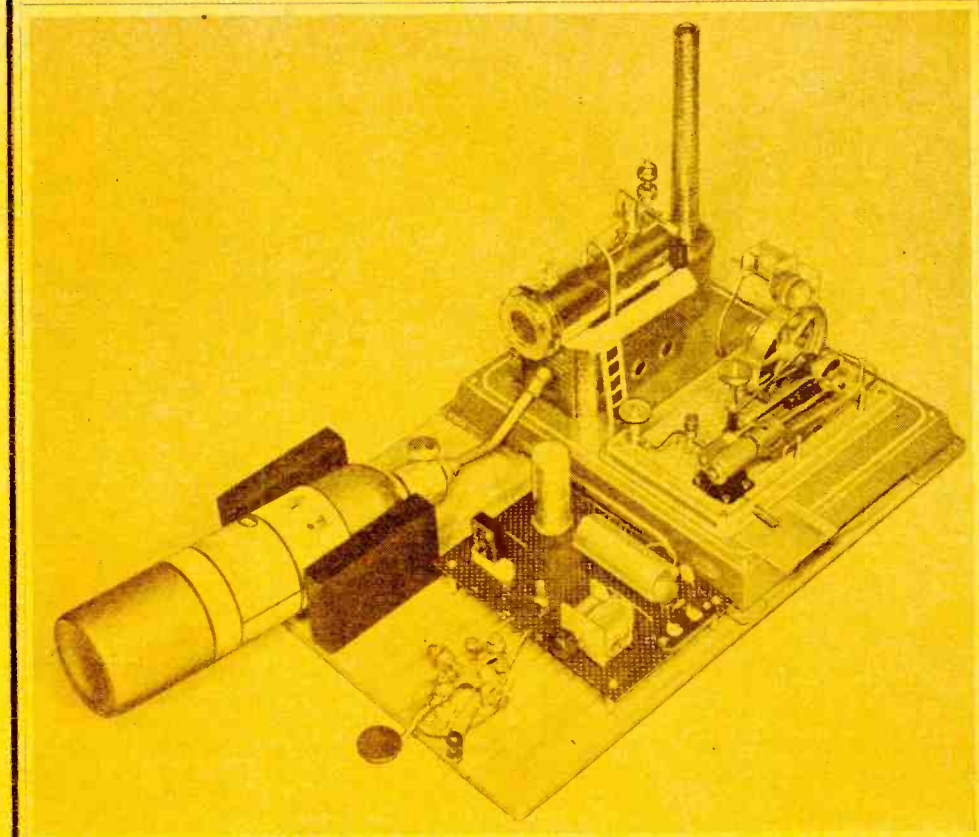
Circle No. 90 on Reader Service Page 15

A printed circuit board, loads of room, and easy-to-follow instructions enable quick assembly. Frequency range is from 550 kc. to 30 mc., without a break.



Off-the-air signals can be used to align the short-wave receiver without test equipment. Adjustments are easy to make. The built-in tuning meter helps.





BUILD STEAM POWERED HAM RIG

Single-transistor flea-power "Milliwatter" transmits readable c.w. signals over a distance of three miles without a battery

By **HARTLAND B. SMITH,** W8VVD

SINCE JAMES WATT first patented his steam engine back in 1769, man has found many uses for this source of power. But perhaps the most unusual one of all, in this day and age anyway, is to harness it to a ham rig such as the "Milliwatter."

Taking its power from a steam-driven generator, the Milliwatter will put out between 10 and 15 milliwatts, easily providing readable signals at distances greater than three miles. So whether you would like to try your hand at flea-power operation, need an emergency transmitter that can run without a battery, or are looking for a Science Fair project, this gadget is for you.

Steam Engine. *Obtaining a steam engine for this project should present no difficulty since many mail order houses carry such items. Although most model steam engines will provide adequate power to drive a generator,*

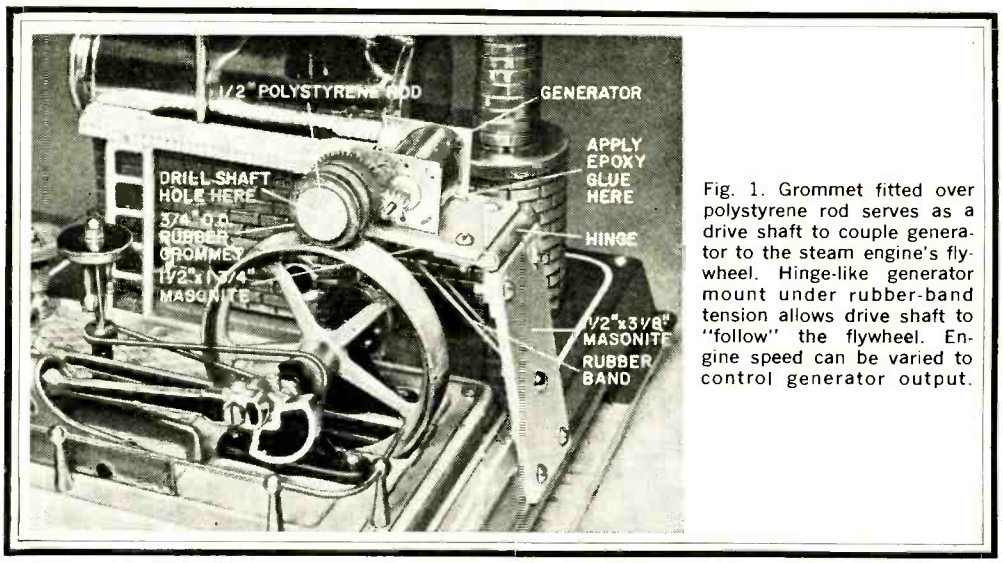


Fig. 1. Grommet fitted over polystyrene rod serves as a drive shaft to couple generator to the steam engine's flywheel. Hinge-like generator mount under rubber-band tension allows drive shaft to "follow" the flywheel. Engine speed can be varied to control generator output.

select an engine with a fairly large boiler to eliminate repeated refilling and time wasted waiting for a new head of steam to build up. The engine and the other components can be mounted on a heavily varnished 12" x 18" x ¼" plywood board.

The steam engine can be fired by anything from a candle to a propane gas tank. Although most companies recommend using dry fuel tablets, you will find a propane tank more convenient. Use wood screws to hold a 3" x 4" x 1" wooden block on each side of the propane tank to prevent it from rolling around.

Since the normal position of the control valve on the tank nozzle will inconveniently face down when the nozzle points up, loosen the compression nut at the base of the nozzle pipe and rotate the pipe until the nozzle points in the same direction as the valve. The valve will now be easy to get to and will serve as a handy vernier-like control of engine speed.

Generator. Although any small permanent magnet motor, such as one that can

PARTS LIST

C1—15 to 409 pf. variable capacitor (Allied Radio 13L524 or equivalent)
C2—0.01-μf. ceramic capacitor
C3—0.0047-μf. ceramic capacitor
C4—100-μf., 25-volt electrolytic capacitor
L1—For 3.5 mc.: 45 turns of #20 wire, 1" in diameter, 2¾" long; For 7 mc.: 22 turns of #20 wire, 1" in diameter, 1⅜" long (B & W Miniductor cut to desired length)
Q1—2N1526 transistor (a 2N370, 2N371, 2N384, or 2N1517 can be substituted)
R1—68,000-ohm, ½-watt resistor
R2—5600-ohm, ½-watt resistor
TS1—2-screw terminal strip
GEN.—875E-½WR 3-volt d.c. motor available from Wilson's of Cleveland, P. O. Box 8995, Fort Lauderdale, Fla., for $3 postpaid
KEY—Telegraph key
XTAL.—3.5-mc. or 7-mc. crystal
1—Steam engine (Sears Roebuck 49N2136)
1—12" x 18" x ¼" plywood board
2—4" lengths of 1" x 3" white pine
1—4½" x 6½" perforated phenolic board
Misc.—Crystal socket, transistor socket, 1" metal spacers (4), rubber grommet (¾" O.D., 7/16" I.D.), epoxy cement, hinge, Masonite, polystyrene rod, propane torch, etc.

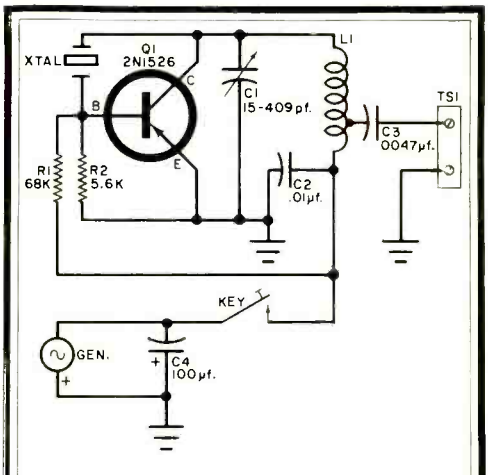


Fig. 2. Coil and crystal can be changed to work different ham bands. A 3-volt battery can be used to operate and test the transmitter; the trick is to operate under a head of steam.

be salvaged from a battery-operated toy, will function as a generator, the motor described in the Parts List with its 3.2 to 1 gear train is recommended. It produces the desired output voltage at a reasonable armature speed. A "spring-loaded" drive mechanism couples the generator to the engine. As shown in Fig. 1, a rubber-tired drive shaft attached to the generator rides on the steam engine's flywheel.

A suitable drive shaft and tire can be made from a $\frac{5}{8}$" length of a $\frac{1}{2}$"-round polystyrene or wood dowel and a grommet having a hole diameter of $\frac{7}{16}$" and an outside diameter of $\frac{3}{4}$". A smaller grommet might load the engine excessively and a larger one would make it necessary to run the engine at a higher speed. Drill a hole in the center of the dowel, just large enough to allow a press-fit over the end of the axle holding the larger gear on the generator. Then stretch-fit the grommet over the newly made drive shaft.

The generator is mounted on a $1\frac{1}{2}$" x $1\frac{3}{4}$" piece of $\frac{1}{8}$" Masonite board hinged to another piece of $1\frac{1}{2}$" x $3\frac{1}{8}$" x $\frac{1}{8}$" Masonite. The second piece of Masonite is screwed to the base of the steam engine as shown in Fig. 1. Use epoxy cement to hold the generator to the first piece of Masonite. Connect a rubber band or spring between the two hinged sections of the support to provide pressure between the flywheel and the drive shaft. Too much tension can overload the engine. Too little will permit slippage.

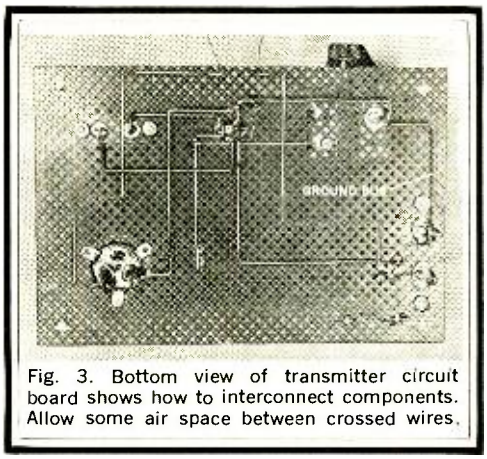


Fig. 3. Bottom view of transmitter circuit board shows how to interconnect components. Allow some air space between crossed wires.

Transmitter. Consisting of a single-transistor crystal-controlled oscillator (Fig. 2), the transmitter is simple and straightforward. Transistor *Q1* is connected in a grounded-emitter, double-tuned configuration and operates in much the same manner as a tube in a tuned-plate, tuned-grid oscillator circuit. The crystal, besides determining the frequency of the oscillator, also supplies the feedback needed to sustain oscillation. Depending on the crystal, and the coil

(*Continued on page 77*)

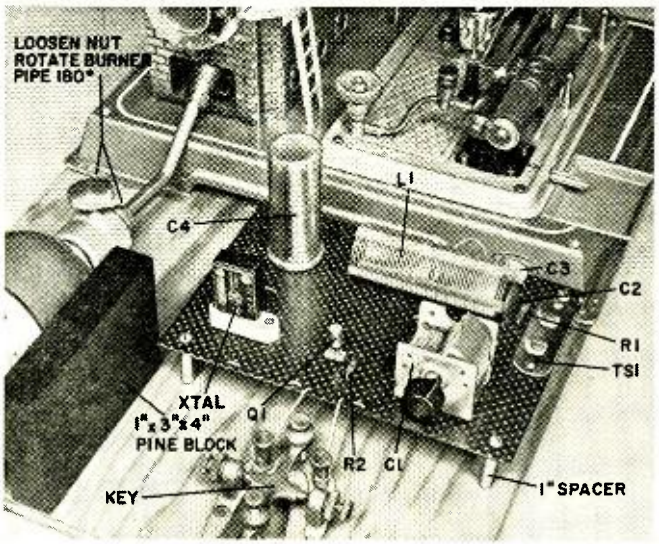


Fig. 4. The entire project is mounted on a plywood board which measures only 12" x 18". Burner pipe is rotated at the compression fitting to enable the gas control valve to face up, making it easier to handle. The gas can be turned down to conserve steam when the transmitter is not used.

USING SILICON DIODES

By CHARLES L. FAIR, W7ZMH

You can stack 'em up to get all the power supply voltage you need, but you have to know how to dress 'em up

MOST EXPERIMENTERS at one time or another probably toy with the idea of substituting silicon diodes for the vacuum tubes in their power supplies. After all, with silicon diodes there is less power consumption, less heat, less need for replacement, and less space required. All too often, however, this apparent panacea to vacuum-tube ills backfires, cancelling out the benefits and leaving you up in the air as to what went wrong.

Often occurring without an obvious reason, power supply failures are especially numerous when several diodes are used in series to handle high voltage and resulting high peak inverse voltage (PIV). If you are planning to convert that power supply of yours, the following suggestions can save you time and money.

Diode Characteristics. First let's briefly review some important diode characteristics. A silicon diode conducting in the forward direction has a voltage drop of one or two volts across it because of its small forward resistance. The same diode exhibits a very high resistance—usually on the order of several megohms—when a reverse voltage is applied. The actual value of this forward and reverse resistance varies from diode to diode, even if they are the same type, unless they are a matched pair. It's this variation in resistance, as we shall see, that is one of the prime causes of series-connected diodes breaking down.

Figure 1 shows an unprotected silicon diode power supply using a 1200-volt center-tapped power transformer and a capacitive-input filter. Each diode string has to rectify 600 volts 50% of the time. While this is a full-wave configuration, the same considerations apply to half-wave circuits. The PIV across each diode string is obtained by multiplying the 600 volts by a factor of 2.8. This works out to be 1680 volts. Good design practice calls for an added 25% safety factor, bringing the PIV requirement to 2100 volts.

Just in case you are wondering how the 2.8 factor is arrived at, keep in mind that the transformer voltage rating is reported out in r.m.s. volts. The same r.m.s. potential reported out in peak volts would be a figure 1.4 times greater. Capacitor *C1* charges up to peak voltage, and retains peak voltage even while the a.c. voltage on the transformer end of the diode string swings negative. The r.m.s. voltage across the string when the transformer end is maximum negative (−600 volts) and the capacitor

end is positive (600 volts) is 1200 volts. Multiplying 1200 volts by 1.4 to determine the amount of peak volts is the same as multiplying 600 volts by 2.8. The result is 1680 volts.

Four 600-volt PIV silicon diodes of the type used here (1N614's) would normally boost the overall PIV rating of the circuit to 2400 volts. However, you can consider yourself lucky if you it sees the extra 72 volts, it will soon change its mind when an additional voltage comes along, such as a transient kicked up by switching the circuit on and off, or by sudden changes in the load circuit.

To prevent this chain reaction of destruction, shunt each diode with a resistance of much lower value than the back resistance of the diode. The in-

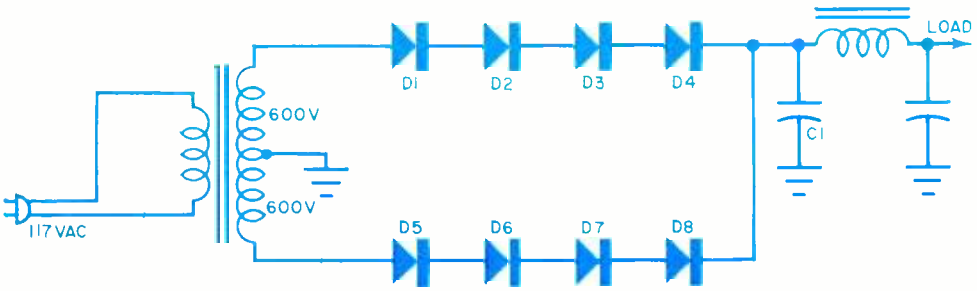


Fig. 1. Inviting trouble: variations in diodes' reverse resistance cause unequal distribution of power supply circuit's inverse voltage and can start a chain reaction of destruction. Transients don't help either.

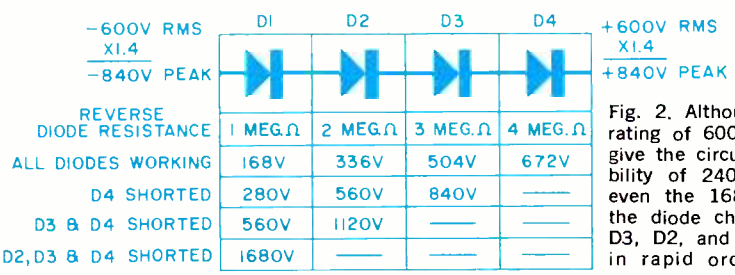
are able to operate at anywhere near this level without breaking down.

PIV Variations. To illustrate the harmful effects of variations in the reverse resistance characteristic, let's assume back resistances of 1, 2, 3, and 4 megohms on *D1* through *D4*, respectively. The voltage drop across each of these diodes at 1680 PIV is shown in Fig. 2.

Since each diode has a maximum PIV rating of 600 volts, *D4* would in time fail—because it has 672 volts across it. In most instances a diode that fails in this manner acts like a very low resistance and an effective short circuit. Once this happens, the voltage distribution changes, leaving 840 volts across *D3*. It doesn't take long for *D3* to fail; *D1* and *D2*, of course, would also fail, as shown in the table in Fig. 2. Just in case *D4* is stout enough not to break down when verse voltage drop will then be nearly independent of the diode's back resistance. A 250,000-ohm resistance across each diode will usually do the trick. If all resistors are of equal value, the PIV across each diode will be the same.

Transients. Transient voltage pulses are of extremely short duration and have a high-frequency characteristic. This characteristic enables us to use capacitors to distribute transient voltages in a harmless manner. In addition to forward and reverse resistance, each diode has a certain amount of capacitance, and like diode resistance, the capacitance varies from unit to unit.

Just as the variations in resistance are compensated for by shunting external resistors across each diode, you can shunt each diode with a capacitor. The capacitive reactance of the external



REVERSE DIODE RESISTANCE	1 MEG.Ω	2 MEG.Ω	3 MEG.Ω	4 MEG.Ω
ALL DIODES WORKING	168V	336V	504V	672V
D4 SHORTED	280V	560V	840V	—
D3 & D4 SHORTED	560V	1120V	—	—
D2, D3 & D4 SHORTED	1680V	—	—	—

Fig. 2. Although each diode has a PIV rating of 600 volts and they appear to give the circuit above a total PIV capability of 2400 volts, it cannot handle even the 1680 volts developed across the diode chain. The table shows why D3, D2, and D1 play follow the leader in rapid order once D4 shorts out.

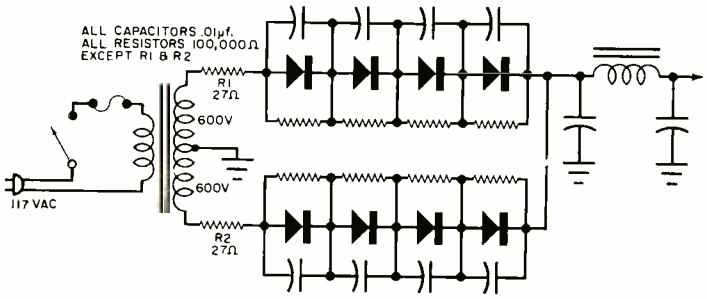


Fig. 3. The "well-dressed" power supply looks like this. Effects of resistance variations are reduced by shunting each diode with a resistance of lower value than the diode's back resistance. In like manner, capacitors take care of transient voltage pulses. A small resistor in each leg minimizes damage from surge currents.

shunt has to be substantially less than the capacitive reactance of the diode to make the distribution of the transient voltage independent of the diode. A capacitor value of 0.01 μf. is usually adequate.

Current Surge. Before you put the power supply to work, it is necessary to minimize the surge of current drawn by the large input filter capacitor when the power supply is first turned on. This is less of a problem with vacuum tube circuits and with choke input filters. But with silicon diodes it is an important consideration.

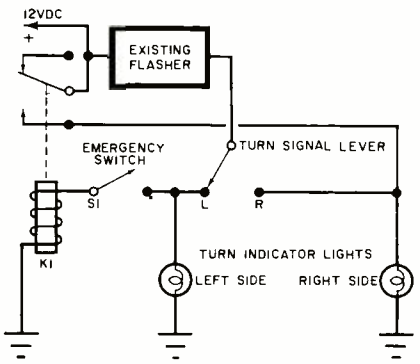
Fortunately, the practical solution is simple. You just insert a small resistance of about 25 to 50 ohms in series with each string of diodes. The voltage drop across these resistors is minimal during normal current flow. An increase in current causes an increase in voltage drop across the surge resistor. The remaining voltage is harmlessly distributed across the diodes.

Figure 3 shows what the "well-dressed" power supply should look like, even down to the fuse in the transformer primary circuit. Once all possible causes of failure are considered and the proper precautions taken, you can expect reliable silicon diode power supply operation. –30–

EMERGENCY FLASHER

FOR safety-conscious and economy-minded motorists, this unit converts turn indicator lights into flashing warning signals in an emergency. All you need to make the converter is a relay and a switch.

The relay voltage rating should be the same as the car's battery voltage rating; and the relay contacts should be able to carry at least 5 amperes. You can use a horn relay similar to one already in your car.



Mount an s.p.s.t. switch (*S1*) in a spot convenient to the driver. The relay (*K1*) can be located under the dash. Only five connections are required, as shown in the schematic diagram.

With *S1* off, the turn indicator works normally. To use the emergency flasher, turn on *S1*, and flip the turn signal lever to the left side. The relay will kick in and out in step with the indicator lights on the left side and turn the lights on the right side on and off at the same time.

It looks as if you could eliminate the relay and just use the switch. But the flasher would then have to handle twice as much current. The absence of the relay would speed up flasher action considerably, and possibly burn out the flasher. The relay carries the current for the indicator lights on the right side, and does not load the flasher appreciably.

—Dan Yeh

SIMPLE SELF-RESETTING TAMPER-ALARM

By **RONALD SEESE,** WA8NCK

Protect your car with this easy-to-build auto sentry

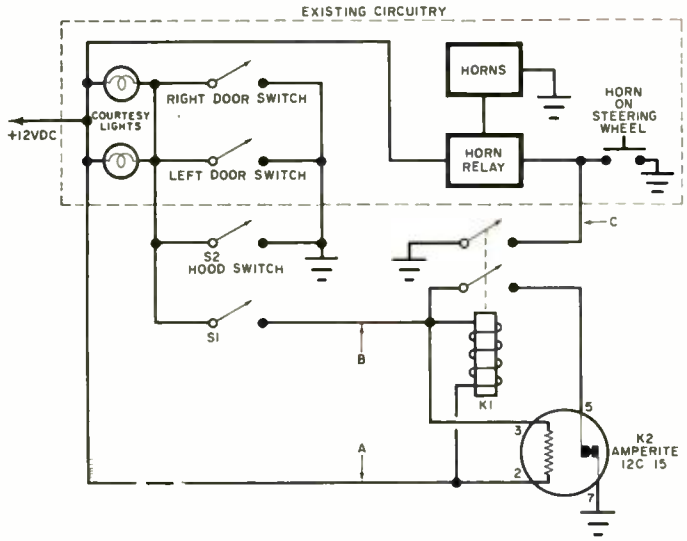
MANY articles have been written on the construction of automotive burglar alarm systems, but most of these systems have been either complicated, difficult to construct and install, or not entirely dependable. This alarm is simple and can be built and installed in a couple of hours. It is 100% dependable, and can be used on any car. Total cost of the project is about $7.00.

The actual alarm is the automobile horn, which gives a continuous 15-second blast when a door is opened or the hood is lifted. Immediately closing the door or hood has no effect on the alarm. The dome or courtesy lamps will light, the horn will sound off, and then the entire system will shut off and the alarm will automatically reset itself.

How It Works. The heart of the alarm circuit is Amperite delay relay *K2*. The relay contains a set of normally closed bimetal contacts and a heater element which causes the contacts to open. A 15-second delay was selected so that battery drain would be at a minimum during operation of the horn, yet a sufficiently long blast would be provided to frighten away anyone attempting to tamper with the car.

Opening a door or lifting the hood actuates a switch which causes relay *K1* to close, completing the horn circuit through one set of contacts. The remaining set of contacts feeds current to the relay coil, keeping it latched on even though the door, or hood may be immediately closed again. This circuit also feeds current to the delay relay heater, causing the contacts to open 15 seconds later; breaking the heater circuit, and the relay coil circuit, and opening the relay; stopping the horns and resetting the alarm circuit.

Construction. The alarm is built into one half of a 2¾ x 2⅛ x 2⅜" aluminum box. Layout and wiring is not critical. A 3-screw terminal strip can be mounted on one side of the box for convenience in wiring the alarm to the car's electrical circuit. Leads from *K1* and *K2* are connected to the terminal strip as indicated by points *A*, *B*, and *C* on the schematic diagram. The unit can be



Existing door switches for courtesy lights can be used to trigger the alarm. Externally mounted switch S1 can be concealed or lock-and-key protected. The normally closed delay relay, K2, holds K1 for a predetermined time to sound the alarm, then lets go and automatically resets itself when the bimetal contact holder, under the influence of the heater, opens and closes the contacts.

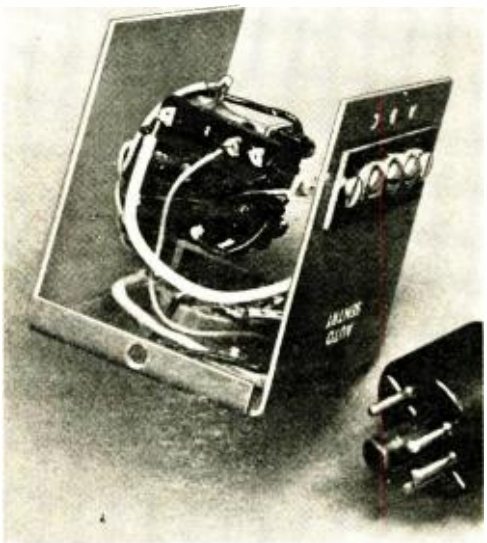
PARTS LIST

K1—12-volt d.c., d.p.s.t. relay (Potter & Brumfield No. KA11DY)
K2—15-sec., normally closed delay relay (Amperite No. 12C15)
S1—S.p.s.t. switch
S2—S.p.s.t. push-button, momentary-contact, normally closed switch
1—2¾" x 2⅛" x 2⅝" box (LMB-100)
Misc.—Octal socket, 3-screw terminal strip, nuts, bolts, etc.

mounted on the firewall or under the dash by drilling two holes in the bottom of the other half of the chassis and fastening it with self-tapping screws in any convenient location.

In order to save a lot of time and trouble installing special alarm switches on each door, you can use the existing courtesy light switches. The lead from the master alarm switch (*S1*) must be tapped into the grounded side of either courtesy or dome light lead between the light and the switch. This switch must be located on the car's exterior. A simple toggle switch can be used if it is concealed in the grille, behind the bumper, etc., or an ignition lock type switch might be used. The author used a toggle switch and mounted it in the recessed area near the rear license plate on his Corvair.

A new switch, *S2*, must be mounted under the hood in such a position that when the hood is down the switch is open. One terminal is grounded and the other is connected at the same point as the lead from *S1*.



Wiring and component location are not critical. The finished unit should be mounted inside the car.

Other Uses. The basic circuit of this alarm can be adapted for many different applications. By selecting the proper relay and delay relay values, a home alarm system can be built, using a floodlight, siren, etc., as the actual alarm. This system can also be used in a boat, or as a control for any other type of alarm. -30-

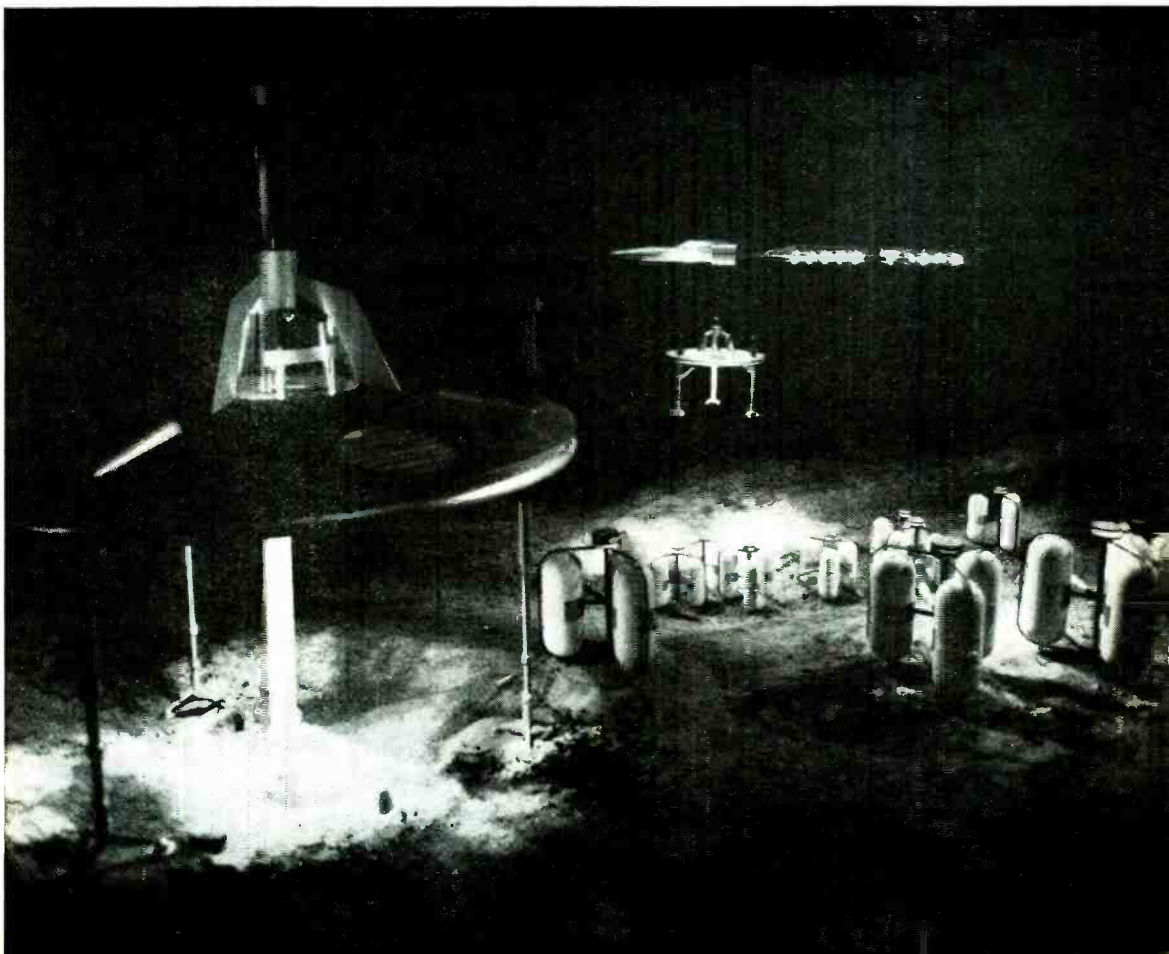
ELECTRONIC MAGIC AT THE WORLD'S FAIR

By ART ZUCKERMAN

Tape systems and other electronic devices run everything from puppet shows to safety programs

THE VAST MEDLEY of imaginative pavilions, exhibits, and amusements at the New York World's Fair should enchant even the most indifferent of fairgoers. For here you have man at his technological best, showing his promise of things to come. And this promise, to a large extent, hinges on many recent developments and applications of electronics.

For instance, complex stereophonic tape and electromechanical systems are used at many pavilions to create mood-setting atmospheres. At other pavilions, tapes run life-like mechanical figures that not only talk but mimic the most subtle of human expressions and movements. Other facets of electronics, such as computers, color television, and the



like, are featured attractions at many pavilions.

Even more important, electronics supplies the nervous system that links the fair's medical, fire, and police units, knitting them into an efficient, quick-acting group. It also finds use in administrative and public service departments.

Rides Into The Future. One of the more exciting rides can be had at General Motor's Futurama, where your personal magic carpet awaits to whisk you into the future. Here visitors sit in individual contour seats with built-in stereophonic speakers. These seats move along a track that alternately dips and climbs through the two floors of the exhibition to the accompaniment of narration and music that sets the scene for the futuristic tour.

The Futurama's sound system uses what looks like an offbeat tape recorder. But instead of tape, its reels are loaded with 16-mm. film. The audio is recorded on four parallel optical tracks. Divided into stereo pairs, these optical tracks have identical program material but run in opposite directions to save rewinding. During one ride circuit, the sound film runs left to right; on the next go-around, it reverses.

Cueing bars positioned along the track trip switches on the car to start the tape playing. Microswitches built into the deck stop and reverse the mechanism upon completion of the ride. These switches are tripped by little buttons set into each end of the sound film.

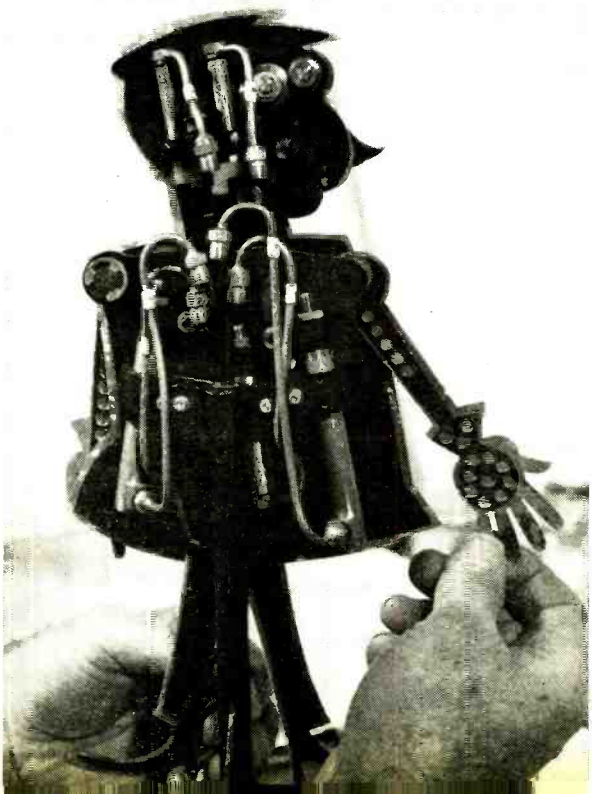
An almost identical system, except for the stereo feature, tells riders of advances made in communications as they take an armchair ride on the upper floor of the Bell Telephone Pavilion. Movies and stage sets tell the story with a three-dimensional effect, accompanied by music and a talk.

Over at the United States Pavilion a different type of ride weaves its own stereo-visual magic. Here visitors are wafted around the huge pavilion in mobile grandstands to a scene-setting flow of stereo music and narrative. Adjustable speaker wings mounted on the seats are fed by a cartridge-type tape deck built into the rear of each car.

The three cartridges in each deck, two for program material and one for special sound effects, are keyed to projector

Behind the scenes at the Bell System exhibit is the tape deck which provides sound for the displays. The 30 tapes give visitors stories ranging from how the laser works to a history of communications.

Tape decks control mechanical figures at the IBM Pavilion. Pneumatically-operated puppets, like the one shown below, act out playlets on computer logic complete with sound effects, music, and dialogue.



clusters along the tracks. The tape operates at 7½ ips. A clear "window" in the tape permits a photocell takeoff to stop the transport at the end of each segment. A tape is restarted when a switch under the car hits a movable cueing block along the track.

Tapes Run Shows. Supplying a sound track is only a small part of the job done by tape at the World's Fair. It is also used to run a good many shows, making it the biggest demonstration of automated entertainment this side of Disneyland.

For example, Bell Telephone's subterranean showrooms are packed with me-

Created by Walt Disney for GE's Progressland, "Grandpa" is but one of the audioanimatronic figures at the fair. The Disney cast performs over 450 integrated motions, and talks like real people.

chanical exhibits equipped with telephones where a visitor may get a story ranging from how the laser works to a history of communications. When a visitor picks up a phone, one of the 30 tape reels located in a back room starts roll-

(*Continued on page* 80)

Sights unseen for millions of years on earth are recreated in full animation at the Ford Rotunda. Here, "living" creatures with nerves and muscles of pneumatic and hydraulic components romp about.

Public and emergency services, such as locating a "lost" parent, are important to the well-being of fair-goers. At the fair these services are linked together in an ingenious communications network.

On the Citizens Band

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

ON April 11, 1965, portions of Northern Illinois and Southern Wisconsin were alerted to expect extremely high winds and storms. By the end of the day, a tornado had ripped through Crystal Lake, Ill., near the dividing line into Wisconsin, pushed its way to the junction of U. S. Highways 176 and 31, then hopscotched to Island Lake. It left five dead in the Crystal Lake area, one in Island Lake, and many injured and homeless along its path. In Crystal Lake Plaza, all buildings were either completely demolished or so badly damaged that the repair cost was estimated by Sheriff Ed Dowd at more than ten million dollars.

CB'ERS TANGLE WITH A TORNADO

Where disasters of this type occur, landline communications are usually stripped to practically non-existence. Such was the situation in the Crystal Lake area where communications were needed above all else. But, as has been the case across these United States for the past seven years, CB'ers were quick to recognize the need for their assistance, and volunteered their time, equipment, and vehicles.

Three Citizens Band clubs teamed up to establish a communications network in the Crystal Lake area: The Tri-County Five Watters (an Illinois/Wisconsin association); the Marengo (Illinois) Rescue Squad; and the Cary Grove Rescue Squad. Between the three of them, they placed about 50 mobile units on the road, acting as runners delivering needed items, as spotters to report emergency situations requiring prompt attention, and as patrol vehicles to help keep vandalism at a minimum.

By the next day, April 12, the Tri-County Five Watters had taken control of Communications Central which was set up in the Crystal Lake High School. Their duties included the manning of Red Cross phones, Civil Defense radio equipment and their own Citizens Band network. Tri-County Five Watters president Roy Schultz reported that more than 1000 CB'ers in adjoining areas and states called to offer assistance to the network and to the officials in charge of cleaning up. He further stated that for more than a week afterwards both men and women manned the CB mobile units and the central communications setup.

Citizens Band operators and other volunteers on the scene were highly commended, and rightly so, for their efforts to ease the heavy burden placed on Northern Illinois residents following one of the worst disasters ever to strike the area.

Debris lay scattered for miles in Northern Illinois where a tornado struck on April 11. Homes were ripped from their foundations, autos thrown through the air, and an entire shopping center demolished.

Tri-County Five Watters CB Club president Roy Schultz (center) stands with other volunteers in the devastated Crystal Lake area. Roy's group and two other CB clubs manned a communications setup.

Safecrackers, Beware! As a result of our radio interview with announcer Bob Gregory on Station WBEL a few months back (see the April column), Bob has been receiving numerous inquiries and bits of information through the mail regarding the Citizens Radio Service. The latest tidbit he forwarded to us concerns an incident where an "eavesdropper" on 11 meters did a little sleuthing on his own and helped the police bag three would-be safecrackers!

It seems that Michael Rehm was listening to his CB rig one evening when he realized that the voice he heard sounded like a lookout man talking to his cohorts in crime. Michael notified the police first, then drove around the area in an attempt to pinpoint the whereabouts of the transmitter.

Seeing three men hurriedly leaving an automobile agency, Michael took down their license number before they whizzed off into the night, then reported the happenings to the Highway Patrol. An investigation at the auto lot showed that someone had indeed attempted to take the safe apart, with no luck!

A short distance from the scene, the Highway Patrol arrested three men sporting the aforementioned license number. The three men had Citizens Band gear in the car. They were booked! Good work, Mike!

Other Assists. Chicago Citizens Radio League member Barney Chaiken, 18Q0200, is also in line for a share of kudos! While monitoring his CB rig one afternoon, Barney heard a plea from KLK8104 for assistance on a 10-33 (emergency). The report indicated that a truck had collided with an automobile. As a result of Barney's quick response, the police were on the scene in short order.

Then, less than a month later, while reclining on his sofa (so the story goes), Barney was aroused with another 10-33 from Mike Abt, KLK5086, also a member of the CCRL. This time two trucks had collided on the Edens Expressway. Barney relayed the information to the police, but never quite made it back to the couch.

Seven minutes later, Mike Abt, who was heading in a southerly direction on the expressway, reported another 10-33 to Barney, this time involving two trucks and an automobile. Barney did his job! A "tip o'-the-whip" to Barney, Mike, and the Chicago Citizens Radio League for their public service consciousness!

A member of the Southern California Citizens Band Association, KEJ3938, thinks quite highly of the Orange County REACT Team for assisting when his fuel pump de-

(*Continued on page 89*)

1965 OTCB JAMBOREE CALENDAR

Planning a jamboree, get-together, banquet or picnic? Send all the details to: 1965 OTCB Jamboree Calendar, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016. For more information on the jamborees listed below, contact the clubs or club representatives at the addresses given.

Lancaster, Pa. — **July 4**
Location: Rocky Springs Park. Sponsor: Lancaster County CB Radio Club, Inc., Box 236, Lancaster.

Monroeville, Pa. — **July 11**
Event: CB Basket Picnic. Sponsor: Allegheny Valley CB Club, Monroeville.

Struthers, Ohio — **July 11**
Event: CB Picnic Location: Holy Trinity Pavilion. Sponsor: Mahoning Valley CB Club.

Alliance, Ohio — **July 17-18**
Sponsor: Carnation City CB Club.

Elyria, Ohio — **July 17-18**
Event: Jamboree Campout. Location: Grotto Park. Sponsor: Lake Erie CB'ers, Inc.

Anderson, Ind. — **July 18**
Location: U.A.W.-C.I.O. Auditorium. Sponsor: Central Indiana CB Club, Box 2155, Anderson.

Toledo, Ohio — **July 24-25**
Event: First International CB Jamboree Location: Lucas County Recreation Center. Sponsor: Ohio Michigan Screwdriver Club, Inc. Contact: Jamboree, Box 38, Pemberville, Ohio.

Columbus, Ohio — **July 25**
Event: Fifth Annual CB Picnic. Location: Ohio State Fairgrounds. Sponsor: Central Ohio CB Assn., Inc. Contact: Jamboree, Box 92, Columbus.

Lewistown, Pa. — **July 31-Aug. 1**
Event: Statewide CB Jamboree. Location: Kishacoquillas Park. Sponsor: Lewistown Circle 11 CB Club. Contact: Galen M. Bratton, R.D. #2, McVeytown, Pa.

Grayslake, Ill. — **Aug. 13-15**
Location: Lake County Fairgrounds. Sponsor: Citizens Radio Assn. of Lake County, Ill. Contact: Jack Diamond, Box 251, Waukegan, Ill.

Jacksonville, Fla. — **Aug. 14-15**
Event: First Annual Northeast Florida Grand National CB & Communications Jamboree. Location: Jacksonville Suns Stadium. Sponsors: Citizens Radio Operators Organization, Inc. and the Gateway Monitors. Contact: Southeastern Decorators, Inc., 220 Talleyrand Ave., Jacksonville.

Lebanon, Ohio — **Aug. 21-22**
Event: Nationwide CB Jamboree. Location: Warren County Fairgrounds. Sponsor: S.W.O.C.B.A.

Norwalk, Ohio — **Aug. 21-22**
Location: Huron County Fairgrounds. Sponsor: Sheriff's Huron Co. Emergency Net, Inc.

Quincy, Ill. — **Aug. 22**
Location: Eagles Alps. Sponsor: Quincy Area CB Radio Club.

Enon Valley, Pa. — **Aug. 28-29**
Event: Sociable 5 Watts CB Family Jamboree (Fourth Annual). Location: Big Beaver Fire Hall and Grounds. Sponsor: Sociable 5 Watts CB Club.

Wichita, Kan. — **Aug. 28-29**
Event: Second Annual Air Capital CB Jamboree. Sponsor: Citizens Radio Club of Wichita, Inc. Contact: Jamboree, Box 441, Wichita.

Maryville, Tenn. — **Sept. 4-6**
Event: Fourth Annual Hillbilly CB Jamboree. Location: Maryville Fairgrounds. Contact: G. H. Tarpley, Rt. 4, Maryville.

Fort Wayne, Ind. — **Sept. 19**
Event: CB Roundup. Location: Coliseum. Sponsor: Maumee Valley CB Club.

Transistor Topics

By **LOU GARNER,** Semiconductor Editor

ELECTRONICS as a hobby is due for another boost if a new line of products introduced by International Rectifier Corporation (233 Kansas St., El Segundo, Calif.) catches the public's fancy. Completely transistorized, and consisting of a series of self-contained, pre-wired "building blocks" and appropriate accessories, the IRectronics line can be assembled into a variety of useful electronic devices and systems using nothing more than an ordinary screwdriver.

Designed to attract people at all levels of interest, IRectronics brings the "paint-by-numbers" approach to the electronics hobbyist. Twenty different projects — ranging from an emergency danger blinker to a remote-controlled garage door opener—can be assembled with no more knowledge or skill than is required to change a light bulb, bake a pre-mixed cake, or press the shutter of a simple box camera.

There are 25 circuit modules and 19 accessory items, including microphones, telegraph keys, loudspeakers, cabinets, etc. Each module is sealed in a clear plastic container to protect the components and to simplify assembly. The projects include an AM or FM radio receiver, a p.a. system, walkie-talkie, wireless intercom, photoflash slave, boat signal horn, "baby-sitter," metronome, telephone amplifier, guitar amplifier, remote-control system, etc. Batteries or a power converter plugged into a standard electrical outlet can be used to operate the devices.

In keeping with the intended market, the IRectronics line will be distributed through electronics suppliers, department stores, supermarkets, hardware stores, automotive suppliers, camera stores, hobby shops and other retail outlets. Prices range from $4.95 for the danger blinker to $19.95 for a walkie-talkie, plus accessories.

Manufacturer's Circuit. High-voltage, low-current d.c. power sources are required for a variety of projects, including Geiger counters, photoflash strobelights, and insulation testers. A simple d.c.-to-d.c. power converter capable of supplying up to 1000 volts at 25 microamperes from the Triad Distributor Division of Litton Industries (305 N. Briant St., Huntington, Ind.) may

Father and son match screwdrivers to assemble a project made up of self-contained, prewired transistorized building blocks recently introduced by International Rectifier Corporation. Twenty different products make up the IRectronics line, designed to appeal to people at all levels of electronic interest.

satisfy your needs. The circuit, shown in Fig. 1, incorporates a single power transistor and can be operated by a 3-volt battery.

Referring to the schematic diagram, *pnp* transistor *Q1* is used in a blocking oscillator circuit. Transformer *T1* provides the feedback necessary to start and sustain oscillation and the stepped-up voltage. The base bias circuit is from *B1* through *R1*, *R2*, the lower portion of *T1*'s primary, and back to the battery through the emitter. Adjustment of *R1* varies bias current for optimum performance.

The blocking oscillator conducts at a periodic rate determined by the time constant of *R1*, *R2* and *C1*, and *T1*'s characteristics. "Sharp" collector current pulses developed in the primary winding are stepped up by the secondary, rectified by *D1*, and filtered by *C2* to provide a high-voltage d.c. output.

Standard components are used in the design. Transistor *Q1* is a 2N670 and *D1* an International Rectifier T-35-HP high-voltage rectifier. Potentiometer *R1* is rated at 1 or 2 watts and *R2* is a 1-watt resistor. A 10-volt electrolytic is used for *C1*, and a 1600-volt, oil-filled paper, mica or ceramic capacitor for *C2*. Transformer *T1* is a Triad TY-200X. The 3-volt battery can be made up of two size D flashlight cells connected in series.

Any standard construction technique can be used, but signal leads should be kept short and direct to reduce unwanted radiation. Ample spacing must be provided when wiring *T1*'s high-voltage secondary circuit to prevent arcing. When the wiring is completed, double-check your work before applying power.

Adjust *R1* to provide the desired d.c. output voltage under load. Normally, *R1* should be present at its maximum resistance position before circuit power is applied. No attempt should be made to obtain an output voltage in excess of 1000 volts, as this might damage *Q1* or cause insulation breakdown in *T1*.

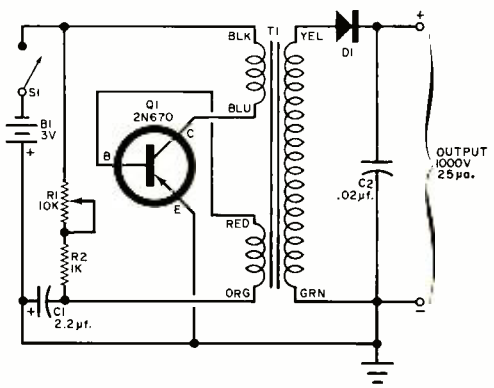


Fig. 1. Simple d.c. to d.c. power supply steps up 3 volts to 1000 volts in Triad converter circuit.

Readers' Circuits. A young but enthusiastic amateur, Terry Mayhugh, K3FCE (19 N. 4th St., Clairton, Pa.), submitted the circuit illustrated in Fig. 2: a low-cost *relative field strength meter* which he finds useful for adjusting his Viking II transmitter.

Resistors *R1*, *R2* and *R3*, and *Q1*'s emitter-collector resistance form a simple d.c. bridge. Potentiometer *R3* is adjusted to compensate for *Q1*'s small leakage and to balance the bridge. Power is obtained from *B1*, a 1½-volt D cell. A 0-1 ma. meter is used as a bridge-balance indicator.

To operate the FSM, first balance the bridge by adjusting *R3* for a zero meter reading, then expose the antenna to an r.f. signal. The signal is detected by *D1* and applied to the base of *Q1*. This results in a change in *Q1*'s emitter-collector resistance, unbalances the bridge, and causes an upscale reading on the meter. If the meter doesn't read up scale, reverse the connections to it. The degree of bridge unbalance, and hence the meter reading, is proportional to the signal strength.

Readily available parts are used in the FSM. Diode *D1* is a 1N34 or 1N34A or equivalent, *Q1* is a 2N508, and *R1* and *R2* are half-watt resistors. The antenna is a 2-foot length of ordinary hookup wire. Although the instrument can be assembled on a small metal chassis, or wired on a board, K3FCE suggests that you may prefer to assemble the circuit in a standard sloping-front meter case. There is ample room in standard meter cabinets to hold the circuit and penlight battery.

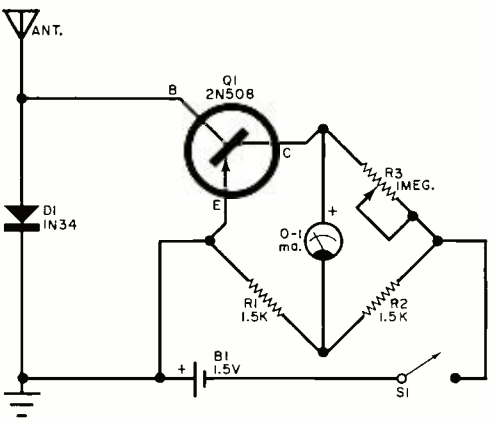


Fig. 2. Terry Mayhugh's bridge hookup is a low-cost battery-operated relative field strength meter.

The *wireless broadcaster* circuit in Fig. 3 was submitted by Christopher C. Hoffman (510 Crescent Parkway, Sea Girt, N. J.). You may recall that Chris recently contributed an electronic siren circuit which was published in the February issue. Nice going, Chris.

The circuit in Fig. 3 differs from the wireless microphone circuits heretofore presented in several respects. It is a two-transistor circuit featuring a gain control in the audio stage to adjust modulation level, a shielded r.f. oscillator transformer (*T2*), and a phonograph and microphone input.

Transistor *Q1* serves as a common-emitter audio amplifier and modulator while *Q2* is used in a modified Hartley oscillator circuit. A s.p.d.t. selector switch (*S2*) permits a choice of microphone (*Mic*) or phonograph (*Phono*) input signals. A small loudspeaker in conjunction with an impedance matching transformer (*T1*) serves as a microphone. A high-impedance phono cartridge can be plugged into *J1*. Circuit power is obtained from a 9-volt battery.

A portion of the audio signal, depending on *R1*'s setting, is coupled through *C1* to *Q1*'s base circuit. Resistors *R2*, *R3* and *R5* determine *Q1*'s base bias, while *R4* serves as the collector load. The amplified audio signal developed across *R4* is applied through *C2* to the base circuit of the oscillator stage (*Q2*). Transformer *T2*, tuned by shunt capacitor *C6*, acts as the r.f. oscillator transformer. The feedback needed to start and maintain oscillation is coupled back to *Q2*'s base through *C4*; the base bias circuit is through *R6*. Capacitor *C5* provides bypass action across the battery, and the modulated r.f. signal from *Q2* is radiated by the antenna.

The microphone is a miniature (2″ to 4″) loudspeaker with a 3- to 6-ohm voice coil; *T1* is a 500- to 4-ohm output transformer wired in reverse; and *J1* is a standard RCA type phono jack. Except for potentiometer *R1*, all resistors are half-watt types. Capacitors *C1*, *C2* and *C3* are 12-volt electrolytics and *C4* and *C5* are either paper or ceramic types. Capacitor *C6* is a small trimmer rated at 4.6 to 75 pf. The oscillator transformer (*T2*) is a Meissner 149006. A 9-volt transistor battery powers the broadcaster, and the antenna is a short length of hookup wire.

The unit can be assembled on a conventional metal chassis, on a perforated phenolic wiring board, in a plastic case, or in a small Minibox. All signal leads should be kept short and polarities must be observed.

Two component values should be determined experimentally. First, *Q2*'s base bias resistor (*R6*) is selected for the best compromise between r.f. output and modulation quality; a relatively high value resistance (100,000 ohms to 1 megohm) will be required in most cases. Second, a fixed mica or ceramic capacitor (*C7*) must be shunted across *C6* to "fix" the unit's basic tuning range within the AM band; values of from 25 to 270 pf. can be used, depending on the desired frequency range.

When operating the wireless broadcaster, preadjust *C6* until the output signal can be picked up at a "dead" spot on a nearby AM receiver (where no local stations are received). Potentiometer *R1* should be adjusted for best audio quality.

Chris did not indicate the nominal broadcasting range of his design, but as a general rule this depends upon a number of factors,

(*Continued on page* 89)

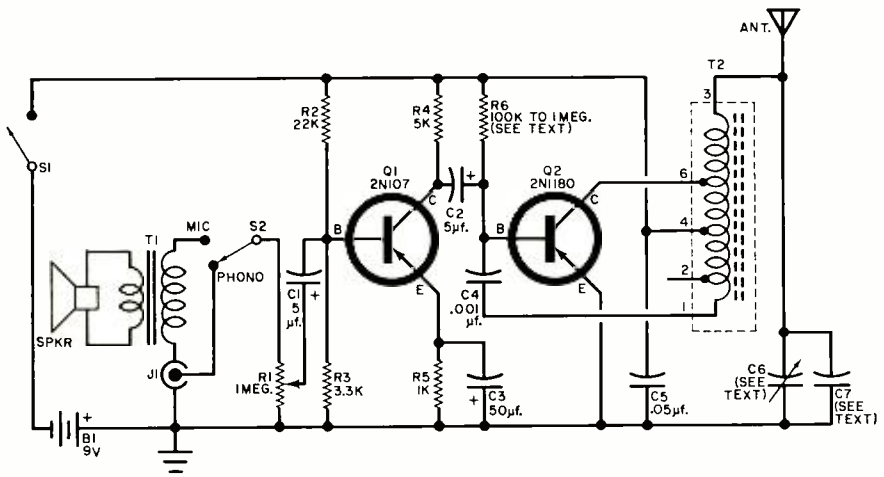
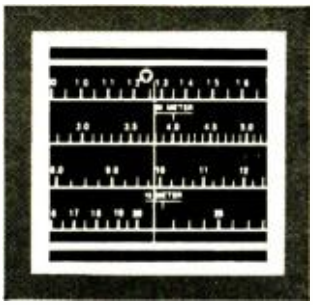


Fig. 3. Christopher C. Hoffman's wireless microphone has an input jack for a phono cartridge, and a gain control in the audio circuit to adjust the modulation level. The unit operates in the AM broadcast band.



Across the Ham Bands

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

AUSTRALIAN "YOUTH RADIO SCHEME"

THERE is no Novice license in Australia to encourage young people to become licensed amateurs. As a result, Rex Black. VK2YA, Federal Coordinator of the Wireless Institute of Australia's Youth Radio Scheme, reports that the percentage of licensed amateurs and general "electronic-mindedness" is much smaller there than in the United States and other countries with Novice licenses. Four years ago, for example, there were only three school radio clubs in all of New South Wales, Australia's most populous state.

In 1961, the sponsors of these clubs—the Reverend Brother Lee Kinsella, VK2AXK, St. Edward's College; Keith Howard, VK2AKX, Booragul High School; and Rex Black, VK2YA, English and History Master, Vaucluse Boys' High School—realized the fun Australian boys and girls were missing by not knowing about ham radio. They also were aware of the loss to the country in not having a reservoir of electronically interested young people. So they decided to do something about it.

Rex Black had pioneered an awards program at the Vaucluse Radio Club which was very popular with the club members. In this program, members who successfully completed specified construction projects and passed a written quiz on them earned certificates of achievement. After much consultation, Keith, Lee, and Rex presented a refined version of this program to the New South Wales division of the W.I.A. The W.I.A. accepted the program "in toto" and eventually "sold" the "Youth Radio Scheme," as it is now called, to the State Education Department—as a valuable extra-curricular supplement to school science courses and for groups like the Boy Scouts and the Girl Guides (the Australian equivalent of Girl Scouts).

A new participant in the Y.R.S. earns his or her Elementary Certificate by building and describing the operation of a crys-

Amateur Station of the Month

Rag-chewing on c.w. at about 20 wpm is the favorite pastime of Warren Hubert, WA4UXC, Montgomery, Ala., but he also works some phone and chases DX. Besides the Heathkit "Apache" transmitter and Hammarlund HQ-110A receiver shown, "Hube" has a home-built, flea-power 6-meter transceiver. Separate horizontal dipoles for 80, 40, and 6 meters and an "all-band" vertical antenna lend an air of distinction to the WA4UXC estate. "Hube" will receive a one-year subscription for submitting this winning photo for July in our Amateur Station of the Month contest. If you would like to enter, send us a clear picture of your station, preferably showing you at the controls, accompanied by some details on your equipment and your ham career. Mail your entry to Amateur Photo Contest, c/o Herb S. Brier, P. O. Box 678, Gary, Ind. 46401.

tal receiver, Morse code practice set, or some other device on that level. By the time the boy or girl has achieved the Junior, Intermediate, Senior, and Advanced certificates, he or she has usually been in a club two or three years and has completed a number of increasingly complex construction projects. The participant is then about ready to take the Australian amateur radio examination.

The examination is technically for the "Amateur Operator's Certificate of Proficiency" and is aproximately equivalent to the U.S. General Class examination, with a 14-wpm code test. There is also a "Limited Amateur Operator's Certificate of Proficiency" in Australia which entails no code test but limits operation to frequencies above 50 mc.

In addition to the basic certificates, the Y.R.S. offers special awards for members of clubs with amateur radio stations. There are also special competitions between clubs, and various Australian electronics firms donate small prizes to the winners of the various competitions. Of course, there are now many more radio clubs to compete than the original three which existed back in 1961.

Australian school authorities have discovered that most participants in the Youth Radio Scheme improve their school grades. Participants have discovered that displaying their Y.R.S. certificates when applying for a job in the electronics field helps in getting the job.

At present, there are only 3000 licensed amateurs in Australia, less than a quarter—percentage-wise—of those in the United States. Pointing out that the number of U.S. hams has doubled since the introduction of the Novice license in 1951, Australian hams are still trying to convince their government of the value of a Novice type license.

Until they succeed, as Rex Black puts it, "Let us hope that our respective systems—Novice licensing and the Youth Radio Scheme—will introduce increasing numbers of young people in both countries to this wonderful hobby and lead to many VK-W friendships to bind us together in the friendly bonds of amateur radio."

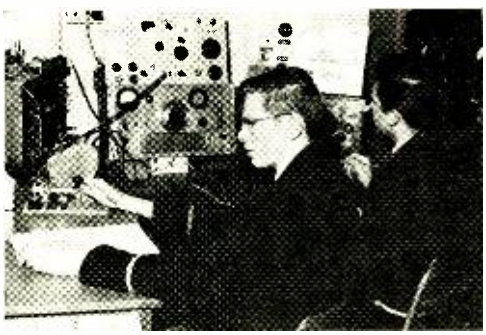
New FCC Amateur License Proposals. On March 31, the Federal Communications Commission introduced its long-expected proposals to modify amateur regulations. The new proposals in FCC Docket #15928 would increase the life of the Novice license from one to two years, but would eliminate Novice phone on 2 meters. They would also create a new First Class license requiring one year of experience and passing a 16-wpm code test and a written test midway between the General and Extra Class written tests.

One year after the new regulations become effective, if they do, only Extra Class licensees will be permitted to operate in the lower 25 kc. of the 80-, 40-, 20-, and 15-meter c.w. bands; and after two years, in the lower 50 kc. of these bands. On the same timetable, only First and Extra Class licensees would operate in aproximately the lower quarters and halves of the phone segments of these bands. Also, the bottom 250 kc. of 6 meters and 1000 kc. of 2 meters would be reserved for Extra or First Class licensees.

Present Advanced Class licenses would be renewed as General licenses. Technicians would be assigned WT or WU prefixes, and Conditionals WC or WD prefixes. Extra and First Class licensees would be assigned 2-letter calls; present holders of such calls would retain them.

Although the new proposals are not liked

(*Continued on page 88*)



Here are two "graduates" of the "Australian Youth Scheme": Roger Davis, VK1RD, and George Brzostowski. VK1GB. Roger is shown sending "slow Morse" (code practice) on 80 meters, while George examines his home-constructed SSB transmitter.

Chuck Lucking, WAØIDZ, St. Charles, Minn. (at left) runs 120-150 watts to a Collins 32V-1 transmitter and receives on a Drake 2-B aided by a Heathkit Q-multiplier. He has 35 states confirmed.

Monthly Short-Wave Report

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

MOBILE DX'ING

VIRTUALLY all mobile DX hunting is done on the medium waves—the standard broadcast band—and nearly all of it is done between sunset and sunrise. During daylight hours, the traveler is not likely to hear anything other than local stations in the area he is passing through, although some of these locals are daylight-only, low-powered stations that he might not be able to hear from his home base. But once the afternoon shadows begin to lengthen and the daytimers leave the air, a far larger number of stations can be tuned in.

Don't write off the daylight hours, though. Some good catches can be made when you're speeding through mile after mile of open flatlands and gently rolling farmlands, for there are no nearby obstructions to hinder reception, nor are there—for the most part—the bothersome electrical disturbances that are generated by high-tension lines and neon lights. Your Short-Wave Editor has been able to log a number of the large 50,000-watt stations at distances of 400 to 500 miles on this type of terrain, using an ordinary run-of-the-mill car receiver. Travelers in coastal areas may also find reception from stations located near the coast surprisingly good, for radio signals travel considerably further over open water.

Mountains, on the other hand, present a formidable challenge to the daytime DX'er and, often, to the nighttime DX'er as well. There are many areas in which the broadcast band can be tuned with only a very few weak signals, if any. This is particularly true where a roadway passes through a valley between mountain ranges. Start climbing over the hills, and reception will pick up.

The Adirondacks in eastern interior New York State provide a variety of reception conditions. But as you ease down towards the Hudson River in the area of Lake George, you may find New York City's WINS—a couple of hundred miles away—booming through like a local on 1010 kc., the result of the signal traveling through an almost straight river valley. And in upper-central Michigan, near Lake Michigan, many low-powered Wisconsin stations can be logged.

At night, you'll have little trouble picking up stations on nearly every channel. You'll hear most of the 50,000-watt stations within a radius of 750 to 1000 miles, and countless numbers of other lower powered stations. Tune for an hour or so after local sunset, and you may hear the heterodynes (whistles) of the larger European stations; with luck, you may even tune in one or more of these stations. (We once heard Dakar, Senegal, on

Patrick Richardson, WPE9GLO, of Chicago, Ill., is a retired Western Electric supervisor who finds DX'ing ideal for filling in long hours. With his Lafayette HE-80 receiver, he has achieved a record of 38 countries heard and 32 verified—so far.

"Ted" Tompkins, VE3PE1ZJ, of Toronto, Ontario, Canada, listens on a Gonset GR-211. To date Ted has logged 86 countries, with 71 verified. On the medium waves, he has 13 verified out of 17 heard.

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

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

COUNTRY	STATION	FREQUENCY *(kc.)*	TIMES *(EST)*
Argentina	Buenos Aires	11,780, 9690, 6090	2200, 0100 (Mon.-Fri.)
Australia	Melbourne	17,840, 15,220	2030, 2130, 2230
		9580	0745
Bulgaria	Sofia	6070 (and/or 9700)	1900, 2300
		7290	1630
Canada	Montreal	15,190, 11,760, 9625,	1800 (E. Coast)
		9625, 5970	0230 (W. Coast)
Congo (East)	Leopoldville	11,755	1630
Congo (West)	Brazzaville	15,370, 11,930	1430
Czechoslovakia	Prague	11,990, 9795, 7345, 7115, 5930	2000, 2230
Denmark	Copenhagen	15,165	0730
		9520	2100
West Germany	Cologne	11,885, 11,795, 9735	1010
		9640, 6175	2040
		9735, 9575, 6145, 5960	0000
Hungary	Budapest	9833, 9540, 7305, 6234	1930, 2030
		9833, 7305, 7215, 6234	2200, 2330
Italy	Rome	9575, 5960	1930, 2205
Japan	Tokyo	15,135, 11,780	1900
Jordan	Amman	9555	2000
Lebanon	Beirut	9750	2130
Netherlands	Hilversum	15,425, 11,950	1235 (Tues., Fri.)
		15,425, 11,730	1535 (Tues., Fri.)
Netherlands Antilles	Bonaire	9685	2300
Portugal	Lisbon	6185, 6025	2100, 2245
Romania	Bucharest	9590, 9570, 9510, 7225, 6190, 5990 (9570 not used at 2030)	2330, 2200, 2030
Spain	Madrid	11,715, 9615, 6140	2200, 2100, 2000
Sweden	Stockholm	15,195	0900
		5990	2045
		9705	2215
Switzerland	Berne	9535, 6105, 6080	2015
		15,305	2315
Turkey	Ankara	15,165	1700
United Kingdom	London	15,300, 11,860	1100
		9610, 6195	1700, 1800, 1900, 2100
U.S.S.R.	Moscow	15,180, 15,140, 9730, 9660, 9640, 9630, 9570, 9540, 7360, 7330, 7320, 7310, 7290, 7250, 7240, 7230, 7200, 7150, 7130, 6070 (all channels not in use at any one time)	1730, 1900, 2000, 2100, 2300, 0040
Vatican City	Vatican City	9645, 7250, 5985	1950

764 kc., while traveling west through Pennsylvania.) Eastern listeners will all be able to log numerous Caribbean area stations while western DX'ers will hear Mexicans and other Central American stations. *Radio Americas*, Swan Island (1157-1162 kc.), *Trans World Radio*, Bonaire (800 kc.), and Belize, British Honduras (834 kc.) are good examples of stations that are being heard with relative ease.

Short-wave DX'ing by the mobile method is not too common; in fact, it is nearly non-existent. The main reason for this is that there are virtually no general-production automobile receivers that will tune in the short waves.

In the interests of safety, we strongly recommend that you DX with the car receiver *as a passenger and not as a driver*. Auto travel is often hazardous at best; at night, the hazards multiply, and you will have enough to do without driving and tuning at the same time.

(*Continued on page* 90)

The new Amphenol 860 Color Commander cuts alignment time in half!

Ever finish a convergence job to find the raster off center. Lose convergence when you re-centered? Can't happen with the Amphenol Color Commander, battery-powered, solid-state color generator. A special, single-crossbar pattern consists of one horizontal and one vertical line, crossing just where the center of the raster should be. No need to guess when centering the raster with this new pattern.

See dots before your eyes when you want only one to start static convergence? The 860 gives you that single dot, right at center screen. You'll be switching back to this important dot during dynamic adjustment to make sure you haven't gone off the track.

Even the old patterns offer something new. Line spacing in the cross-hatch pattern is rigidly maintained for the 4:3 aspect ratio. You can rely on it for linearity, height, and width adjustments. The pattern gives you finely etched line width at normal brightness levels. What good is perfect convergence at reduced brightness if you lose it when the set's readjusted for normal viewing? This special crosshatch also eliminates receiver fine-tuning error. Among the 860's nine (most generators have only 5 or 6) are: multiple-dot, single vertical line, single horizontal line, vertical lines only, and horizontal lines only.

Finally, the Color Commander's unique color bar pattern (just three bars—R-Y, B-Y and R-Y) simplify color adjustments. You can get a rapid, overall check of color circuits. Then adjust color demodulator phase or pre-set the hue control and check its operating range. In each step, you know precisely how the color bars should look and how they should change during adjustment.

A new timing circuit eliminates instability and loss-of-synch problems. Silicon transistors maintain built-in precision and stability indefinitely. RF output is on channel 3 or 4, switch selected. An attenuator simulates weak-signal conditions. It has gun killer circuit. With 9 penlight cells, the Color Commander weighs 3½ lbs. $149.95.

AMPHENOL CRT COMMANDER, MODEL 855. Solid-state. Checks all black-and-white or color CRT's with the same techniques used by tube manufacturers. Rejuvenates where others fail. Versatile 5-socket cable accommodates 7 different sockets. With CRT chart, $89.95.

See the new Color Commander test instruments at your Amphenol distributor.

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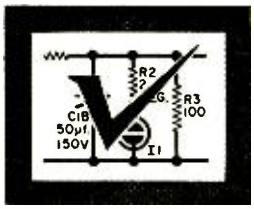
CIRCLE NO. 2 ON READER SERVICE PAGE

Operation Assist



THROUGH THIS COLUMN we try to make it possible for readers needing information on outdated, obscure, and unusual radio-electronics gear to get help from *other* P.E. readers. Here's how it works: Check the list below. If you can help anyone with a schematic or other information, *write him directly*—he'll appreciate it. If *you* need help, send a postcard direct to OPERATION ASSIST, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016. Give maker's name, model number, year of manufacture, bands covered, tubes used, etc. State specifically what you want, i.e., schematic, source for parts, etc. Be sure to print or type everything legibly, including your name and address. Because we get so many inquiries, none can be acknowledged, and POPULAR ELECTRONICS reserves the right to publish only those items that are not available from normal sources.

Schematic Diagrams

Detrola Model 3041 117-volt, a.c.-d.c. receiver. Has 6A1, 6K7, 6R7, 25L6 and 25Z5. (Peter Phegn, 56 Mulford Garden, Yonkers, N. Y.)

Delta Model 10A vacuum-tube voltmeter. (William Weingart, 1806 Metzerott Rd., Adelphi, Md. 20783)

Calex Mfg. Model 603 "U-Test-Em" tube tester. (Stan Jamrose, Hammond, Ind.)

Nora Radio Model 42178 German receiver, type K62, circa WWII. Tunes s.w. band. Has 5 tubes: DCH11, DF11, DAF11, DL11 and UYN. (A. T. Rosselli, Route 1, Garner, N. C.)

Fisher "M-Scope" metal detector, type M.A. (R. E. Drew, 735 S. Third, El Cajon, Calif. 92147)

Admiral 17T1 TV set, circa 1946. Has 7" electrostatic tube. (W. Q. Cochran, Township Line Rd., Chalfont MR. #2, Pa. 18914)

E. H. Scott Model X-72 receiver, custom-built. (Russ Panneton, 13107 Andrew Dr., Silver Spring, Md.)

Transistorized relative humidity indicator. Schematic needed to build unit. (S. H. Hoffman, Box 354, Brooklyn 11, N.Y.)

Heath Model O-9 oscilloscope. (Larry Forster, 420 Herndon Dr., Evansville, Ind.)

Supreme Model 546 oscilloscope, circa 1941. (Gene Snider, 845 N. Albany Rd., Albany, Oreg.)

Meisnner de luxe signal shifter, circa 1940. Has 5 tubes. (J. C. Plute, 531 19 St., San Diego, Calif. 92102)

National Intercommunications Model 610 PBXC "Convers-o-Call" intercom, circa 1948. (Walter L. Johnson, 125 E. Court St., Cincinnati, Ohio 45202)

Bendix Model MN-26C compass receiver. Tunes 150 to 1500 kc. **Bendix** Model MN-28C remote control box. (William Via, 1870 Marshall Rd., Baltimore, Md. 21222)

Atwater Kent Model 35 receiver. (Ronnie Bryant, Box 221, Windsor, Calif.)

Supreme Model 574 vacuum-tube voltmeter. (R. W. Billups, 50 W. 129 St., New York, N.Y. 10027)

AMECO Model AC-1 transmitter. (Eddie L. Williams, 1912 W. Graham Rd., Gastonia, N.C. 28054)

Link Model 1288 test meter, type 1288, for 5-FRX transceiver. (Dan Turkisher, 6 Pin Oak Lane, White Plains, N.Y. 10606)

Precision Radiation Model 107C Geiger counter. (Dennis Wilkison, Box 721, Cloverdale, Calif. 95425)

Panoramic Model RDP/SA-6 adapter. (Robert E. Quenstedt, 1001 Plantation Parkway, Fairfax, Va.)

Triumph Model "841" 3-inch oscilloscope. (Guy Russo, Jr., 6410 Eads St., New Orleans, La. 70122)

Radio City Products Model 322 "Dynoptimum" tube tester. (C. Navarro, 128 West Ave. 28, Los Angeles, Calif. 90031)

Hickok Model OS-12 a.f.-r.f. oscillator. (A. H. Lohner, 919 Ross Ave., Pittsburgh 21, Pa.)

Transvision TV component tester, circa 1954; has octal socket on front panel. (A. Aulbur, Martinsburg, Mo.)

Precision Model E-400 sweep generator. (Steve Topley, 145 Quanny St., Mt. Pleasant, Pa.)

Atwater Kent Model 317 receiver, ser. 31021F1297. Tunes BC and s.w. bands. (Stanley Potopa, 2410 18 St., Altoona, Pa. 16601)

Special Data or Parts

National Model HRO-M receiver. Coil units A, B, C, and D (with bandspread) needed. (James Wyma, 4230 N. 31 Ave., Phoenix, Ariz. 85017)

Atwater Kent Model 20 receiver, ser. 350305. Schematic and/or parts needed. (Clyde Gerber, Route 1, Watertown, Wis. 53094)

Philco Model 36-71 receiver, circa 1937; tunes BC and s.w. bands. Schematic diagram, tuner section coils, switch, etc., needed. (Joseph R. Kenski, 407 W. Rowland, Madison Hts., Mich. 48071)

Zenith Model 7G605 receiver; tunes BC and s.w. bands. Schematic, and 1LN5 and 1LD5 tubes wanted. (Stephen Stone, 19 Blue Bonnet Knoll, New Milford, Conn. 06776)

RCA Model 810K receiver, circa 1938; tunes .54 to 18 mc. on 3 bands; has 10 tubes. Dial face or tracing with frequency markings needed. (Barry Zimmerman, 1215 Bridge St., New Cumberland, Pa. 17070)

RCA Model AR-782 "Radiola 41" receiver, circa 1924. Schematic and tubes needed. (John Lansing, Box 927, Ridgecrest, Calif. 93555)

Sparton receiver, ser. G66238; has 3 bands and 6 tubes (6A7, 2 42's, 75, 78 and 80). Schematic, tubes, and power transformer needed. (Robert Andrews, 606 S. Sandusky, Catlin, Ill.)

Stromberg Carlson Model PR 500 turntable. Rubber drive belt wanted. (Kurt W. Reiss, 229 Hughes Rd., King of Prussia, Pa.)

"Pacotronics" Model SA-50 kit. Mode selector switch #P14-253A needed. (Ralph M. Carpenter, 99 Orange St., Stamford, Conn. 06902)

Stromberg Carlson receiver, circa 1947; tunes BC, FM and 2 s.w. bands. Power transformer with 50-volt tap needed to operate band-changing motors. (Q. V. Hullinger, 1274 S. LaSalle Dr., Abilene, Tex. 59605)

Heath Model V6 vacuum-tube voltmeter kit. Construction manual and chassis needed. (Joseph Koss, 1130 Duss Ave., Ambridge, Pa. 15003)

McMurdo Silver "Silver Vomax" Model 900 receiver. **Echophone** Model EC-2 receiver; tunes .55 mc. to 31 mc. on 3 bands; has 7 tubes. Schematics, alignment data, and operating manuals needed. (Lyle W. McWilliams, Workman Ave., Box 717, Route 2, Eureka, Mo. 63025)

RCA Model 86K receiver, circa 1933; tunes BC and 2.1 to 22 mc.; doubles as phonograph amp.; has 5 tubes. Speaker hookup data and schematic wanted. (Douglas M. Blair, Wilbur Rd., Lincoln, R.I. 02865)

FADA "Neutrodyne" receiver, ser. 55831, circa 1918. Tubes, source for parts, operating manual, and schematic needed. (Edward Carlson, 811 S. Green Brier, Arlington, Va.)

Crosley Model 881 receiver, ser. A863382, circa 1935. Battery hookup info and schematic needed. (Robert L. Crawshaw, 1715 N.E. Parkway, Wichita, Kan. 67208)

Minshall Model S organ. Servicing manual and schematic needed. (Charles Fricker, 100 Laurel Lane, McGregor, Tex. 76657)

Earl Webber Model 200 "Imperial" tube tester. Tube chart needed. (Walter O. Niemeyer, Box 21, Clarksville, Iowa)

Triplett Model 2413 or 3212 tube tester. Tube chart needed. (Theodore F. McFadden, Box 48, Montezuma, Kan. 67867)

—30—

No Stick on a Swivel

(*Continued from page 39*)

cent design, the EMI Castagna, literally floats the arm on a frictionless air cushion. It is held in mid-air by a magnetic field strong enough to suspend the arm's entire weight.

Low friction in the vertical direction helps the arm ride more easily over warped records. Too much resistance to this roller-coaster motion would mess up the vertical response in stereo. Modern low-mass design even reduces the inertia of the arm by making it as light as possible, enabling it to follow the warp of the record without bending the stylus as it goes over the hump.

The "Feel" of the Arm. Many of the quality factors given here have not been standardized. Often they are not even stated in the specs. But you can usually get a fair idea of tone arm performance from the "feel" of the arm as you move it about—just as a driver can judge a car from the way it handles. The arm should move smoothly, evenly, and with a minimum of push.

The final payoff of a high-quality arm is not merely better sound. A quality arm also makes your records and your stylus last longer. Combined with a high-compliance cartridge, a good arm puts so little load on the record surface that there is practically no wear—provided that you keep your records dust-free. So if you value your record collection, a light-tracking, low-friction arm is about the best protection you can buy—it's no longer a "stick on a swivel." —30—

Steam Powered Ham Rig

(*Continued from page 57*)

(*L1*), you can operate on 40 or 80 meters. Keying is accomplished simply by interrupting the series-fed power supply. A 4½" x 6½" perforated board holds all of the transmitter components.

Before starting the engine for the first time, spin the flywheel by hand in the

same direction that it will turn when steam-driven and check the polarity of the voltage across *C4* with a d.c. voltmeter. If the polarity is not correct, reverse the two leads from the generator.

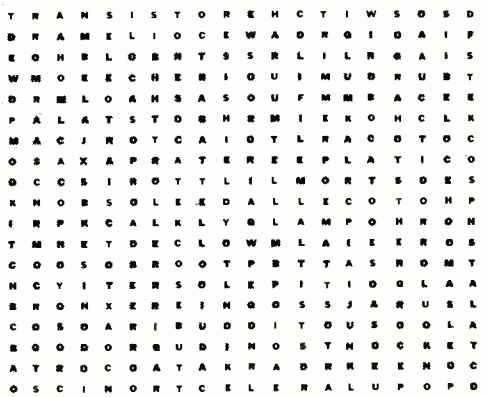
Almost any long wire connected to the rig will suffice as an antenna. However, best results can be obtained from a dipole cut to the operating frequency.

Testing and Use. In testing the transmitter, you may find it easier to work with a 3-volt battery than with the generator. Disconnect the key from the generator and *C4*, and connect the battery between the key and ground bus. Depress the key and tune *C1* until you hear the transmitted signal in a nearby receiver.

Next, vary the tap position on *L1* and tune *C1* until you radiate the strongest signal while still allowing the crystal to start reliably each time the key is depressed. You may have to detune *C1* slightly to get the crystal to start. When you are satisfied with the results, remove the battery and reconnect the generator and *C4*.

Now it's time to fire up the engine. After building up a head of steam, set the engine speed so that approximately 3 volts appear across *C4* with the key open. The transmitter input will be between 10 and 15 milliwatts. The engine can be made to deliver up to 5 or 6 volts, but at the expense of more steam and higher fuel costs.

Remember, the Milliwatter works in the ham bands. You *must* possess an amateur license before you put the unit on the air. —30—



Answers to "Find the Components" Puzzle on page 47

OLD-TIMER PROPOSES A CLASS H LICENSE

OBJECTIVES: *Increase the number of hams around the world and take the would-be hams off the CB channels*

THE INTRODUCTION of the Class D Citizens Band service in the 27-mc. band by the Federal Communications Commission set up a chain reaction of events that was totally unexpected. The basic intent of establishing Class D operation was to provide short-distance radio communications for business and pleasure. It was not to provide for ham-like activity where different licensees talk to each other as on the ham bands. But despite regulations expressly prohibiting such communications, ham-style chit-chat has become immensely popular.

The FCC rules now restrict inter-licensee communications to 7 of the 23 CB channels, and thousands of would-be amateur communicators are being discouraged from pursuing their hobby. Their only recourse is to obtain a full-fledged ham license. But the requirement of code and theory exams stops most of these people.

At the moment, less than 400,000 amateurs hold valid licenses throughout the world. They occupy substantial portions of the radio spectrum. Several of the popular amateur bands are very crowded, while others are partially unoccupied.

The experience derived from the Class D service places the FCC in a most favorable position to establish a new type of amateur service for the United States and provide a pattern for other countries to follow. What is needed is a hobby class license (Class H) which would permit many more people to communicate with each other on a worldwide basis. The ideal place to establish the Class H service would be on a segment of the 10-meter ham band.

A Class H band could be divided into three sub-bands:

Sub-band 1 could be set aside for the use of low-power AM equipment identical to the FCC type-approved requirements for Class D service. This would permit conversion of existing Class D equipment. Sub-band 1 could have 10 channels at 10-kc. intervals between 28.005 and 28.095 megacycles.

Sub-band 2 could be assigned to AM transmitters having an input power limitation of 50 watts. FCC type-approval requiring an effective low pass filter in the antenna circuit would be mandatory. This sub-band could have 5 channels spaced 10 kc. apart between 28.105 and 28.145 mc.

Sub-band 3 could be for single-sideband (upper sideband only) suppressed-carrier equipment. Type-approval requirements could be easily drawn up based on the performance characteristics of commercially available equipment. A limit of 200 watts peak envelope power is recommended for this sub-band. A power of 200 watts would permit worldwide communications. Thirty-four channels spaced at 10-kc. intervals between 28.150 and 28.249 mc. are recommended.

Procedures for licensing people for Class H operation could be drawn from those presently required for Class D Citizens Band and other types of licenses required in the use of radiotelephony service. The establishment of the Class H license and the sub-allocation of a portion of the 10-meter band for this service would open the doors of amateur radio to tens of thousands of people. —*Dana A. Griffin, W2AOE*

Ham Radio: Plan Now

(*Continued from page* 51)

help to have a set of code-practice records or tapes, too.

Your first major piece of equipment should be a receiver—you can use it to build up your code speed by listening to practice sessions transmitted by W1AW, the ARRL station, and listening to individual hams. I suggest that you buy the best receiver you can afford. Expect to pay at least $100 for a good used one or about $150 for a new one.

Next, you'll need an antenna. A simple dipole or a random length wire and an inexpensive tuner will do the job.

Your first transmitter can also be something simple. Try building one from parts salvaged from scrapped TV sets (there are many plans in the radio handbooks), or build a simple kit. After you've been on the air as a Novice long enough to build up your code speed to nearly 13 words per minute, you can trade up to a more elaborate transmitter.

Once you've completed these six steps, you'll be well on your way to getting your license. And when you experience the excitement that comes with your first contact, whether it be the fellow down the block or a weather station on a tropical island, you'll be glad you mastered the challenge of the hobby. -30-

Electronic Magic at the Fair

(*Continued from page* 65)

ing. One track of the tape supplies the recitation; the other is used in controlling display mechanisms. The display is tape-controlled like a slide projector, but instead of making a slide change, the tape signal rotates a camshaft which closes a series of switches. The tape recorders used are four-track machines modified to play in both directions. Identical material is recorded on each pair of tracks.

Another sophisticated use of tape is made at the IBM Pavilion where small

mechanical figures act out playlets on computer logic with comment, dialogue, and music. And, as you have probably already guessed, sound and control for these pneumatically-operated puppets are provided by tape decks. One track of the tape carries the audio; one to three other tracks are used to regulate the air compressor and the many intricate valves found in the pneumatic system of each puppet. The tape is automatically rewound at the end of each performance by means of a photocell takeoff.

"Audioanimatronics." This is the jawbreaking name given to Walt Disney's fantastic creations that perform at various pavilions throughout the fair. Disney's designers and technicians have created life-size "living" figures with nerves and muscles of pneumatic and hydraulic tubes.

At the Pepsi-Cola-UNICEF Pavilion, visitors glide through canals serenaded by life-like animated children singing in many languages. Sights unseen for millions of years are recreated in full life-size animation as dinosaurs and cavemen fight for survival at the Ford Pavilion. At General Electric's Progressland, Disney creations capable of over 450 integrated movements act out the story of changes brought about by electrical appliances. But it is at the Illinois Pavilion that the awesome possibilities of Disney's creations are more fully realized. Here the visitor watches as a life-like President Lincoln slowly rises from his chair to deliver a speech. His expressions and movements seem quite human.

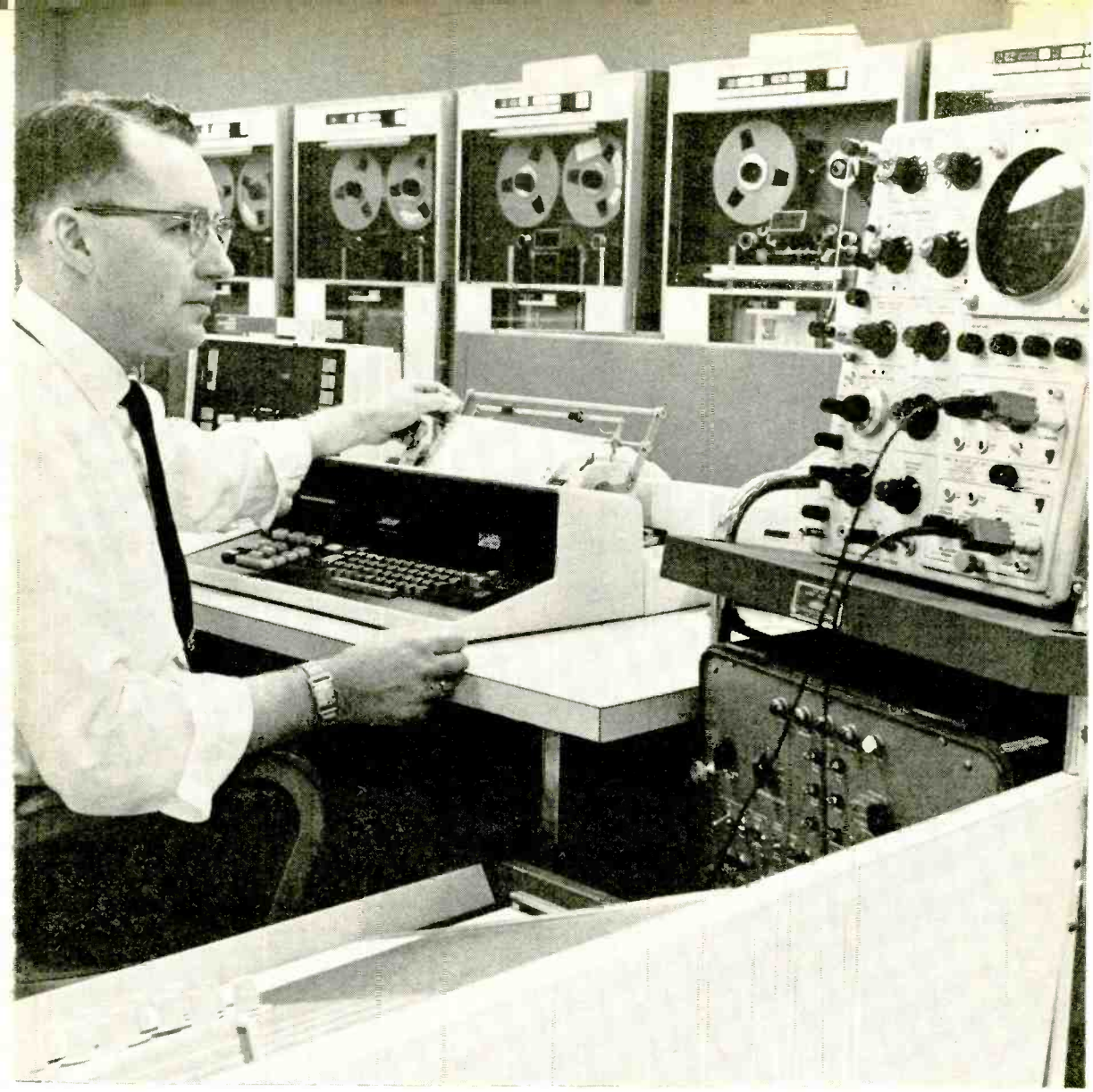
All these Disney creations draw their life from tape machines—instrumentation-type decks worthy of a Cape Kennedy blockhouse. They race 1″ tape along at 30 i.p.s, producing both sound and control signals from 16 separate tracks. Each of these tracks is split into four channels by a system very much like the multiplexing technique of FM stereo broadcasting, producing two audio and two control channels. The frequency range of the audio is limited to 8 kc., leaving plenty of room for the control signals.

The animated children at the Pepsi-Cola-UNICEF Pavilion move in rather simple patterns; thus, they can be handled by simple on-off signals which control the opening and closing of solenoid valves. But for the more complex creations such as those at the General Electric and Illinois Pavilions, the intensity as well as the sequence of motion must be regulated. Here, d.c. voltages are used, since they can minutely control the degree of opening in servo valves, thus regulating the volume of air in the pneumatic circuits.

Emergency Communications. Like the small city that it is, the Flushing Meadow extravaganza has its own police, fire, and medical departments. But unlike those in most American cities, these services are linked together in an ingenious communications network.

Dotting the fairgrounds are public, push-button emergency telephones. The moment you lift off the handset, a series of numbers lights up on an emergency switchboard. These numbers automatically tell a dispatcher the location of your emergency phone, and the nearest fire, medical, or police team. All you do to set the needed team in action is tell the dis-

(*Continued on page* 86)



Why Fred got a better job . . .

I laughed when Fred Williams, my old high school buddy and fellow worker, told me he was taking a Cleveland Institute Home Study course in electronics. But when our boss made him Senior Electronic Technician, it made me stop and think. Sure I'm glad Fred got the break . . . but why him . . . and not me? What's he got that I don't. There was only one answer . . . his Cleveland Institute Diploma and his First Class FCC License!

After congratulating Fred on his promotion, I asked him what gives. "I'm going to turn $15 into $15,000," he said. "My tuition at Cleveland Institute was only $15 a month. But, my new job pays me $15 *a week* more . . . that's $780 more a year! In twenty years . . . even if I don't get another penny increase . . . I will have earned $15,600 more! It's that simple. I have a plan . . . and it works!"

What a return on his investment! Fred should have been elected most likely to succeed . . . he's on the right track. So am I *now*. I sent for my three *free* books a couple of months ago, and I'm well on my way to Fred's level. How about you? Will you be ready like Fred was when opportunity knocks? Take my advice and carefully read the important information on the opposite page. Then check your area of most interest on the postage-free reply card and drop it in the mail *today*. Find out how you can move up in electronics too.

How You Can Succeed In Electronics

. . . Select Your Future From Five Career Programs

The "right" course for your career

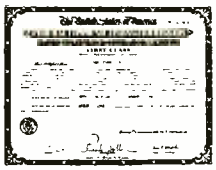
Cleveland Institute offers not one, but five different and up-to-date Electronics Home Study Programs. Look them over. Pick the one that is "right" for you. Then mark your selection on the reply card and send it to us. In a few days you will have complete details . . . without obligation.

1. Electronics Technology

   A comprehensive program covering Automation, Communications, Computers, Industrial Controls, Television, Transistors, and preparation for a 1st Class FCC License.

2. First Class FCC License

   If you want a 1st Class FCC ticket *quickly*, this streamlined program will do the trick and enable you to maintain and service all types of transmitting equipment.



3. Broadcast Engineering

   Here's an excellent studio engineering program which will get you a 1st Class FCC License and teach you all about Program Transmission and Broadcast Transmitters.

4. Electronic Communications

   Mobile Radio, Microwave, and 2nd Class FCC preparation are just a few of the topics covered in this "compact" program . . . Carrier Telephony too, if you so desire.

5. Industrial Electronics & Automation

   This exciting program includes many important subjects such as Computers, Electronic Heating and Welding, Industrial Controls, Servomechanisms, and Solid State Devices.

An FCC License . . . or your money back!

In addition to providing you with comprehensive training in the area indicated, programs 1, 2, 3, and 4 will prepare you for a Commercial FCC License. In fact, we're so certain of their effectiveness, we make this *exclusive* offer:

> The training programs described will prepare you for the FCC License specified. Should you fail to pass the FCC examination after completing the course, we will refund *all* tuition payments. You get an FCC License . . . or your money back!

CIE's "AUTO-PROGRAMMED" method helps you learn faster and better

Cleveland Institute uses the new programmed learning approach. This "Auto-Programmed" method presents facts and concepts in small, easy-to-understand bits . . . reinforces them with clear explanations and examples. Students learn more thoroughly and faster through this modern, simplified method. You too will absorb . . . retain . . . advance *at your own pace.*

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Once enrolled with CIE, you will get a bi-monthly listing of the many high-paying interesting jobs available with top companies throughout the country. Many Cleveland Institute students and graduates hold such jobs with leading companies like these: American Airlines, American Telephone and Telegraph, General Electric, General Telephone and Electronics, IBM, Motorola, North American Aviation, New York Central Railroad, Raytheon, RCA and Westinghouse.

Electronics is a fast moving, dynamic industry . . . Cleveland Institute keeps you current

The Electron Bulletin is CIE's bi-monthly digest of new developments in the world's fastest growing industry. As a CIE student, you will get a free copy throughout your training to keep you up-to-date on Masers, Lasers, Solid State Devices, and other new inventions.

Full accreditation . . . your assurance of competence and integrity

Cleveland Institute of Electronics is accredited by the Accrediting Commission of the National Home Study Council. You can be assured of competent electronics training by a staff of skilled electronics instructors.

Your Future In Electronics Is Up To You. Make It A Brighter One. Mail Reply Card Today.

Cleveland Institute of Electronics

patcher what's wrong. His message is simultaneously carried to every mobile unit and emergency service officer. If needed, the entire emergency force can be marshaled for instant duty.

Officers in charge of special foot details carry walkie-talkies. If a fair official must be reached away from his desk, the dispatcher merely throws a switch to activate a tiny paging receiver carried in the man's pocket.

As part of this emergency service, the fair has an Atomedic Hospital ready for all emergencies. In addition to being constantly watched by closed-circuit television, patients are "plugged" into a computer so that any significant change in heartbeat, respiration, or temperature automatically signals the nurse on duty. Part of the medical equipment on hand is the "Pacemaker," an electronic cardiac stimulator and regulator which has already saved several lives. —30—

Swiss Quad Antenna

(*Continued from page* 53)

in and out to obtain the lowest possible SWR. Move the U's no more than a quarter inch at a time, and keep the ratio between the "director" and "reflector" dimensions constant.

After the SWR is reduced to a minimum by adjusting the U's, vary the length of the *gamma* for a possible further reduction in SWR. It should be a simple matter to reduce the SWR to well below 1.2:1. These adjustments can be made in any reasonably clear space, as long as there is a separation of five feet or more between the antenna and the nearest large object. Be sure to solder all joints and connections.

Results. The front-to-back ratio of the Swiss Quad is about 25 db; its front-to-side ratio is over 35 db. In operation, a moderately strong signal from the front of the antenna will disappear off the back and sides. Indicated gain is a minimum of a solid 6 db over a reference dipole antenna. For its size and cost, the "Swiss Quad" is an excellent performer. By the way, it radiates a horizontally polarized signal. —30—

SHORT-WAVE MONITOR CERTIFICATE APPLICATION

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

All certificates are filled in and lettered before mailing; they are mailed flat and unfolded. If you want to register and receive your WPE identification sign, fill in the application blank below. Mail with 50 cents in coin (or stamps) to: MONITOR, P.O. Box 333, Cherry Hill, N.J. 08034. (Personal checks will not be acceptable). Canadians should use their own currency, and other applicants not in the U.S.A. should use 10 International Postal Reply Coupons. Allow 4-6 weeks for processing.

(Please Print)

(Do not fill out)

Name . . . . . .

Street, City and Zone . . . . . .

State and Zip . . . . . .

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

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

Age Occupation . . . . . .

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

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

I use the following antennas . . . . . .

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

Signature Date . . . . . .

Across the Ham Bands

(*Continued from page 72*)

by everyone, the level of approval by thinking amateurs is surprisingly high. The FCC invites comments (in the form of an original and 14 copies) of the proposals in Docket #15928 by July 15. Address: The Secretary, Federal Communications Commission, Washington, D.C. 20554.

Swiss Quad Antenna. In the drawing of the 15-meter Swiss Quad antenna in our April column, the illustrator combined two dimensions which make it seem that the top and bottom Quad X's are in the same vertical plane. Of course, they are horizontal and parallel to each other; and the distance between them should be 156", instead of 100.5". All other dimensions in the diagram are correct.

Incidentally, the Swiss Quad works almost as well with the narrower vertical spacing as with the wider spacing, if the lengths of the horizontal arms are increased to compensate for the difference. (See the article on building a 144-mc. Swiss Quad on page 52 of this issue.)

News and Views

Mike Griffin, WA3AZI, 715 Webb St., Aberdeen, Md., recently switched to 15 meters and worked all over the U.S. and Canada, Africa, South America, and Central America—with a 40-meter dipole only 12 feet high and a Knight-Kit T-60 transmitter. Mike reports that 15 meters suffers not from the depression in the sunspot cycle but from underpopulation. He urges Novices to try 15 meters; after learning its vagaries, he says, they will be pleasantly surprised at the DX they can hear and work. It doesn't take high power and elaborate equipment, either—although both help . . . **Ken Johnston, WN2QMY,** 93 W. Tremont Ave., Bronx, N.Y., is also a 15-meter buff. In about 15 weeks he worked 11 different countries, using an E.F. Johnson "Viking Challenger" transmitter and a Lafayette HE-40 receiver. Ken's antenna farm sports two dipoles, a beam, and a rhombic . . . **M. "Mert" Burns, K1FSY,** 93 Barre St., Montpelier, Vt., spends most of his time giving "first" Vermont contacts and mailing out the QSL cards. Mert operates 80- and 40-meter c.w. and some 40-meter phone with his Heathkit DX-100 transmitter feeding a "trap" doublet antenna. A new beam for 20 meters is in the works.

From K1FSY we learned that **W1EKU,** Chelsea, Vt., has worked Delaware and the midwest on 2 meters and has heard Venezuela via the amateur satellite Oscar III . . . Think you've got trouble? When **Ken Stuber, WN4WWC,** 200 N.W. 40 Court, Pompano Beach, Fla., plugged in his new transmitter, a puff of smoke shot out; since then, he has been tracing down the burned-out parts . . . Maybe Ken should try the latest troubleshooting method of **Frank Erdman, W9MBM.** Frank had been unsuccessfully looking for a mysterious "intermittent" in his Johnson "Valiant" transmitter for three weeks. One evening he stopped into the "Wishing Well" restaurant for a cup of coffee. All else having failed, he flipped a penny into the "Wishing Well" and wished he could find the "bug" in his transmitter. Frank says he went home and immediately found the "bug"—a parasitic oscillation in the driver stage—and quickly eliminated it! . . . **Brent Grover, WN8PAF,** 32200 Gates Mills Blvd., Cleveland, Ohio, dealt himself a Heathkit DX-40 transmitter, a National NC-270 receiver, and a Hy-Gain 14-AVQ vertical antenna when he passed his Novice exam. Thirty-three states, Canada, Guantanamo Bay, Cuba, and Brazil worked in two months is the result.

Brad Geffen, WN8MBG/WA8MBG, 20500 Mansfield, Detroit, Mich., uses his Knight-Kit T-150A transmitter and Hammarlund HQ-100A receiver mostly on 40 and 15 meters, with an occasional excursion to 80 meters. He has 42 states, Canada, and Puerto Rico worked. His antennas include 80- and 40-meter dipoles and a 6-meter beam. Although Brad is fully equipped for 6-meter operation, he never has operated on that band! But now that the code has been mastered and his General ticket is on the way, he may give that band a whirl, too . . . **Rick Abrams, WN1DUV,** Bayne St., Norwalk, Conn., (Tel: 847-8305), would like to hear from other teen-agers in his area with the object of forming a teen-age radio club . . . **Brian Kirchoff, WN6MWD,** 206 Alpine St., San Rafael, Calif., limits his operations to weekends during school periods. But an AMECO AC-1 transmitter running 15 watts into a dipole antenna has put five states in his log. Brian receives on a Lafayette HE-40, and has a new Heathkit DX-20 transmitter running 50 watts. Watch his smoke this summer.

Bob Massey, WN9NBU, 1108 N. Morrison St., Appleton, Wis., sticks to 7180 kc. on the lower frequencies. If 36 states worked mean anything, he sticks pretty good. A Knight-Kit T-150A transmitter feeding a 10-40 meter "trap" antenna, and a Drake 2-B receiver are his intelligence converters. Bob is a member of the Civil Air Patrol and works 148.14 mc. with a war-surplus "522" transmitter/receiver. Oh, yes, the "N" will be gone from his call letters by the time you read this . . . **Mike Brand, WN4UMN,** 1800 Mountain Circle, Tarrant, Ala., says it with results. In his first ten days on the air, his Johnson "Adventurer" transmitter, Hallicrafters SX-28 receiver, and an antenna 15' high made 28 contacts in 15 states.

Would you like to see *your* "News and Views" or station picture on these pages? Send them in. Address all mail to: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Ind. 46401.

73. *Herb, W9EGQ*

"Okay, so it's 4 a.m.! Leave me alone—I think I've made contact across the state line this time."

Transistor Topics

(*Continued from page 70*)

such as antenna length, sensitivity of the receiver with which the unit it used, the value of *R6,* and the operating frequency. However, the range should be adequate for most applications.

Transitips. As a general rule, we confine this section of our column to the discussion of a single topic. However, we do have a file of short tips and, from time to time, will try to pass on a few of them. Here, then, are a pair of "quickies."

Leaky transistors, if not actually shorted, often can be used in oscillator circuits and as self-biased a.c. amplifiers, but generally are not suitable for critical designs and d.c. amplifiers. There are exceptions, however. We've found that leaky units may give excellent results, even in critical circuits, if reverse-biased. The proper technique here is to apply just enough reverse base bias to cancel a portion of the normal leakage current, resulting in a net forward bias.

Push-on connectors for power transistor emitter and base leads can be obtained from discarded 9-pin miniature tube sockets. You simply break up the sockets and remove the individual pin contacts.

That's all for now . . .

—Lou

On the Citizens Band

(*Continued from page 67*)

cided to pump no more! He was miles from familiar ground but decided to put in a request on channel 9. The REACT monitor not only saw to it that KEJ3938 received a fuel pump, but a gentleman to install it as well. That's service!

And in New York City, members of the Lower East Side Emergency Radio Team and other CB'ers undoubtedly helped save a man's life. An alert CB'er noticed a man on the Brooklyn Bridge attempting suicide. Relaying the information to a base station, the mobile CB'er stood by as all communications on the channel ceased for further possible message handling. Within ten minutes after the original call for help, police were on the scene and the suspect was removed from the bridge.

I'll CB'ing you.

—Matt, KB

Short-Wave Report

(*Continued from page 73*)

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 SHORT-WAVE REPORT, P.O. Box 333, Cherry Hill, N.J., 08034, in time to reach your Short-Wave Editor by the fifth of each month; be sure to include your WPE identification, 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.

Afghanistan—*R. Afghanistan,* Kabul, is reportedly broadcasting on 15.225 kc. in German at 1230-1300 and in French at 1300-1330; however, the International Telecommunications Union lists the frequency as 15.125 kc., with operations from 0600 to 0630, with 50 kw. power. Another outlet on 4785 kc. has been noted at 0930-1000 in Urdu, according to a European source.

Angola—*R. Comercial da Angola,* Ciaxa Postal 259, Sa da Bandeira, is a new station but has already moved from 4859 kc. to 4775 kc., where it is noted from 0100 with many commercials and from 0130 with a world news bulletin in Portuguese. *R. Clube de Malanje,* CR6RE, Malanje, 4967 kc., has non-stop music from 1630 and a newscast at 1650 (not daily and the time may vary); s/off is at 1700, s/on at 0100. *R. Clube de Cabinda,* CR6RW, Cabinda, 5032 kc., is another musical station which operates at 0100-1700, all-Portuguese.

Austria—Vienna, now on 11.905 kc. in a beam to South America, is noted at 2000 with multi-language announcements and ID's.

Belgium—Brussels was logged on 11.885 kc. at 1400 in French and Flemish and at 1615 with IS and s/on. The French and Flemish schedule reads: 1715-1800 on 15.335, 17,860 and 21,510 kc.; 2230-2315 on 9515 and 17,860 kc.; 2330-0200 on 9515, 9745 and 17,860 kc.; and 0400-0600 on 6180, 7140 and 9745 kc.

We've received a report on *R. Omega,* located off the Belgian coast, giving a schedule of 1015-1050 and 1615-1645 on 6300 and 11,550 kc. All programs are religious and in Russian. Has anyone else heard this station?

Bolivia—Station CP48 (?), *R. Universo,* Casilla 232, La Paz, was noted on 5014 kc. requesting reports. They feature much music and Spanish ID's from 1900 to s/off, which varies between 2130 and 2210.

British Guiana—*R. Demerara* has been noted on) kc. at 0515-0542 in Eng. with time checks and and U.S. pop music. There is a short news- at 0515. Reports go to Broadcast House, 's Green, High St., Georgetown, British

Honduras—The latest schedule from Belize ations on 3300 and 834 kc. at 0700-1030, nd 1730-2300 (Sundays at 0700-1400 and The medium-wave outlet is often heard y parts of the U.S.

'a has Eng. to E. Africa at 1400-1430 715 kc. The Eng. program to N.A. 1 on 6070 and 9700 kc. The latest also lists news in Eng. to N.A.

'di, Usumbura, 6195 kc., has from 0000 s/on to 0030. Lon- same channel during this ften found to be somewhat

Otherwise known as Elihu Savad, of Brooklyn, N.Y., WPE2MQT had 15 countries verified out of 20 heard when this photo was taken. The receiver in his listening shack is a Hallicrafters S-118; in standby service are older Philco and General Electric units.

Canada—Here is Montreal's newest schedule: to Australasian areas at 0230-0335 on 9625 and 5970 kc.; to Europe (I) at 0600-0714 on 17.820 and 15.320 kc. (and on 5970 kc. to Northern Canada); to Europe, N.A., and Antilles at 0715-0813 on 17.820 and 15.320 kc. (and on 5970 kc. to the U.S.) and at 0816-0844 on 17,820 and 15.320 kc. (and on 11.720 kc. to the Antilles); to Europe (II) at 0845-1330 on 17.820, 15.320, and 11.720 kc. (the transmissions at 1016-1029 and 1131-1159 on 11.720 kc. are to Northern Canada only); to Africa at 1332-1458 on 17.820, 15,320 and 11.720 kc.; to Europe (III) at 1500-1652 on 15,320, 11.720 and 9630 kc.; to Northern Canada (I) at 1658-1746 on 15,320, 11.720, and 9625 kc.; to the Caribbean and Latin American areas at 1758-1946 on 15,190, 11.760 and 9625 kc.; to Northern Canada (II) at 1958-2130 on 15.320, 11.720 and 9625 kc., at 2130-0055 on 11,720 and 9625 kc., at 0055-0130 on 11,720 kc. (also on 9625 kc. to Europe), and at 0130-0205 on 11.720 and 9625 kc.

Ceylon—*R. Ceylon* verifies reports occasionally but only for listeners who tune in regularly and who give program details written down to the last word. Reports may be kept a year or longer before they are answered.

Congo (East)—*R. Diffusion de la Republique Democratique du Congo*, Leopoldville, is on 11.790 kc. at 1617-1730 with international pop music and annts in French. News is given at 1646-1655.

Ecuador—The newest HCJB schedule reads: "Southern Cross Salute" to New Zealand and Australia daily at 0200-0445 on 11.915, 9745, and 6050 kc.; "Morning In The Mountains" to Jamaica, Caribbean, and the Americas on Sundays at 0900-1030, Mondays to 1015, Tuesdays to 0930, and Saturdays at 1000-1100 on 17.890 and 15.115 kc.; "Quito Calling" to Europe, daily except Monday at 1330-1500, and "Caribbean Call" to the Caribbean, Americas, and Europe at 1830, both on 17,890 and 15,115 kc.; and "Ecuadorian Echoes" to North, Central, and South America at 2100-2315 on 15.115, 11.915 and 9745 kc. Station HCJB has recently converted to hydro-electric power, replacing the diesel generators which had cost over $100 per day to operate.

England—The "General Overseas Service" from London has been renamed the "BBC World Service."

SHORT-WAVE ABBREVIATIONS

annmt—Announcement	N.A.—North America
BBC—British Broadcasting Corporation	NBC—National Broadcasting Company
Eng.—English	QSL—Verification
ID—Identification	R.—Radio
IS—Interval signal	s/off—Sign-off
kc.—Kilocycles	s/on—Sign-on
kw.—Kilowatts	xmsn—Transmission

France—Paris was noted on a new frequency of 11.765 kc. at 1330 with Eng. news.

Ghana—Accra's latest schedule includes these Eng. xmsns: on 6070 kc. to W. Africa at 0945-1030, 1200-1245, 1500-1545, and 1630-1715; on 9545 kc. to S. Africa at 1500-1545 and 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 17,910 kc. to E. Africa at 0945-1030 and at the same time on 21,545 kc. to S., S.W., and S.E. Africa.

Greece—Athens is said to have a foreign service in which French is given at 1230-1245 and Eng. to 1300 on 11,720 and 15.345 kc., but monitoring has found Greek-only at this time.

Greenland—*Grønlands Radio* has been testing on 5960 and 5980 kc. with 1 kw., relaying the Home Service. Reports are welcomed. No schedule was given but the Home Service is aired weekdays at 0530-0720, 1000-1105, and 1530-2105, and on Sundays at 0630-0730 and 1000-2105.

Honduras—Contrary to some reports, HRST, *R. 1° de Mayo*, Tela, 4790 kc., continues to close at 2200. They feature Latin American pop tunes and ads in Spanish. Do not confuse this station with the Ecuadorian on 4789 kc. which signs off later.

Iran—*R. Teheran* has been testing on 7340 kc. with a time signal only from 1430 to 1500, when a 10-minute broadcast in Eng. was given. After 1510, the time signal resumed until 1530, when they went into Persian.

Israel—*Kol Zion*, Tel Aviv, is now using 9725 kc. to Europe and England in addition to 9625 and 9009 kc. for its daily 1515 Eng. xmsn.

Korea (North)—Pyongyang has Eng. to Latin America at 1900-2000 on 14.520 kc. (strong on the West Coast; good at times in the East—Ed.). Other Eng. xmsns are aired at: 1300-1400 to the Near and Middle East on 10.380 kc.; 1400-1500 to Africa on 7580, 7379 and 6540 kc.; 2200-2300 to Latin America on 9750 kc.; and 0500-0600 to S.E. Asia on 7580 kc. and 0600-0700 on 9750 kc.

Korea (South)—*Voice of Free Korea*, Seoul, is testing in Eng. at 0930 on 9640 kc., at 1800 and 1830 on 11.925 kc., and at 1900 on 15.125 kc. These broadcasts are being made preparatory to a regular service for the Korean military contingent in Viet Nam. Reports are welcomed.

Lebanon—Beirut has been heard with Eng. at 2130, Arabic at 2200, and Spanish at 2230 on 9750 kc. and at 2100-2130 on 9660 kc. to Europe and N.A.; and in Arabic and Portuguese at 1800 on 11,935 kc. to South America.

Malagasy Republic—The International Service of *Radiodiffusion Nationale Malgache* is broadcast in French and Eng. at 1100-1200 on 15,270 kc. On Saturdays they present the "QSL Service" at 1130-1145 and the "Friendship Club" at 1145-1200.

Malaysia—*R. Malaysia*, Kuala Lumpur, 11.900 kc., has Indonesian news and music to 1900, when there is a chime IS similar to that of the NBC. This is followed by Eng. news, and a commentary at 1911. From 1929 they broadcast in Chinese.

Mozambique—Lourenco Marques has again moved, this time to 15,285 kc., where it is heard at 1130 and later.

Netherlands—As was previously reported, in the recent popularity poll conducted by the International Short Wave Club of London, the winning station was *R. Nederland*. The writer of the "best letter of commendation" was one of our own monitors, John Beaver, Sr., WPEØAE, of Pueblo, Colo. He received a bound de luxe edition of an illustrated work on Holland. Congratulations, John!

The current schedule for the "Happy Station Program," in effect until Sept. 5, reads: 0100-0220 to New Zealand and 0230-0350 to Australia and Japan, both on 9715 and 6025 kc.; 0530-0650 to Europe on 9715 and 5980 kc.; 0900-1020 to S. Asia

DX Country Awards Presented

To be eligible for one of the DX Country Awards designed for WPE Monitor Certificate holders, you must have verified stations in 25, 50, 75, 100, or 150 different countries. The following DX'ers recently received their awards.

One Hundred Countries Verified

Gerry Klinck (WPE2FAH), Buffalo, N. Y.
Edward Fellows (WPE7BLN), Seattle, Wash.

Seventy-Five Countries Verified

Edward J. Tompkins (VE3PE1ZJ), Toronto, Ont., Canada

Fifty Countries Verified

David Thompson (WPE6FHP), Suisun, Calif.
G. A. Benadom (JA6PE1E), FPO, San Francisco, Calif.
Trever Clegg (WPE6FAF), Fresno, Calif.
Jeff Tallent (WPE4HUZ), Louisville, Ky.

Twenty-Five Countries Verified

Glenn W. Hagen (WPE4HQK), Huntsville, Ala.
Roberto F. Nin (WPE5DVO), Bayamon, Puerto Rico
John Hasse (WPEØEDO), Vermillion, S. D.
Arthur B. Epstein (WPE2MPW), New York, N. Y.
Reg. Firth (WPE2FGO), Amsterdam, N. Y.
Tony Tittle (WPE2MOA), Alen Rock, N. J.
David J. Decker (WPE2LGL), Philmont, N. Y.
Jack Thurman (WPE6FXO), Salinas, Calif.
Robert Knarr (VE3PE2AN), Elmira, Ont., Canada
Steve Kunkel (WPE3GIM), Randallstown, Md.
Frank Lucia (WPE2JHI), Union City, N. J.
J. A. Brebner (VE3PE2EL), Kingston, Ont., Canada
Darrell R. Long (VE6PE5X), Calgary, Alberta, Canada
David Doernberg (WPE4EGB), Atlanta, Ga.
LeRoy Merle Potter (WPE2FYB), Syracuse, N. Y.
Greg Wilt (WPE3GCW), Hollidaysburg, Pa.
Lloyd H. Daniel, Jr. (WPE4IGD), Hampton, Va.
Bill Jarvis (WPE1GEP), Lebanon, N. H.
Jack F. Palladay, Jr. (WPE9EOE/4), Maxwell AFB, Ala.
Alan Burnley (WPE2MRJ), Westfield, N. J.
Roger Greene (WPE2NFC), Bronx, N. Y.
Mike Poore (WPE3GHH), Washington, D. C.
Wm. Favorite (WPE1FEQ), Wilbraham, Mass.
Alan Petersen (WPEØEHF), Hampton, Iowa
Jack Page, Jr. (WPE5DXH), Pontotoc, Miss.
John Hubbell (VE3PE2EU), Port Credit, Ont., Canada
Michael St. Amand (VE3PE1KK), Levack, Ont., Canada
Roger Giannini (WPE5EFR), Waco, Texas
Carl Swanson (WPE6DTJ), Fremont, Calif.
Mike Tilbrook (WPE3FTZ), Pittsburgh, Pa.
Brian Hickey (WPE3GGT), Wayne, Pa.
Henry Henderson (WPE4IAV), Halifax, Va.
C. H. Andrews, Jr. (WPE4IIK), Rocky Mt., N. C.
Howard Moss (WPE2LUY), Jamaica, N. Y.
Gale Shader (WPE7CGB), Deming, Wash.
Peter Grenier (WPE1FWI), Fall River, Mass.

DX STATES AWARD RULES

Are you eligible to apply for a 20, 30, 40, or 50 States Verified Award? Here is a brief resume of the rules and regulations.

(1) You must be a registered WPE Short-Wave Monitor and show your call on your application. An application form appeared on page 67 of the February issue.

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

(3) A fee of 50 cents (U.S. coin) must accompany the application to cover the costs of printing, handling, and mailing. This fee will be returned in the event an applicant is found to be ineligible. Applicants in countries other than the U.S. may send the equivalent of 60 cents (U.S.) in coins of their own country if they wish. Please do NOT send International Reply Coupons (IRC's) or a personal check when applying for an award.

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

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

on 15.425 and 9625 kc.: 1030-1150 to Africa and Europe on 15.425 and 11.950 kc.; 1400-1520 to N.A. on 11,950 and 11,730 kc.; 1530-1650 to Spain. N. Africa and S. America on 11.950 and 9715 kc.; 1700-1820 to South and Central America on 11,800 and 9715 kc.; and 1830-1920 and 1940-2030 to North, Central, and South America on Bonaire—800 kc. The xmsns at 0530, 0900, 1530 and 1700 are also aired on 6020 kc. to Europe.

Netherlands Antilles—Station PJD2 is operating on 1295 kc. with 1 kw. (soon to be raised to 5 kw.) from Philipsburg, Sint Maarten. They s/on at 0532 and were heard at 1900-2000 in southern states. The station is operated by the New Testament Baptist Church.

New Guinea—Two 250-watt stations that N.A. DX'ers most likely will *not* be able to hear are VL9CG, *R. Gogorica*, 2410 kc., and VL8BD, *R. Daru*, 3304 kc. Their low power, coupled with the low frequency, would classify them as extremely rare DX. But you might keep an ear on the two channels around 0300-0400—just in case.

South Africa—The Africa Service from Paradys is on the air at 2200-2300 daily on 6150 and 7270 kc.; at 0500-1040 (Sundays from 0600) on 15,220 and 17,805 kc.; at 1040-1210 (Sundays to 1150) on 11,900 and 15,200 kc.; at 1210-1415 (Sundays from 1150) on 9525 and 11,900 kc.; and at 1415-1615 on 7270 and 9525 kc. A new 250-kw. station is expected to take to the air in October and will be used for the External Services of *R. South Africa*.

Sweden—*R. Sweden*'s xmsns to N.A. are now scheduled at 0900 on 15.195 kc., and at 2045 and 2215 on 9705 kc.

Switzerland—Berne has been noted from 1900 s/on in Portuguese to Brazil on 11.810 kc.—a previously listed inactive channel. The 9595-kc. outlet has been tuned at 1430 in an African beam.

Venezuela—Station YVCN, *Escuelas Radiofonicas*, San Fernando de Apure, 2430 kc., now closes at 2000 because Venezuela is on summer time. This channel is noted around 1800 with cultural programming and classical music and is dual to 6110 kc.; the latter channel is not often heard, however, because the BBC is on at the same time.

Yemen—Midwestern reports indicate that Sanaa is being heard around 2230-2300 on 5805 kc. with a day-to-day signal that ranges from very good to quite poor. Programming is Arabic music with very little talking.

Point-to-Point Stations—The majority of DX'ers report poor success in trying to verify the point-to-point stations. However, a letter has been received from RCA Communications, Inc. in reply to a report sent to one of its stations in Guam. The letter states, in part, that they will furnish QSL's provided that the approximate frequency, the time of reception, and the date are given in reports. The letter further states that there are no specific schedules since they operate on a demand type of service, but frequencies were given as 15.690 and 16.030 kc. (for Kahuku, Hawaii), 19.980 kc. (Manila), and 10.410 and 18.695 kc. (Guam). Reports should be sent to 66 Broad St., New York, N. Y., attention of C. N. Macpherson, Plant Operations, Engineering. —30—

SHORT-WAVE CONTRIBUTORS

David Smith *(WPE1GBC)*, Everett, Mass.
Mac Stewart *(WPE2JKV)*, Mooers, N. Y.
William Graham *(WPE2LMU)*, Binghamton, N. Y.
Frank Mather *(WPE2LWW)*, Buffalo, N. Y.
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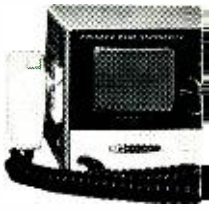

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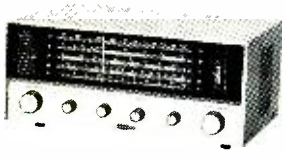

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