More on Transistor Ignition

POPULAR ELECTRONICS

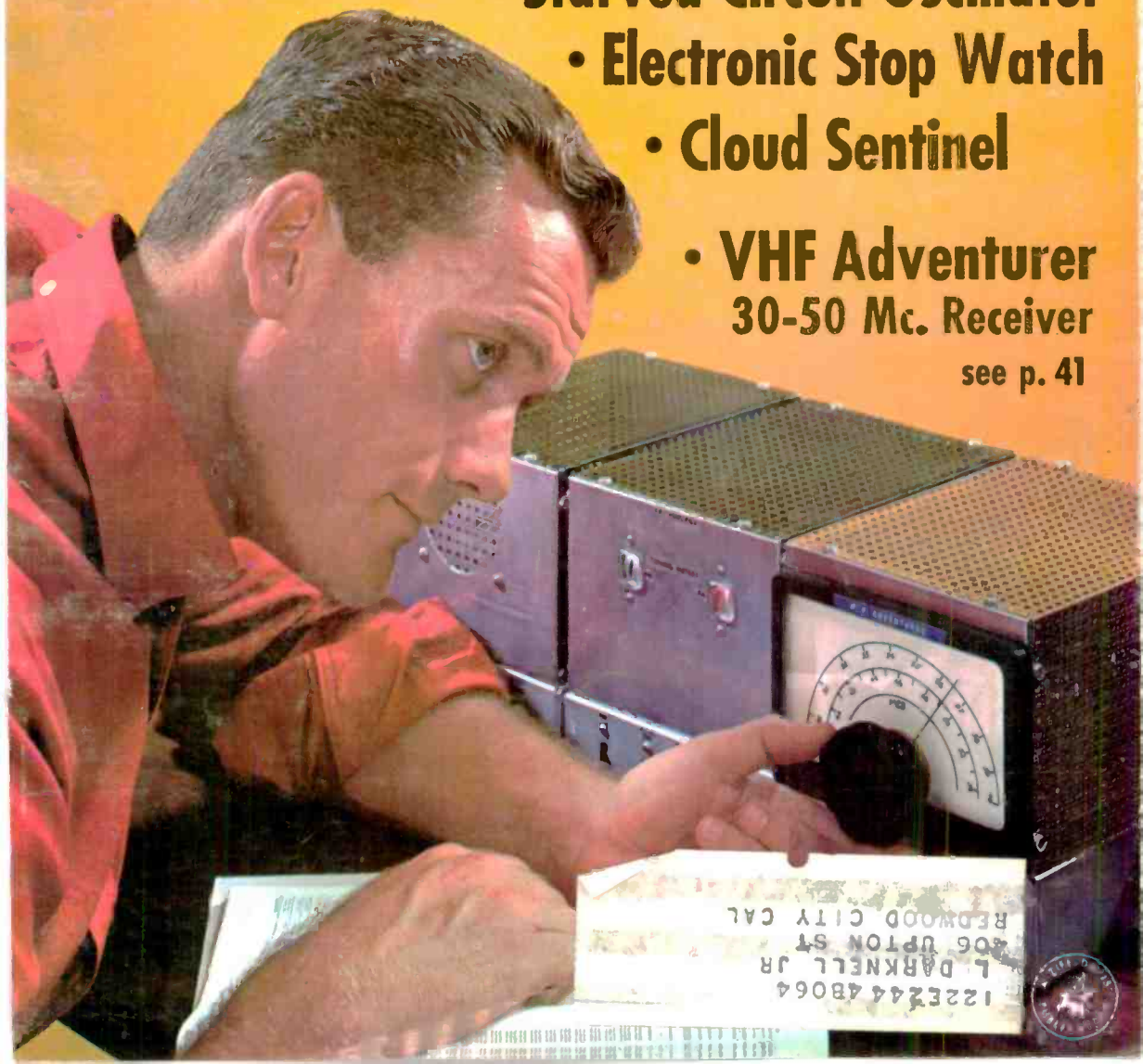
OCTOBER 1963

35 CENTS

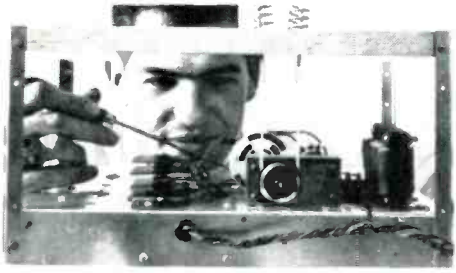
It's Project Building Time

- Starved Circuit Oscillator
- Electronic Stop Watch
- Cloud Sentinel
- VHF Adventurer
  30-50 Mc. Receiver

see p. 41



IRI has been the ome for Radio-TV



NRI Equipment Makes Training Faster, Easier, More Interesting

Thanks to NRI's pioneering home-study techniques, even men who didn't complete high school may successfully launch new careers. Of major importance are the special training Kits NRI furnishes *at no extra cost.* Use equipment you build to work experiments, learn-by-doing. NRI equipment is designed to bring to life the things you read in illustrated, easy-to-read texts. And all equipment is yours to keep.

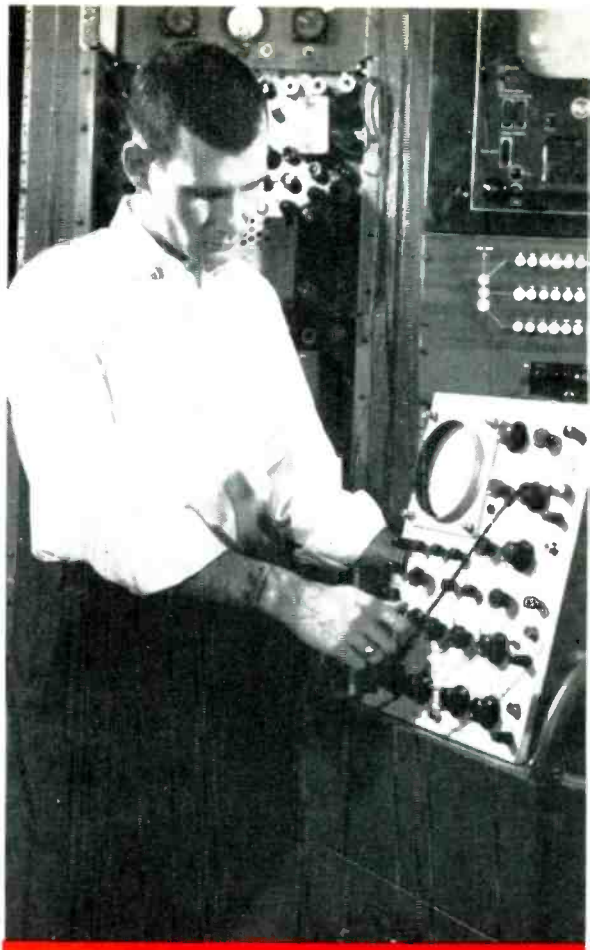
These Men Trained for Success With NRI—YOU Can, too

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

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

"I can recommend the NRI course to anyone who has a desire to get ahead," says Gerald L. Roberts, of Champaign, Ill., whose Communications training helped him become an Electronic Technician at the Coordinated Science Laboratory, U. of Illinois, working on Naval research projects.

Even before finishing his NRI training, Thomas F. Favaloro, Sherburne, N.Y., obtained a position with Technical Appliance Corp. Now he is foreman in charge of government and communications divisions. He writes, "As far as I am concerned, NRI training is responsible for my whole future."



Save time and money
Choose from

NINE SPECIALIZED INSTRUCTION PLANS

offered by NRI—
oldest and largest
school of its kind

HOW THE NRI CANCEL-AT-ANY-TIME AGREEMENT TAKES THE GUESSWORK OUT OF TRAINING

As a reader of this magazine, you realize what a growing and expanding industry Electronics is today. That's why so many ambitious men are enrolled for NRI's specialized instruction plans. If you are asking yourself, "Am I capable of learning Electronics at home?" or "Does NRI have the exact training plan I need?"—NRI now makes it possible for you to get the answers—**without risk.** NRI's special Cancel-At-Any-Time agreement lets you enroll and start your training **without** obligating you to continue. With NRI you sign an agreement—not a **contract.** If for any reason you decide you do not want to continue your training all you do is notify NRI and you are not obligated for payments beyond that time. Mail the postage-free form for complete information about NRI's specialized instruction plans and NRI's exclusive Cancel-At-Any-Time agreement. Do it today. NATIONAL RADIO INSTITUTE, Washington, D. C.

nri

Pick Your Career in the Wonderful Field of Electronics

1. **TELEVISION-RADIO SERVICING**
Learn to service AM-FM Radios, black and white and color TV sets, Stereo Hi-Fi, PA systems, etc. A profitable, interesting field for part-time or full-time business of your own.

2. **INDUSTRIAL-MILITARY ELECTRONICS**
Learn Principles, Practices, Maintenance of Electronic equipment used today in business, industry, defense. Covers Electronic controls and measurement, computers, servos, telemetry, multiplexing, many other subjects.

3. **COMPLETE COMMUNICATIONS**
A comprehensive training program for men seeking careers operating and maintaining transmitting equipment in Radio-TV Broadcasting or mobile, marine, aviation communications. Prepares you for your First Class FCC License.

4. **FCC LICENSE**
Prepares you quickly for First Class License exams. Every communications station must have one or more FCC-licensed operators. Also valuable for Service Technicians.

5. **BASIC ELECTRONICS**
An abbreviated, 26-lesson course covering Automation-Electronics, Radio-Television language, components and principles. Ideal for salesmen, hobbyists and others who find it valuable to be familiar with the fundamentals of this fast-growing industry.

6. **MATH FOR ELECTRONICS**
A short course package of carefully prepared texts that take you from basic arithmetic review through graphs and electronic formulas. Quick, complete and low in cost.

7. **AVIATION COMMUNICATIONS**
For men who want careers working with and around planes. Covers direction finders, ranges, markers, loran, shoran, radar, landing systems, transmitters. Prepares you for FCC License.

8. **MARINE COMMUNICATIONS**
Shipboard transmitting equipment, direction finders, depth indicators, radar are all covered in this course. You prepare for your First Class Radiotelephone License with Radar Endorsement.

9. **MOBILE COMMUNICATIONS**
Training in installation and maintenance of mobile equipment and associated base stations like those used by fire and police, taxi companies, etc. Prepares you for First Class FCC License.

NATIONAL RADIO INSTITUTE
Oldest and Largest Radio-TV Electronics Home Study School
Washington, D.C.

POPULAR ELECTRONICS

VOLUME 19 OCTOBER 1963 NUMBER 4

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

Cover photo by Bruce Pendleton

Special Construction Features

Construction Projects

Audio and High Fidelity

Amateur, CB, and SWL

Electronic Features and New Developments

Departments

POPULAR ELECTRONICS

World's Largest-Selling Electronics Magazine

Publisher **PHILLIP T. HEFFERNAN**
Editor **OLIVER P. FERRELL**
Feature Editor **W. STEVE BACON, W2CJR**
Technical Editor **L. JEROME STANTON, W2WHM**
Art Editor **JAMES A. ROTH**
Associate Editor **MARGARET MAGNA**
Technical Illustrator **ANDRE DUZANT**

Amateur Radio Editor **H. S. BRIER, W9EGQ**
CB Editor **M. P. SPINELLO, 18W4689**
Semiconductor Editor **L. E. GARNER, JR.**
Short-Wave Editor **H. BENNETT, W2PNA**
Contributing Editor **J. T. FRYE, W9EGV**
Radio Propagation Editor **STANLEY LEINWOLL**
Editorial Consultant **OLIVER READ, W4TWV**

Advertising Manager **WILLIAM G. McROY, 2W4144**
Advertising Service Manager **ARDYS C. MORAN**

ZIFF-DAVIS PUBLISHING COMPANY
Editorial and Executive Offices (ORegon 9-7200)
One Park Avenue, New York 16, New York

William B. Ziff, Chairman of the Board (1946-1953)
William Ziff, President
W. Bradford Briggs, Executive Vice President
Hershel B. Sarbin, Vice President and General Manager
M. T. Birmingham, Jr., Vice President and Treasurer
Robert P. Breeding, Circulation Director
Charles Housman, Financial Vice President
Stanley R. Greenfield, Vice President
Phillip T. Heffernan, Vice President

Midwestern and Circulation Office (WAbash 2-4911)
434 South Wabash Avenue, Chicago 5, Illinois
Midwestern Advertising Manager JAMES WEAKLEY

Western Office (CRestview 4-0265)
9025 Wilshire Boulevard, Beverly Hills, California
Western Advertising Manager, WILLIAM J. RYAN, 11Q3002

Foreign Advertising Representative
D. A. Goodall Ltd., London, England

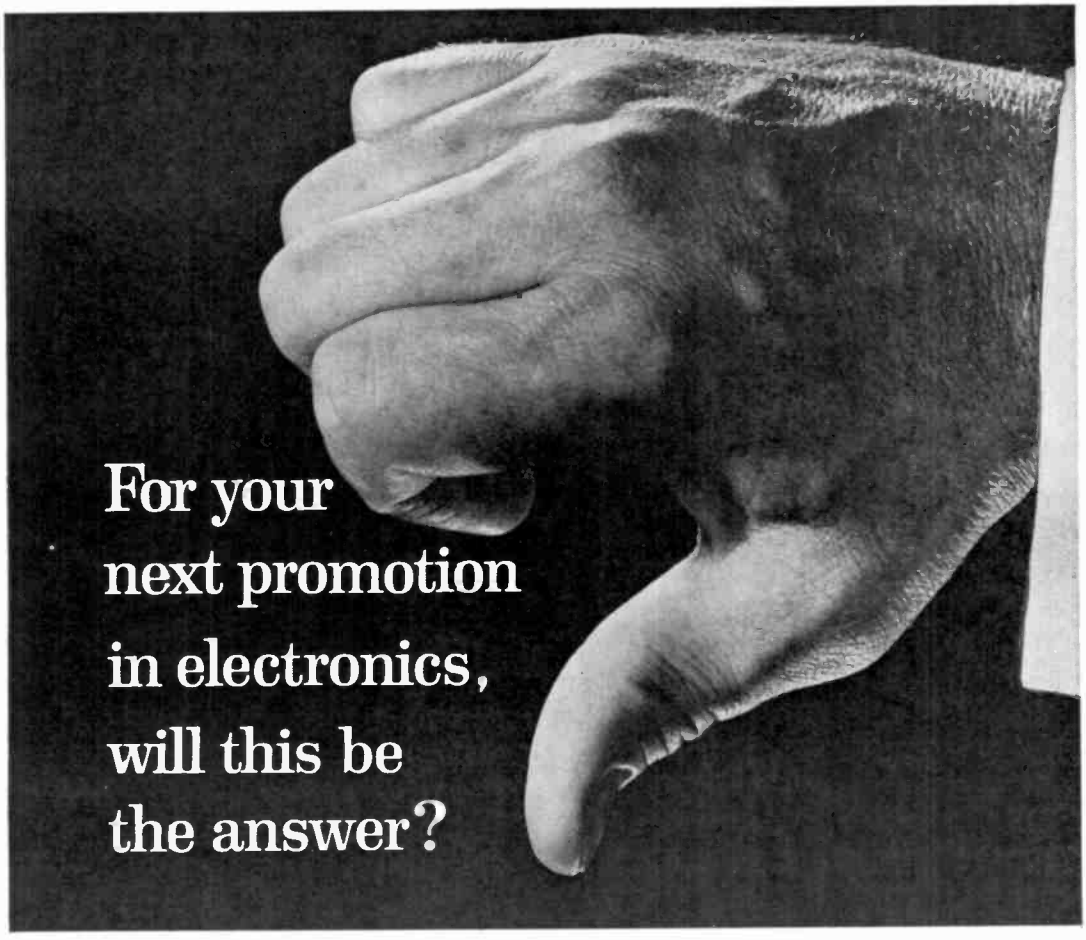
Member
Audit Bureau of
Circulations

POPULAR ELECTRONICS is published monthly by Ziff-Davis Publishing Company at 434 South Wabash Avenue, Chicago 5, Illinois. October, 1963. Volume 19, Number 4. (Ziff-Davis also publishes Popular Photography, Electronics World, HiFi/Stereo Review, Popular Boating, Car and Driver, Flying, Modern Bride, Amazing, and Fantastic.) Subscription Rates: One year United States and possessions, $4.00; Canada and Pan American Union Countries, $4.50; all other foreign countries, $5.00. 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.

PAYMENT MAY ALSO BE REMITTED in the following foreign currencies for a one-year subscription: Australian pounds (2/6/10); Belgian francs (260); Danish kroner (36); English pounds (1/17/6); French francs (26); Dutch guilders (19); Indian rupees (26); Italian lire (3300); Japanese yen (1750); Norwegian kroner (38); Philippine pesos (21); South African rands (3.80); Swedish kronor (28); Swiss francs (23); or West German marks (21).

SUBSCRIPTION SERVICE: All subscription correspondence should be addressed to POPULAR ELECTRONICS, Circulation Department, 434 South Wabash Avenue, Chicago 5, Illinois. Please allow at least six weeks for change of address. Include your old address as well as new—enclosing if possible an address label from a recent issue.

EDITORIAL CONTRIBUTIONS must be accompanied by return postage and will be handled with reasonable care; however, publisher assumes no responsibility for return or safety of art work, photographs or manuscripts.



If you're doing a routine job that anyone who knows a little electronics can handle, you're not worth more money. And you won't be worth more unless you get more training in electronics. Maybe you can't go on to college—but you can learn advanced electronics—even the new field of space technology—and increase your earning power through a CREI Extension Program in Electronic Engineering Technology. You're eligible if you have a high school education and work in electronics. If your knowledge of fundamentals is rusty, CREI includes a refresher course. Our Free book gives all the facts—mail coupon today or write: CREI, Dept. 1210-A, 3224 Sixteenth St., N. W., Washington 10, D. C.

ACCREDITED MEMBER OF THE NATIONAL HOME STUDY COUNCIL

CREI

FOUNDED 1927

SEND FOR FREE BOOK

ELECTRONICS

The Capitol Radio Engineering Institute
Dept. 1210-A, 3224 Sixteenth St., N. W.
Washington 10, D. C.

Please send me FREE book describing CREI Programs in Electronics and Nuclear Engineering Technology. I am employed in electronics and have a high school education.

Name_____ Age_____

Address_____

City_____ Zone_____ State_____

Employed by_____

Type of Present Work_____

Check: ☐ Home Study ☐ Residence School ☐ G. I. Bill

PE13

FCC Report

By ROBERT E. TALL
Washington Correspondent

IF there has been any doubt in the minds of Citizens Band radio users as to whether or not their radio service is in real trouble, it has certainly been dispelled by the latest pronouncement of an FCC official prior to the Commission's August recess. Ivan H. Loucks, chief of the agency's Amateur & Citizens Radio Division, stated that the FCC staff has reviewed and summarized the "more than 3000 comments" elicited by the citizens rule proposals, and declared that the "past behavior" of CB licensees has caused "considerable concern" at the FCC "as to whether the Class D category in the citizens radio service has or can be expected to justify its existence."

So far as a predicted timetable for the rule changes to actually come into being is concerned, Mr. Loucks advised a Virginia CB club that no decision "will be released before September, and it may be much later."

In a statistical review, the FCC Division Chief noted that there are now over 450,000 licensees in the citizens radio service, and "as nearly as we are able to estimate, over 375,000 of these are Class D." He added that new licensees are being added at the rate of over 10,000 per month, and that the citizens service, "in terms of numbers of licenses or licensees, outnumbers all of the rest of the services administered by the Commission, if we leave out the 250,000 amateurs."

Referring to the possibility of the Commission's assigning additional frequencies to the Citizens Band service, Mr. Loucks commented that "there is not a ghost of a possibility of increasing the number of channels," and that the agency may even be at the point of considering whether or not the present "small frequency space" available to CB should be continued if it is taken up by "idle chit-chat, long-winded discussions of equipment, DX contacts, exchanges of names and addresses, the solicitation of QSL cards, etc."

He urged CB'ers not to "jeopardize your legitimate use of citizens radio where you need radio communications in the conduct of your business or personal affairs by encouraging the 'idle chatter' boys who even

LET'S CONSIDER **YOUR** FUTURE IN ELECTRONICS

NOW YOU CAN ENJOY THE ADVANTAGES OF RESIDENT TRAINING IN ELECTRONICS—THE BEST AND FASTEST WAY TO AN INTERESTING AND PROFITABLE CAREER IN THIS FIELD

If you are within commuting distance of any of the areas below you can remain fully employed while training, as R.E.T.S. has developed a specialized training program in BASIC ELECTRONICS—TV SERVICING—INDUSTRIAL ELECTRONICS (AUTOMATION) where you attend practical lab classes only one evening or morning each week in addition to study of theory at home.

COMPLETE FULL OR PART TIME TRAINING IN ALL PHASES OF ELECTRONICS

LOCATION OF **R.E.T.S.** RESIDENT TRAINING LABORATORIES

CALIFORNIA:
433–20th Street, Oakland

FLORIDA:
215 N. E. 15th Street, Miami

ILLINOIS:
Citizen's Building, 225 Main St., Peoria

INDIANA:
5719 Calumet Avenue, Hammond
150 South Senate Street, Indianapolis
734 South Michigan Street, South Bend

MARYLAND:
107 Market Place, Baltimore

MASSACHUSETTS:
1088 Boylston Street, Boston

MICHIGAN:
1625 East Grand Boulevard, Detroit
4900 N. Saginaw Street, Flint
44 Ionia Street, Grand Rapids

NEW JERSEY:
255 Passaic Avenue, Kearny

OHIO:
2044 Florence Avenue, Cincinnati
894 West Broad Street, Columbus
136 N. St. Clair Street, Dayton
622 Summit Street, Toledo

PENNSYLVANIA:
214 South 69th St., Upper Darby (Philadelphia)

CANADA:
8607 St. Laurent Boulevard, Montreal, Quebec
807 Bathurst Street, Toronto, Ontario

For complete information and our booklet "NEW FUTURES IN ELECTRONICS" write—visit—or phone the R.E.T.S. laboratory nearest you or mail coupon below to International Headquarters, 1625 East Grand Boulevard, Detroit 11, Michigan.

R.E.T.S. ELECTRONIC SCHOOLS

R.E.T.S ELECTRONIC SCHOOLS
1625 East Grand Boulevard
Detroit 11, Michigan

NAME.....

ADDRESS.....

CITY.....STATE.....

FCC Report

(*Continued from page* 6)

now at times make it impossible for you to use it."

CB Licenses and Fees. Mr. Loucks pointed out that the time required for the Commission to issue a CB license—at the moment, 75 days—will probably not be shortened until the FCC's new automatic data processing equipment takes over the operation. "That is scheduled to happen sometime this fall or early winter," he commented. The machine, he said, "will be able to do in a few hours what now takes us weeks."

He also reminded CB'ers that beginning January 1 the Commission is scheduled to start collecting fees in connection with applications for radio station licenses—$8 each for applications in the Citizens Class B, C or D services. "This means," he said, "if your application for renewal or modification or for a new station license is received on or after January 1, it will be returned without action unless it is accompanied by a check, draft or money order for $8.00."

Mr. Loucks pointed out that the fee applies to the filing of the application, "regardless of whether or not you get the license you apply for. You will not have to pay the fee again if the application is returned to you for completion or for more information," he said, "but the fee will not be returned to you, even though you never reapply."

He also cautioned that "there will probably be a time limit on resubmitting an application which has been returned for some reason, so if you want to save that extra $8, you should be prompt in answering the Commission's questions."

New Application Form. The FCC's new 1963 revised application Form 505—to be used when applying for a Class B, C or D citizens station license—was expected to make its debut about the first of October. The new form is designed for data equipment processing. The Commission said it will not accept CB applications on the older versions of the form (1962) after November 30.

Garage Door Troubles. A Chicago manufacturer of electronic garage door openers and similar devices has petitioned the FCC for rule changes which would permit such equipment to operate on frequencies allocated to other services further removed from the Class D citizens service frequencies. The company contends that CB opera-

PORTRAIT OF AN EARLY AMERICAN ELECTRONICS STUDENT

The illustrious gentleman pictured above is, of course, Benjamin Franklin, who took time out one day from his full-time career as a diplomat to discover electricity! Now, the Electronic Technology Series offered by Grantham School of Electronics does not go quite back to Mr. Franklin's kite and key experiment, but it does start right at the beginning of the modern subject of electronics. And, it builds from this basic beginning, in a logical step-by-step manner up through the complex theory of the missile age.

The following is a brief description of Grantham's 3-step program for electronics advancement:

FCC LICENSE TRAINING

The first class FCC license is a "diploma" in electronics issued by the U. S. Government. To obtain this license, you must pass a comprehensive electronics examination. Section IA of the Grantham Series qualifies you thoroughly and quickly to obtain this license, which is a "door-opener" to industrial electronics employment and a necessity in many phases of communications electronics.

LABORATORY TRAINING

Men who add equipment experience to their knowledge of electronics theory have an added employment advantage in that they require little or no on-the-job training. Section IB of the Grantham Series gives you this experience in four weeks (160 hours) of intensive, supervised laboratory training. Grantham offers free placement assistance to students when they complete Section IB of the Series.

ADVANCED TRAINING

To continue to grow and advance as an electronics man, you will more than likely need further training. Grantham supplies this advanced electronics training in Section II of the Series. Section II is designed to be taken after you are employed in electronics, and provides thorough training in such subjects as Microwave, Radar, Computer Theory, Mathematical Analysis, Pulse Circuitry, etc.

Grantham training is available in the classroom, in the laboratory, or by home study. For full details on this proven electronics program, complete and send us the coupon on the right. We will be glad to send you (without charge or obligation) our free 44-page booklet, "CAREERS IN ELECTRONICS."

GRANTHAM
SCHOOL OF ELECTRONICS

FOUR CONVENIENT LOCATIONS:

1505 N. Western Ave.	408 Marion Street	3123 Gillham Road	821-19th Street, NW
Hollywood 27, Calif.	Seattle 4, Wash.	Kansas City 9, Mo.	Washington 6, D. C.
HO 7-7727	MA 2-7227	JE 1-6320	ST 3-3614

Mail in envelope or paste on postal card

TO: GRANTHAM SCHOOL OF ELECTRONICS
NATIONAL HEADQUARTERS OFFICE
1505 N. WESTERN AVE., HOLLYWOOD, CALIF. 90027

Please send me your FREE 44-page booklet, "CAREERS IN ELECTRONICS."

Name _____ Age _____
(PLEASE PRINT)

Address _____

City _____

State _____

I AM INTERESTED IN: ☐ HOME STUDY ☐ RESIDENT CLASSES 39R

FCC Report

(*Continued from page 8*)

tions are causing great difficulties in the use of its devices.

While the garage door openers use Class C citizens frequencies, the company said, Class D licensees are either "deliberately operating on Class C frequencies" or causing trouble with "off-frequency operation;" "sustained carrier heterodyning;" "severe overmodulation;" or operation with "greater transmitter power than permitted by the rules."

Violations Test. In a recent test period, the FCC's Field Engineering & Monitoring Bureau reported, 552 man-days of concentrated monitoring of Class D citizens radio operations turned up 5470 violation cases.

Government-Industry Committee. Word should be coming from the FCC this fall about the establishment of a joint government-industry committee to define the problems of mobile radio services, including citizens and amateur radio.

FCC Chairman E. William Henry has pointed out to interested groups that the Commission's staff was instructed to "set out some of the problem areas and how we might best tackle them," to give the Commissioners some background in the non-broadcast communications field, which is quickly becoming one of the most volatile areas under the agency's jurisdiction.

"Jamming" on Guam. A group of Citizens Banders on the island of Guam have asked the FCC to investigate their charge that "someone in the vicinity" is deliberately jamming the citizens frequency of 27.105 megacycles by constant transmission of a "dead carrier" on the frequency. They requested that the agency monitor the frequency, "apprehend" the "offender," and revoke his license.

Amateur Items. Representative Elford A. Cederberg (R., Mich.) has introduced a bill in the House of Representatives which would permit the FCC to authorize, but not license, alien amateur radio operators to use their stations in the United States and its possessions, provided that a bilateral reciprocal agreement is in effect between the U.S. and the foreign country involved.

At the same time, the Dominican Republic has been added to the list of countries whose amateurs may exchange messages or other communications from or to third parties with amateur stations licensed by the FCC. Other countries with whom the U.S. has a similar agreement include: Bolivia, Canada, Chile, Costa Rica, Ecuador, El Salvador, Haiti, Honduras, Liberia, Mexico, Nicaragua, Panama, Paraguay, Peru and Venezuela. -30-

audiotape

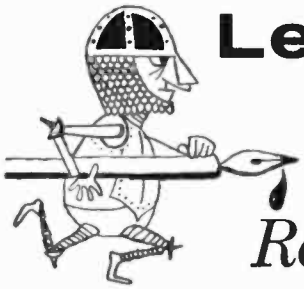
"it speaks for itself"

Play Fiddle, Play

(Audiotape is listening)

Audiotape can be your best friend. Talk to it by the hour and it will never protest. Speak gently and Audiotape returns the compliment. Play your violin and Audiotape will respond graciously, and never comment on your talent. Let a thousand violins fill the air and Audiotape remembers every note . . . and reminds you whenever you ask. It never volunteers an opinion, speaks only when spoken to. And when heard, its voice is unmistakable . . . clear, far ranging, free from distortion. They say friendship can't be bought. This one can. Buy a reel, and a friend, soon.

AUDIO DEVICES, INC., 444 Madison Avenue, New York 22, N. Y. • Offices in Los Angeles • Chicago • Washington, D. C.



Letters *from our Readers*

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

Magician's "Nonsense Box"

■ I enclose a clipping from our local newspaper which reports on a project of mine, "a weird machine well furnished with knobs and flashing lights"; a device somewhat similar to, but more elaborate than, the "Nonsense Box" (July, 1963, page 47). This machine is the LERA (*L*oquacious *E*mpiric *R*efulgent *A*nalyser), which name represents the initial two letters of the names of my two sons—*LE*onard and *RA*lph! There is also a LERA II under construction which incorporates further features such as numerical display tubes, and a stroboscopic light which varies in speed and duration of flash. This device, as well as the original LERA, are controlled by me using a 27-mc. multi-channel transmitter which I carry concealed from the audience. LERA is completely portable, and is powered by rechargeable batteries.

MISTEREE THE MAGICIAN
Middlesex, England

Our thanks to "Misteree" (he prefers not to use his real name) for the clipping from the Wembley News *of Nov. 17, 1960, which describes his sophisticated "Nonsense Box." Although the account*

credited Misteree and his device with many feats of magic, the reporter professed to be a bit disappointed that the gadget didn't give one "the power to hit the pools jackpot every week, to

How can you be sure the speaker you own is really well-made?

Build it yourself!

(with the new KS-2 StrataKit)

NOT CONTENT with developing the world's first true slim-line speaker system in kit form (the KS-1), Fisher now presents the KS-2, the newest, most advanced 3-way slim-line speaker system available in *any* form at anywhere near the price.

By simply installing the drivers, connecting the crossover network and completing the pre-assembled cabinet, you'll be well on your way to hearing why.

The KS-2 features a 12" free piston woofer with a half-roll cotton surround, massive 6 lb. magnet structure, and a free-air resonance of 25 cycles. The 5" mid-range has a butyl-coated surround and is sealed off in back to avoid interaction with the woofer and tweeter. The 3" cone-type tweeter is a hemispherical dome bonded directly to a 1" voice coil with a big 2 lb. magnet structure. Highs are silky smooth and widely dispersed.

The full 3-way inductance-capacitance network crosses over at 1200 and 2800 cycles and has a continuously variable tweeter level control to compensate for room acoustics and variations in pickup characteristics.

Measuring 20" wide x 25" high and only 6½" deep, the completely sealed, fiberglass-packed cabinet weighs 35 lbs. when assembled.

Response of the KS-2 is 35 cycles to well beyond audibility. It requires as little as 10 watts of power and will handle up to 60 watts. Price, in unfinished sanded birch, $89.50*.

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

Fisher Radio Corporation
21-52 44th Drive, Long Island City 1, N. Y.

Name_____

Address_____

City_____ Zone___ State_____

101012

The Fisher

*IN UNFINISHED WALNUT, $94.50. FACTORY ASSEMBLED, IN SANDED AND FINISHED BIRCH, $114.50, IN OILED WALNUT, $119.50. PRICES SLIGHTLY HIGHER IN THE FAR WEST. EXPORT: FISHER RADIO INTERNATIONAL, INC., LONG ISLAND CITY 1, N.Y. CANADA: TRI-TEL ASSOCIATES, LTD., WILLOWDALE, ONT.

Letters

(*Continued from page* 12)

'clean out' the bookmakers, or to get rich quick on the Stock Exchange."

More On BCB DX'ing

■ Several of my friends could hardly believe that over a hundred different stations can be heard on the broadcast band, and they are now avidly pursuing this hobby. We feel that a column giving information on which stations QSL, tips on receivers and antennas, BCB clubs, etc., would be very helpful.

EDWARD S. LIGHT, WPE2FBT
New York, N.Y.

■ In DX'ing the broadcast band since 1961, I have logged 644 stations in six countries. The best times for DX seem to be around sunrise and sunset, and also after midnight when stations on the West Coast can be heard here if conditions are right. I find BCB DX'ing just as exciting as SWL'ing, and hope to see a column on this subject. Please print my address—I'd like to correspond with other BCB DX'ers in the East.

JERRY BOND, WPE2FXO
159 Bowers Ave.
Watertown, N.Y.

■ Would we be interested in a column for BCB DX'ers ("Letter Tray," August, 1963)? Boy, would we! Some people consider this hobby odd, but it's one of the fastest growing fads around.

DAVE HELTON
Gardena, Calif.

■ I would be very much in favor of a column on BCB DX'ing. Also, how about more on TV DX'ing?

JAMES E. MCDONALD, WPEØCYR
Mason City, Iowa

■ A column for BCB DX'ers would be both singular and useful. I hope such a feature will appear in future issues.

LIONEL DEIMEL
New Orleans, La.

■ It would be a good idea. I've received a total of 45 AM stations on a little clock radio, including *Radio Americas*, the VOA station at Marathon (see "Radio Marathon Broadcasts Truth to Cuba," August, 1963), plus two Cuban propaganda stations.

Patrick Shaughness
North Miami, Fla.

Our thanks to all of those readers who have written letters asking for more articles and a column on BCB DX'ing. As a first step, POPULAR ELECTRONICS *is planning expanded coverage of broadcast band activities and propagation phenomenon.*

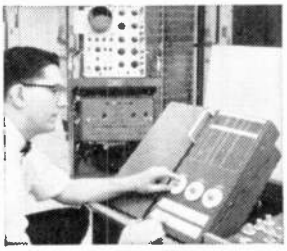
Two-Meter Receiver Applauded

■ This letter is in reference to the "2-Tube, 2-Meter Superregen" receiver which appeared as a

(*Continued on page* 20)

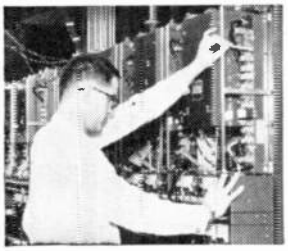
Pick the course for your career...

Electronics Technology



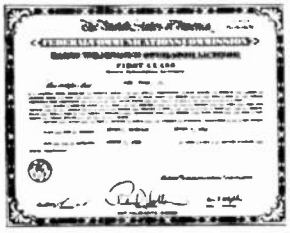
A comprehensive program covering Automation, Communications, Computers, Industrial Controls, Television, Transistors, and preparation for a 1st Class FCC License.

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.

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.

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.

Get A Commercial FCC License ...Or Your Money Back!

A Commercial FCC License is proof of electronics skill and knowledge. Many top jobs require it . . . every employer understands its significance. In your possession, an FCC Commercial Ticket stamps you as a man who knows and understands electronics theory . . . a man who's ready for the high-paid, more challenging positions.

Cleveland Institute home study is far and away the quickest, most economical way to prepare for the FCC License examination. And that's why we can make this exclusive statement:

> The training programs described above 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!

Before you turn this page, select the program that fits your career objective. Then, mark your selection on the coupon below and mail it to us today. We'll send you . . . without obligation . . . complete details on our effective Cleveland Institute home study. Act NOW . . . and insure *your* future in electronics.

Cleveland Institute of Electronics

1776 E. 17th Street, Dept. PE-9
Cleveland 14, Ohio

Accredited Member

Mail Coupon TODAY For FREE Catalog

Cleveland Institute of Electronics
1776 E. 17th St., Dept. PE-9
Cleveland 14, Ohio

How to Succeed in Electronics

Please send FREE Career Information prepared to help me get ahead in Electronics, without further obligation.

CHECK AREA OF MOST INTEREST—

- ☐ Electronics Technology
- ☐ Industrial Electronics
- ☐ Broadcast Engineering
- ☐ First Class FCC License
- ☐ Electronic Communications
- ☐ _____ other

Your present occupation _____

Name _____ Age ____
(please print)

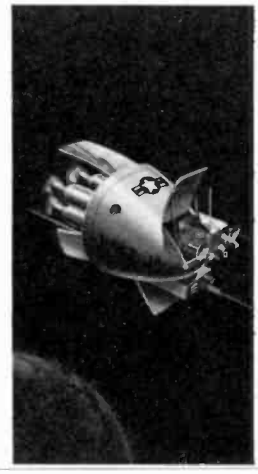
Address _____

City _____ Zone ____ State _____

Approved for Veteran's Training under Korean GI Bill. PE-9

A NEW WORLD OF OPPORTUNITY AWAITS YOU WITH N.T.S. ALL-PHASE HOME TRAINING IN ELECTRONICS

You can install and maintain electronic circuitry in missiles and rockets . . . specialize in micro-waves, radar and sonar.



You can succeed in TV-Radio Communications . . . prepare for F.C.C. License, service advanced satellites for industry and defense.

You can service and repair the electronic "brains" of industry—computers, data processing, and other automation equipment.

You can become a highly-paid TV-Radio Technician, an electronics field engineer, or succeed in your own sales and service business.

The N.T.S. Master Course enables you to do more, earn more in

ELECTRONICS • TELEVISION • RADIO

YET N.T.S. TRAINING COSTS NO MORE THAN OTHER COURSES FAR LESS COMPLETE

THERE'S A GOOD REASON WHY N.T.S. Master-Training opens a wide new world of opportunity for you in Electronics, Television, Radio.

EVERYTHING YOU LEARN, from start to finish, can be applied DIRECTLY to ALL PHASES of the Electronics Industry.

AS A RESULT, the N.T.S.-Trained Technician can move ahead faster, IN ANY DIRECTION—from TV-Servicing to Radio Communications to Space-Missile Electronics and Automation for industry and defense. You can go wherever pay is highest and opportunity unlimited.

ELECTRONIC CIRCUITRY, for example, is one of science's miracles that is BASIC to the entire field of Electronics. It is used in satellites, computers and space capsules as well as in today's television sets and high fidelity equipment. N.T.S. SHOWS YOU HOW to service and repair electronic circuitry for ALL electronic applications.

YOU WORK ON MANY PRACTICAL JOB PROJECTS. You build a DUAL SPEAKER, standard broadcast-short wave receiver (dual speakers for better sound distribution), plus a large-screen television set from the ground up. N.T.S. training kits contain all the parts you need . . . at NO EXTRA COST. (See box next page.) You also receive a PROFESSIONAL MULTITESTER to use during training and on the job.

READ THESE TYPICAL "SUCCESS REPORTS" FROM N.T.S. STUDENTS AND GRADUATES:

"Your home study course in Electronics has been very beneficial to me . . . I earn top wages as Electronic Installer at Douglas Aircraft . . . my success is due to National Technical Schools' excellent training . . ." Arnold Jones, Los Angeles, Calif.

". . . My employers are expanding and plan to open a new department within the next 2 years . . . they have urged me to complete your course as soon as possible . . . my supervisor says that your course is by far the finest one he has seen . . ."
E. P. Gardner, No. Battleford, Canada

". . . I am now in charge of Instrumentation, a new field for my company . . . my training has paid off better than I had hoped for . . ."
W. F. Fitzpatrick, Waco, Texas

START NOW. A wide, new world of opportunity awaits the man trained in Electronics by National Technical Schools—a recognized leader in technical training for 58 years. See next page.

ACCREDITED MEMBER—NATIONAL HOME STUDY COUNCIL

N.T.S. GIVES YOU EXTRA BENEFITS —IN TRAINING, ON THE JOB, IN DAILY LIFE

1 TRAINING BENEFITS

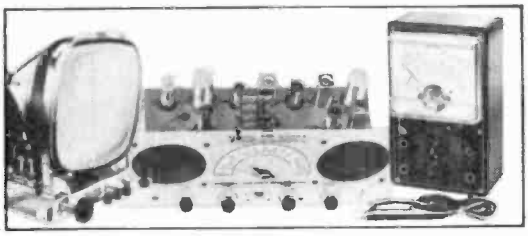
The N.T.S. Master Course embraces ALL PHASES of Electronics—Industrial, TV-Radio Communications, Servicing. You become that indispensable man—the all around technician.

ONE MASTER COURSE COVERS THE FIELD. ONE LOW TUITION INCLUDES EVERYTHING—lessons, manuals, counselling, all equipment. (We do not divide the field into separate courses with separate tuitions.)

YOU GET 19 KITS OF LATEST, PROFESSIONAL EQUIPMENT; including a professional, factory-made, precision Multitester and a new, wide-screen TV picture tube. All yours to keep.

VITAL ASSET: N.T.S. HOME TRAINING IS BASED ON METHODS USED IN SHOPS AND CLASSROOMS OF THE N.T.S. RESIDENT SCHOOL AT LOS ANGELES. No other method of teaching has proved so successful for home study.

N.T.S. Home Training is Shop-Tested in the N.T.S. Resident School at Los Angeles.



The newest, professional equipment—19 kits in all. Yours to keep.

2 ON-THE-JOB BENEFITS

ALL-PHASE training puts you in an enviable position. You can pick and choose your career. Specialize or go into business for yourself. Your services will always be in demand wherever you go—and you can go anywhere. Electronics is a vital part of almost every business today.

Earn while you learn. Many students start earning extra money within a few weeks and help pay for their tuition. You can, too.

3 LIFETIME BENEFITS

Your success is ours. N.T.S. Graduate Advisory Service stands ready to help in solving technical problems of your job, in securing an FCC License, in establishing your own business, in countless other ways. No charge for this lifetime service.

Detach, fill in, and mail the postage-paid card today. A complete, fully-illustrated "Opportunity" Book and Actual Lesson will be mailed to you. Go over them carefully. We believe you will make the right decision . . . that ONE Master Course at ONE low tuition is the best way to become the "Man in Demand" in Electronics, Television, and Radio.

Accredited Member N.H.S.C.

MAIL REPLY CARD OR COUPON FOR FREE BOOK AND ACTUAL LESSON

YOU ENROLL BY MAIL—AND SAVE MONEY.
Lower costs for us means lower tuition for you.

RESIDENT TRAINING AT LOS ANGELES

If you wish to take your Electronics-TV-Radio training in our famous Resident School in Los Angeles—the oldest and largest school of its kind in the world—write for special Resident School catalog and information, or check coupon.

NATIONAL TECHNICAL SCHOOLS
WORLD-WIDE TRAINING SINCE 1905
4000 So. Figueroa St., Los Angeles 37, Calif.

NATIONAL TECHNICAL SCHOOLS
WORLD-WIDE TRAINING SINCE 1905

National Technical Schools, Dept. R2G-103
4000 S. Figueroa St., Los Angeles 37, Calif.

Please Rush FREE Electronics-TV-Radio "Opportunity" Book and Actual Lesson. No Salesman Will Call.

Name_____ Age_____

Address_____

City_____ Zone_____ State_____

☐ **Check if interested ONLY in Resident Training at L.A.**

High school home study courses also offered. Check for free catalog. ☐

Letters

(*Continued from page* 14)

project in the October, 1962, issue. I built it for two meters, but then discovered that, by moving coil *L1*, I could pick up the aircraft bands. After adding a stand-by switch, a pilot light, and a small whip antenna, I found myself with the sharpest little receiver I have ever had. It would be quite worthwhile for faithful POP'tronics readers to dig out this issue and have themselves a ball building a two-meter or VHF aircraft receiver.

ROBERT MELSON, WPE2JYZ
Cherry Hill, N. J.

Ceramic vs. Wood Enclosures

■ I don't see what merit ceramic enclosures have ("Another Ceramic Tile Enclosure," April, 1963). All enclosures have a resonance point, and I've been under the impression that the reason for installing ducts, baffles, sound deadeners, and the like is to get rid of this inherent resonance—which is always present regardless of size and the type of material used for the cabinet. Wood has a good appearance; who wants a living room adorned with tile tubing? Wood is more porous, of course, but I don't believe this factor means much. Do you think that pottery violins or guitars will appear on the market in the near future? I'm all for wood in any case.

STACY L. LETTERMAN
Mobile, Ala.

Reader Letterman has confused the panel *resonance of an enclosure with the* Helmholtz *resonance of an enclosure. The ducts, baffles, and so on that he mentions are designed to control the Helmholtz open (bass reflex) resonance, and will have little, if any, effect on the panel vibration of a cabinet. It is in solving this latter problem that ceramic enclosures are of value. We agree that a guitar or violin should not be constructed of a ceramic material, of course, but these are musical instruments designed to have a characteristic sound. The ideal sound* reproducer *has* no *characteristic sound of its own, and, therefore, the acoustic designer does everything he can to produce a speaker without coloration and house it in a vibration-free cabinet.*

Converting Command Receivers

■ I was very pleased with the results I got from a Command receiver converted as per your article in the June, 1963, issue ("Converting Your First 'Command' Receiver"). I made one small change, using 600-volt d.c. diodes instead of a 6X4 rectifier in the power supply. Please publish more articles on converting surplus equipment. There are undoubtedly many other readers who would like good conversion data on surplus receivers and transmitters.

BART B. BONNEY
Radio Station WZUM
Pittsburgh, Pa.

■ Although the E. H. Marriner article on converting "Command" receivers had one fault—the

Announcing the new line of world-famous Schober Organ Kits . . .

ASSEMBLE YOUR OWN ALL-TRANSISTOR SCHOBER ELECTRONIC ORGAN

All-New, All-Transistor Schober Recital Organ

- 32 voices, 6 couplers delight professional musicians . . . make learning easy for beginners.
- Standard console, pedals, keyboard correspond exactly to pipe-organ specifications.
- Printed circuit construction and detailed illustrated instructions make for easy assembly . . . no prevous experience necessary.
- Highly accurate church and theatre pipe tone in 5 pitch registers make every kind of organ music sound "right."
- Optional: Combination Action, Schober Reverbatape Unit, Repetitive Theatre Percussions, Schober Library of Stops.
- All-transistor circuitry makes possible full 5-year guarantee.

Designed by organists for organists, the new Schober Recital Organ actually sounds like a fine pipe organ. All-transistor circuitry has greatly reduced the space needed for the electronic components . . . permitting the incorporation of many new and exciting musical features . . . described in detail in the FREE 1964 Schober Catalog. An instrument of this caliber would cost you $5000 to $6000 in a store. Direct from Schober, in kit form, costs you only **$1500.**

New, All-Transistor Schober Consolette II

Here's the most luxurious "home-size" organ available today . . . with full 61-note manuals, 17 pedals, 22 stops and coupler, 3 pitch registers, and authentic theatre voicing. Musically much larger than ready-made organs selling for $1800 and more . . . the Consolette II, in kit form, costs only **$850.**

New Schober Spinet

The Schober Spinet is a quality electronic organ; only 39¼-inches wide, it will fit into the smallest living room or playroom—even in a mobile home. The Schober Spinet far exceeds the musical specifications of ready-made organs selling for $1100 and more. In easy-to-assemble kits . . . only **$550.**

HERE'S WHY YOU SHOULD BUILD A SCHOBER ORGAN!

You cannot buy a finer musical instrument for over twice the price. You get the finest in musical and mechanical quality.

It's easy to assemble a Schober Organ. If you can read and use your hands, you can easily make your own superb organ. Everything you need is furnished . . . including the know-how; you supply only simple tools and time—no knowledge or experience is required.

You can buy the organ section by section . . . so you needn't spend the whole amount at once.

You can begin playing in an hour, even if you've never played before—with the ingenious Pointer System available from Schober.

Thousands of men and women—teen-agers, too—have already assembled Schober Organs. We are proud to say that many who could afford to buy any organ have chosen Schober because they preferred it musically.

Schober Organ Kits are sold in the U.S. only by . . .

THE *Schober Organ* CORPORATION

43 W. 61st St., New York, N.Y. 10023 Dealers in Canada, Australia, Hong Kong, Mexico, Puerto Rico & the United Kingdom.

SEND FOR FREE 1964 SCHOBER CATALOG . . . Describes the exciting Schober Organ and optional accessories in detail; it includes a **FREE** 7-inch "sampler" record so you can hear before you buy.

Also available: 10-inch high-quality, long playing record . . . fully illustrates all three models with different kinds of music. Price is refunded with first kit purchase . . . $2.00.

The Schober Organ Corp., Dept. PE-13
43 West 61st Street, New York, N. Y., 10023

☐ Please send me, without cost or obligation, the 1964 Schober Organ Catalog and FREE 7-inch "sampler" record.

☐ Enclosed find $2.00 for 10-inch quality, LP record of Schober Organ music. ($2.00 refunded with purchase of first kit.)

Name_____

Address_____

City_____ State_____ Zip No._____

Letters

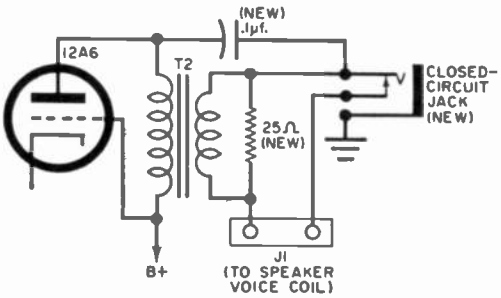
(*Continued from page 20*)

author made no provision for a headphone jack —I was happy to see it published. With surplus gear still available, conversion information is just as important today as it was in the late forties and early fifties. Perhaps someone can conjure up some uses for, say, the computer circuit boards which one finds on sale in great quantities today.

As far as the "Command" receivers are concerned, they would make excellent SWL receivers in spite of their lack of selectivity if their frequency range could be extended. Much has been published on converting them for ham use, but nothing for the SWL. How about a crystal-controlled converter to put the BC-454 on 31, 25, or 19 meters?

STUART L. ASTOR
Brooklyn, N. Y.

Thank you for your comments, Bart and Stuart. Although conversion data for most of the popular surplus units is available from various sources, articles of this sort, as well as articles that cover other aspects of using surplus equipment, will certainly be considered if enough readers are interested. The schematic reproduced here shows a good way to connect headphones to a converted



"Command" receiver by adding a .1-μf., 400-volt coupling capacitor, a 27-ohm, 2-watt voltage limiting resistor, and a closed-circuit jack to the audio output circuit. This scheme will work best with high-impedance headphones. Although it might be possible to squeeze the jack on the front panel, a better way is to mount it in a small Minibox.

"Electronic Electroscope" Wins Prize

■ For this year's local science fair, I built the "Electronic Electroscope" which appears in the July, 1958, issue of POPULAR ELECTRONICS on page 85. Instead of a 6J7, I used a 12BA6 pentode with a grid disc 8½" in diameter. The device proved to be extremely sensitive, and won a "first place." It also won a "fourth place" at the county science fair. I'm in the ninth grade.

DAVID PHILLIPS
Commerce City, Colo.

Congratulations on both awards, Dave, and on your updating an idea that appeared over five years ago. Your version of the "Electroscope" is probably more sensitive than the original. —30—

RAD-TEL'S

Amazing Introductory Offer . . . .

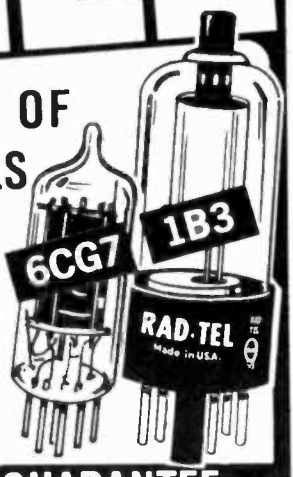
Your Choice:

1B3 - 6CG7

FREE!

TAKE ONE OF THESE TUBES FREE...

with the purchase of every 9 Rad-Tel Quality Brand New Tubes!



HURRY!
OFFER EXPIRES
November 30, 1963

ONE YEAR GUARANTEE

up to **75%** OFF*

* Manufacturers Suggested List Price

RAD-TEL'S QUALITY BRAND NEW TUBES

ONE DAY SERVICE — 500 TYPES IN STOCK

EACH TUBE ATTRACTWELY BOXED & BRANDED RAD-TEL

Qty.	Type	Price	Qty.	Type	Price	Qty.	Type	Price	Qty.	Type	Price
	0Z4	.79		6AU8	.87		6K6	.63		12CU5	.58
	1AX2	.62		6AV6	.41		6S4	.52		12CU6	1.06
	1B3	.79		6AW8	.90		6SA7GT	.99		12CX6	.54
	1DN5	.55		6AX4	.66		6SH7	1.02		12D4	.69
	1G3	.79		6AX5	.74		6SJ7	.88		12DE8	.83
	1J3	.79		6BA6	.50		6SK7GT	.95		12DL8	.88
	1K3	.79		6BC5	.61		6SL7GT	.84		12DQ6	1.04
	1R5	.77		6BC8	1.04		6SN7	.65		12D57	.84
	1S5	.75		6BE6	.55		6SQ7GT	.94		12DT5	.76
	1T4	.72		6BF5	.90		6T4	.99		12DT7	.79
	1U5	.65		6BF6	.44		6T8	.85		12DT8	.78
	1X2B	.82		6BG6	1.70		6U8	.83		12DW8	.89
	2AF4	.96		6BH8	.98		6V6GT	.54		12DZ6	.62
	3AL5	.46		6BJ6	.65		6W4	.61		12ED5	.62
	3AU6	.54		6BJ7	.79		6W6	.71		12EG6	.62
	3AV6	.42		6BK7	.85		6X4	.41		12EK6	.62
	3BC5	.63		6BL7	1.09		6X8	.80		12EL6	.50
	3BN6	.75		6BN6	.74		7A8	.68		12EZ6	.57
	3BU8	.78		6BQ6	1.12		7AU7	.65		12F8	.66
	3BY6	.58		6BQ7	1.00		7EY6	.75		12FA6	.79
	3BZ6	.56		6BU8	.70		7Y4	.69		12FM6	.50
	3CB6	.56		6BX7	1.11		8AU8	.90		12FR8	.97
	3CS6	.58		6BZ6	.55		8AW8	.93		12FX8	.90
	3DG4	.85		6BZ7	1.03		8BQ5	.60		12GC6	1.06
	3DK6	.60		6C4	.45		8CG7	.63		12J8	.84
	3DT6	.54		6CB6	.55		8CM7	.70		12K5	.75
	3GK5	.99		6CD6	1.51		8CN7	.97		12L6	.73
	3Q4	.63		6CG7	.61		8CS7	.74		12SF7	.69
	3S4	.75		6CG8	.80		8EB8	.94		12SK7GT	.95
	3V4	.63		6CL8	.79		8FQ7	.56		12SL7	.80
	4BQ7	1.01		6CM7	.69		9CL8	.79		12SN7	.67
	4CS6	.61		6CN7	.70		11CY7	.75		12SQ7GT	.91
	4DT6	.55		6CQ8	.92		12A4	.60		12U7	.62
	4GM6	.60		6CR6	.60		12AB5	.60		12V6	.63
	5AM8	.79		6CS6	.57		12AC6	.55		12W6	.71
	5AN8	.90		6CS7	.69		12AD6	.57		12X4	.47

RAD-TEL TUBE CO. NOT AFFILIATED WITH ANY OTHER MAIL ORDER TUBE COMPANY

	5AQ5	.54		6CU5	.58		12AE6	.50		17AX4	.67
	5AT8	.83		6CU6	1.08		12AE7	.94		17DQ6	1.06
	5BK7	.86		6CY5	.70		12AF3	.73		18FW6	.49
	5BQ7	1.01		6CY7	.71		12AF6	.67		18FX6	.53
	5BR8	.83		6DA4	.68		12AJ6	.62		18FY6	.50
	5CG8	.81		6DE6	.61		12AL5	.47		19AU4	.87
	5CL8	.76		6DG6	.62		12AL8	.95		19BG6	1.39
	5CQ8	.84		6DJ8	1.21		12AQ5	.60		19EA8	.79
	5EA8	.80		6DK6	.59		12AT6	.50		19T8	.85
	5EU8	.80		6DN6	1.55		12AT7	.76		21EX6	1.49
	5J6	.72		6DQ6	1.10		12AU6	.51		25AX4	.70
	5T8	.86		6DT5	.81		12AU7	.61		25C5	.53
	5U4	.60		6DT6	.53		12AV6	.41		25CA5	.59
	5U8	.84		6DT8	.94		12AV7	.82		25CD6	1.52
	5V6	.56		6EA8	.79		12AX4	.67		25CU6	1.11
	5X8	.82		6EB5	.73		12AX7	.63		25DN6	1.42
	5Y3	.46		6EB8	.94		12AY7	1.44		25EH5	.55
	6AB4	.46		6EM5	.77		12AZ7	.86		25L6	.57
	6AC7	.96		6EM7	.82		12B4	.68		25W4	.68
	6AF4	1.01		6EU8	.79		12BD6	.50		32ET5	.55
	6AG5	.70		6EV5	.75		12BE6	.53		35C5	.51
	6AH4	.81		6EW6	.57		12BF6	.60		35L6	.60
	6AH6	1.10		6EY6	.75		12BH7	.77		35W4	.42
	6AK5	.95		6FG7	.69		12BK5	1.00		35Z5	.60
	6AL5	.47		6FV8	.79		12BL6	.56		36AM3	.36
	6AM8	.78		6GH8	.80		12BQ6	1.16		50B5	.69
	6AQ5	.53		6GK5	.61		12BR7	.74		50C5	.53
	6AS5	.60		6GK6	.79		12BV7	.76		50EH5	.55
	6AT6	.49		6GN8	.94		12BY7	.77		50L6	.61
	6AT8	.86		6H6	.58		12BZ7	.86		70L7	.97
	6AU4	.85		6J5GT	.51		12CN5	.56		117Z3	.85
	6AU6	.52		6J6	.71		12CR6	.67		807	.75

ORDER FORM ● MAIL TODAY

RAD-TEL Tube Co.
Dept. PE
55 Chambers Street
Newark, New Jersey, 07105

Total Tubes $_____
Total Part(s) $_____
Postage $_____
Grand Total $_____

ENCLOSED IS $_____ Please rush order.

SEND: ____Book(s) Be Your Own TV Repairman @ $1.00 ea. #170
____Cheater Cord 29¢ ea. Lots of 3 - 25¢ ea. #154

Orders under $5.00 - Add $1.00 handling charge - plus postage.

FREE! ☐ Send FREE Tube and Parts Catalog
☐ Send FREE Trouble Shooting Guide

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

● FREE! Send For New Tube & Parts Catalog Send For Trouble Shooting Guide ●

Be your own TELEVISION REPAIRMAN

The Original NOW YOU CAN FIX YOUR OWN TV SET BOOK

You can fix your own TV if you have TV Fixit Book . . . because 80% of troubles are caused by tubes. This book explains, illustrates trouble and what tubes cause this trouble. Pinpoints in over 3000 layouts by model number, position and type tube causing trouble.

No. 170..... **$1.00**

CHEATER CORD

6 ft., No. 154..... 29¢ ea. Lots of 3—25¢ ea.

Easy to work on set while panel is off.

RAD-TEL TUBE CO. TV, RADIO AND HI-FI

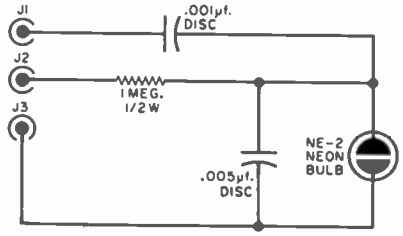
Dept. PE — 55 CHAMBERS STREET, NEWARK 5, NEW JERSEY

TERMS: 25% deposit must accompany all orders, balance C.O.D. Orders under $5: add $1 handling charge plus postage. Orders over $5: plus postage. Approx. 8 tubes per 1 lb. Subject to prior sale. No C.O.D.'s outside continental U.S.A.

Tips and Techniques

FIVE-MINUTE AUDIO OSCILLATOR

Need an audio oscillator in a hurry? This relaxation oscillator won't give you pure sine or square waves, but it will provide an audio tone that's perfectly usable for testing an amplifier, for code practice, or for any number of things. Simply wire to-



gether an NE-2 neon bulb, a 1-megohm resistor, and a 0.005-μf. capacitor as shown in the schematic. A power source—perhaps from the equipment under test—of about 150 volts d.c. is connected between *J2* (the B-plus terminal) and ground (*J3*). Audio output—be sure and include the 0.001-μf. blocking capacitor—is taken from *J1* and *J3*. The frequency can be varied by changing the value of the resistor or capacitor, or the applied voltage. —*Ray Dulgar*

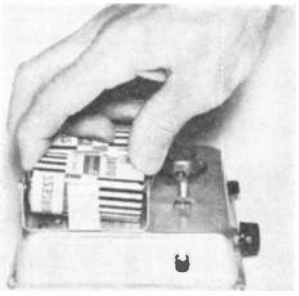
SATIN ENAMEL FINISH FOR ELECTRONICS EQUIPMENT

The beautiful satin enamel finish you used to see on the desk stand telephones of yesteryear can now be applied to beautify other items of equipment. Give the article two coats of glossy enamel. When it is thoroughly dry, rub the surface briskly with a damp rag and a little Bon Ami. Keep rubbing until you have an even satin finish all over the surface, then wash off the Bon Ami with water. Don't use ordinary scouring powder —the grit will scratch the enamel.

—*Carl Dunant*

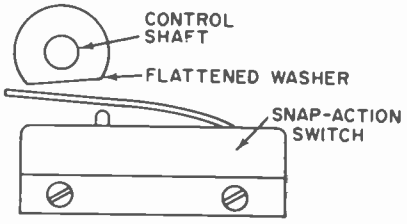
ROCK AND ROLL BATTERY CONTACT CLEANING

Corrosion and dirt eventually reduce the efficiency of almost all battery-operated equipment. In addition to scraping the contacts of the batteries and holders, you can do a quick, in - the - holder cleaning job by grasping each cell with your thumb and index finger and rocking it with a teeter-totter motion. Finally, roll it in the holder. —*Art Trauffer*



MAKE A SUBSTITUTE CONTROL-OPERATED SWITCH

Usually, when a circuit calls for a potentiometer with a switch, you can find the right value in the junk box, but finding the right value *with a switch* is another thing. Of course, a separate toggle switch can be used, but that would eliminate the convenience of the single-knob, dual-function control called for. If your junk box can produce a snap-action type switch, there's a solution to the problem. Solder a washer with one side flattened to the shaft of the potentiom-



eter to act as a cam to activate the switch. With the flat part of the washer against the lever, the switch is off; rotating the control shaft turns it on and keeps it on throughout the range of the potentiometer.

—*Wm. B. Rasmussen*

SMALL TERMINAL STRIPS MADE FROM LARGER ONES

Large barrier terminal strips, readily available from many pieces of surplus equipment, can be cut to any size to make speaker, antenna and ground, power supply, or

Tips

(*Continued from page 24*)

any other type of terminals. A hack saw can be used to cut the Bakelite. If you employ a vise, cushion the terminal strip with pieces of wood to avoid cracking it. The metal contact strips between the screw holes can be removed to make mounting holes by drilling through them with a 3/16" bit.

—*Francis Rahl, Jr., K3KIO*

SUBSTITUTION SPEAKER SPEEDS SERVICING

If you service intercoms or other systems that have a lot of speakers, you can speed up the checking of faulty units by building a substitution speaker into your caddy. Just mount a small, shallow speaker of the type used in the rear deck of a car in a side of your caddy or box. It'll be up off the bottom and far less subject to damage than a spare speaker carried loose among the tubes and hardware, and you will find it much handier to use. Be sure to put in the grille to protect the cone.

—*George R. Moore, Jr.*

COMING NEXT MONTH

Are you straining your ears to hear weak 100-kc. harmonics when you calibrate your receiver? Our November cover feature is a three-transistor frequency standard that puts out readable harmonics well into the VHF part of the spectrum. Built on a printed-circuit card, it's just one of the test equipment projects in this issue.

C BRIDGE

Number two in our line-up of test equipment projects is this capacitance checker. It's so simple that it can be assembled and calibrated during one evening. And after you've built it, you'll probably stay up to the wee small hours sorting out your junk box capacitors.

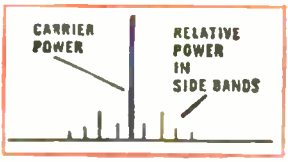
METERLESS VTVM

Using a "magic eye" tube instead of a costly meter, the input resistance of this simplified VTVM is nearly 15 megohms! While possibly not as accurate as a meter, it does a good job for an instrument costing only $12.00-15.00.

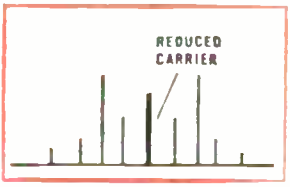
FLASH! The November issue will go on the newsstands one week early. Look for it on Tuesday, October 22!

NEW! SUPER "TALK-POWER"

CRYSTAL-CONTROLLED 23 CHANNEL TRANSMIT AND RECEIVE



Conventional Transmit . . . typical instantaneous modulation pattern.



"Range Gain" Transmit . . . note increase in sideband "talk-power" with DSBRC.

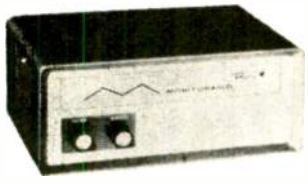
2-Scale 4-Function Illuminated Meter . . . glows red when transmitting.

23 Channels . . . crystal-controlled for both transmit and receive.

COMPLETE, READY TO OPERATE—NOTHING ELSE TO BUY!

Regency RANGE GAIN TRANSCEIVER

with exclusive DOUBLE-SIDE BAND REDUCED CARRIER



Regency

MONITORADIO

Emergency Band Receiver

. . . the first fully transistorized receiver that operates anywhere under any conditions!

Here's a fully transistorized unit combined with an optional auxiliary power supply that automatically kicks on in case of line power failures. Features a dual power supply that permits normal operation on either 117 volts AC or 12 volts DC. The single-crystal controlled unit provides narrow band reception on frequencies within the 25-50 or 152-174 mc. bands. Frequency deviation is limited to 5 kc. to eliminate interference from adjacent stations.

4 TIMES MORE POWERFUL BECAUSE REDUCTION OF HETERODYNES PERMITS DSBRC SIGNAL TO GET THROUGH WHERE REGULAR AM SIGNALS SUFFER FROM OVERPOWERING HETERODYNES

Now get **super power . . . super** performance plus everything you've every wanted in a CB transceiver. Exclusive Regency RANGE GAIN lets you run 10 watts peak envelope power output and still comply with FCC regulations. You get **super** transmission and **super** reception on all 23 channels . . . the horizon line becomes your operating range! And, the NEW Regency RANGE GAIN Transceiver is compatible with existing CB rigs without the use of auxiliary equipment. Now improved and rated excellent by Popular Electronics for TALK POWER, SELECTIVITY, SENSITIVITY, SQUELCH, NOISE LIMITING, STABILITY and OPERATING EASE!

Sugg. retail price **$269.95**

• Free Call Letters Furnished • 2-Tube Push-Pull Modulator • Crystal Filter Built-In • Mobile Mounting Bracket Avail. • Full 12 Month Written Warranty on Unit and Crystals

770

Write today for specifications to:

Regency ELECTRONICS, INC.

7902 PENDLETON PIKE • INDIANAPOLIS 26, IND.

EXPERIMENTER, SWL or RADIO AMATEUR

Select your receiver, transmitter, or VFO from easy-to-build International A O C kits.

Simple step-by-step instructions show you how to assemble factory prewired units. Designed for top performance at a low cost!

RECEIVER KITS

This new line of International receiver kits cover a wide range of amateur, citizens band and special frequencies. Designed for AM, CW, or SSB reception, this basic receiver using a superheterodyne circuit* with regenerative second detector may be expanded to a more elaborate receiver by the addition of other Add-On-Circuits. Sensitivity usable to below 10 microvolts for voice and 1 microvolt for code. Nuvistor rf amplifier, mixer, oscillator, I.F. transformer, detector/1st audio, and power audio amplifier. Tube lineup: 6DS4 nuvistor, 6BE6, 6U8, 6AQ5.

Receiver kit includes 4" speaker and power supply.

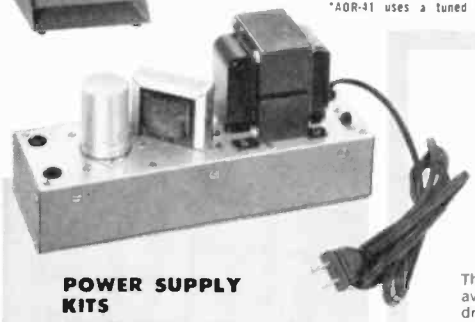
Kit	Frequency	Price
AOR-40	Special	$69.00
AOR-41	150 kc — 450 kc	62.50
AOR-42	2 mc — 6 mc	62.50
AOR-43	6 mc — 18 mc	62.50
AOR-44	80 meter/40 meter	62.50
AOR-45	15 meter/10 meter	62.50
AOR-46	6 meter	66.50
AOR-47	2 meter	66.50
AOR-48	Citizens 27 mc	62.50

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

TRANSMITTER KIT

A compact package delivering a solid 50 watt plate input for CW operation on 80 or 40 meters. 12BY7 crystal oscillator—6DQ6 power amplifier. Pi-network final. When used with AOR-44 receiver, transmitter operates from receiver power supply. Meter and TR switch.

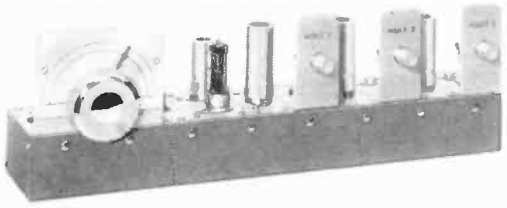
AOT-50 transmitter kit less power supply and key, but with one 40 meter novice band crystal..... $35.00



POWER SUPPLY KITS

AOP-100 350 volts, 150 ma intermittent or 100 ma continuous service; 6.3 volts @ 5 amps. $18.50

AOP-200 650 volts, 250 ma intermittent or 200 ma continuous service, 6.3 volts @ 10 amps. $32.50



VFO KITS

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

Kit	Frequency	Price
AOF-89	VFO 8 mc — 9 mc and buffer	$22.00
AOF-90	VFO 8 mc — 9 mc plus buffer multiplier and 6 meter output	29.00
AOF-91	VFO 8 mc — 9 mc plus buffer multiplier, 6 meter/2 meter output	36.00

International Crystal Mfg. Co., Inc.
18 North Lee, Oklahoma City, Okla.

Please ship_____

I enclose $_____ Send free catalog_____

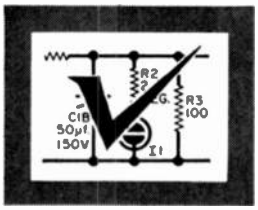
Name_____
(print)

Address_____

City_____ Zone_____ State_____

INTERNATIONAL
CRYSTAL MFG. CO., INC.
18 NORTH LEE, OKLA. CITY, OKLA.

Operation Assist



THROUGH THIS COLUMN we try to make it possible for readers needing information on out-dated, obscure, and unusual radio-electronic gear to get help from *other* readers. Here's how it works: Check over the list below. If you can help anyone with a schematic or other information, *write him directly*—he'll appreciate it. If *you* need help, send a post card to OPERATION ASSIST, POPULAR ELECTRONICS, One Park Avenue, New York 16, N. Y. Give the maker's name, the model number, year of manufacture, bands covered, tubes used, etc. Be sure to print or type everything legibly, including your name and address, and be sure to state specifically what you want, i.e., schematic, source for parts, etc. Remember, *use a post card;* we can handle them much faster than letters. And don't send return envelopes; your response will come from fellow readers. Because we get so many inquiries, none can be acknowledged, and POPULAR ELECTRONICS reserves the right to publish only those requests that normal sources of technical information have failed to satisfy.

Schematic Diagrams

Gilfillan Type GN-2 Neutrodyne radio, ser. KC3873, using UX201-A tubes; tube and alignment data also needed. (Gary Strune, 717 N. 18th St., Moorhead, Minn.)

R.M.C. console radio, AM, FM, s.w., ser. FM718 62075. (Wallace Electronics, 52 Center St., Kingston, Pa.)

Silvertone battery-operated radio, model unknown, BC and 6 to 18 mc. s.w. (Michael Gray, Route 1, Box 92, Buffalo, Texas)

Clough-Brengle Model OMA r.f.-a.f. sweep gen., and book. (R. H. Hopper, 124½ No. Callow, Bremerton, Wash.)

Fairbanks Morse Model 63, 6-tube BC and s.w. radio, Ser. 63-1003, date unknown. (Hugh J. Mckeown, 2929 N. Kilbourn Ave., Chicago 41, Ill.)

Supreme Model 542 multimeter. (Albert Cetrano, 40 Morris Place, Oceanport, N. J.)

Knight Model A-10774 8-tube console radio, early 40's. (Thomas Overcamp, 413 Everatt Drive S.W., Decatur, Ala.)

Olympic RT 11A/APN-12 (Bill McQueen, 1419 S. 14 St., Lafayette, Ind.)

Radioear hearing aid, Model 820, with parts values. (R. Anderson, Biggs Bldg., Occupational Therapy Shop, Fulton State Hospital, Fulton, Mo.)

Philco Model 41-604, code 121 BC and s.w. radio-phono, about 1940. (Victor La Duke, Standish, N. Y.)

Philco Model 37-3610A 3-band BC and s.w. radio-phono, about 1936. (Arthur C. Fritzke, 54 Monkswood Crescent, Newmarket, Ont., Canada)

Trav-Ler record player, ser. 950093-N-P-3; also mechanical diagram. (R. Zillig, 220 W. 2nd St., Fulton, Mo.)

RCA Model 151A oscillograph, about 1945 (?); also book. (J. C. Roy, 822 Duncan St., San Francisco 14, Calif.)

Silver-Marshall Model A18, 8-tube superhet, 10" Jensen Model D-9 speaker, 1932. (R. J. Monson, Lancaster, Va.)

Philco Model 37-675, code 122, 5-band BC and s.w. radio. (R. M. Eggerts, 33 Brunswick Rd., Montclair, N. J.)

Atwater Kent Model 318, BC and s.w.; also tech. data. (John Kyrka K1UMF, 20 Second St., Natick, Mass.)

RCA 29K2 (?); also parts list and pictorial. (Donny Perro, 712 Merritt Drive, Mobile 9, Ala.)

E. H. Scott SLR-2A marine radio, (military BRO-2?). (Fred Walter, 200 MacDade Blvd., Melmount Pk., Pa.)

DeForest-Crossley Type 1751, 7-tube, battery-powered radio. (W. Klammer, 8580 112 St., N. Surrey, B.C., Canada)

Viking 46-61, Series E2-4526, 5-tube, 2-band radio-phonograph, a.c.-powered; alignment data also needed. (Nick Hall-Patch, 2643 Cavendish Ave., Victoria, B.C.)

Silvertone BC and 2-band s.w. console radio, model not known, using 6A7, 6K7, type 80 rectifier, late 30's (?). (Mike Hughes, Route 6, Marion, Ky.)

E. H. Scott Model 537, no other data. (J. H. Van Wallendael, 58 North St., Binghamton, N. Y.)

ARF Products cavity oscillator, RCA JRC-40 lighthouse tube, ser. 4485-R, covering 1000-3000 and 3600-6200 mc. bands. (George Girod, 154 Mill St., Winona, Minn.)

RCA Model AVR-7H aircraft radio receiver. (Wesley Atchison, Route 1, Slidell, Texas)

R-100/URR receiver (surplus military), ser. 29604, 7 tubes, a.c.-d.c.; also instruction book. (Gary Payne, 4812 E. Grant, Fresno 2, Calif.)

Brunswick Panatrope radio, Model A2958, 7 tubes, with push-button tuning and record player. (Thomas Covington, P.O. Box 3082, Corpus Christi, Texas)

Signal generator, Model SG-2, by Radio Kits, Inc., about 1949. (F. R. Phelps, 35 N. Hill St., Brookville, Ohio)

Silvertone Model 6129, 3-band receiver. (WPE3ESN, R.334 Phelps St., Scranton 9, Pa.)

Sparton Model 617, 3-band, a.c.-operated radio, about 1937. (David Hire, 3848 Clinard Ave., Winston-Salem, N.C.)

RA-94A power supply for Hammarlund Super Pro receiver. (Pat O'Brien, 6811 Amboy, Dearborn 6, Mich.)

Philco Model 38-12 BC receiver, code 121. (Eric Bjornbak, 7526 Bison, Wayne, Mich.)

National N-100 6-tube superhet made for U.S. Army, and **Majestic** Model 4810 8-tube radio and record player, about 1949. (R. Rohrer, 506 Phoenix Ave., Elmira, N.Y.)

RCA Model 118 table-model 2-band superhet. (Arthur W. Brown, 88 Governor St., E. Hartford, Conn.)

PP-1295/UPM-66 power supply, USAF surplus, 115 volts, 380 to 1000 cps. (R. Wolfe, 5372 Detroit Rd., Elyria, Ohio)

National Type RCE communications receiver, made for U.S. Dept. of Commerce. (John L. Hartzler, R.R. 1, Box 413, Elkhart, Ind.)

Atwater Kent Model 856, BC and two s.w. bands, 540 to 18,000 kc., ser. 31286. (Ed LaFortune, 126 Second Ave., Troy, N.Y.)

Philco Model 41-256, code 121 BC and s.w. to 12 mc., 7 tubes. (S. Clifton, 800 West End Ave., New York 25, N.Y.)

Zenith Model 4R regenerative receiver, 4 tubes, Armstrong patent licensed, age unknown; **Philco** Model 513 7-tube t.r.f., ser. 043292; **Firestone** "Air Chief" 6-tube superhet, 550 kc. to 18 mc. (Jerome B. Oder, 617 Bensyl Ave., Danville, Ill.)

Temple Model 150 superhet, ser. 500033, BC set with s.w. converter. (M. J. Dubrick, 3216 165th St., Hammond, Ind.)

Packard-Bell Model 5AGP radio, about 1937, part of phono/radio console. (R. Pankey, 2975 Wallingford Rd., San Marino, Calif.)

Crossley Tridyn 3-R-3 regenerative receiver, Armstrong license. (Tom Lindsay, R.R. 1, Bourbonnais, Ill.)

Pioneer Rectifier VTVM, Model 12, about 1948. (J. Young, 1544 Bush St., Louisville, Ky.)

Test Set I-77-H VOM made for Army by Triumph Mfg. Co., ser. 4294. (J. Steven Bumpous, Rte 5, Lubbock, Texas)

(*Continued on page* 30)

Operation Assist

(*Continued from page 29*)

Sparton Model 1068, 9-tube console, a.c. receiver. (Walter Wasowski, 11150 Condon Ave., Inglewood, Calif.)

Philco Model 38-4 BC-s.w. radio, ser. 836723, mid '30's. (R. B. Jackson, Country Club Hts., RR. 1, Maysville, Ky.)

Superior Model 70 VOM; also instruction book. (William C. Grudier, Oak Drive, Spencer, W. Va.)

Hallicrafters Model S-20R Sky Champion. (Bill Grow, 622 W. Gowen St., Shamokin, Pa.)

Coronado Model 11B, 11-tube console radio, date unknown; also modification for new tube types. (S. Sgt. Pedro G. Vasquez, 631 Irving St., Antigo, Wis.)

Steinite Crystal Set #7310, date unknown, made by Steinite Labs., Atchison, Kans.; **Precision** Equipment Co. #262B regenerative receiver, made under 1914 patent; **Dictogrand** Loud Speaker, Type R-80, ser. 9539, made by Dictograph Prod. Corp., New York, N.Y.;

Crossley radio, Sylvania and Oriole 201A tubes dated 11/23/29. (G. Cavanaugh, Upper Otsego St., Ilion, N.Y.)

Merit VTVM Model M345, ser. 2522, date unknown. (Col. Fred T. Crimmins, Jr., 1400 Patton Ave., Asheville, N.C.)

Howard Model 435 communications receiver, ser. 43513. (Terry Martin, Star Rte., Russell, Kans.)

Parts or Special Data

Hallicrafters SX-42, S-meter needed. (Edward J. Gauss, 107 Van Wyck Ave., Pittsburgh 27, Pa.)

Philco Model 38-610 s.w. receiver, dial needed. (Leon Schegg, 3018 Steiner St., San Francisco 23, Calif.)

Type 6P7 receiving tube wanted for old set. (Fred Hamilton, 262 Lowell St., Waltham 54, Mass.)

Webcor Model 228-1 wire recorder, any technical data, or will sell. (S. Rowin, 1213 Ave. Z, Brooklyn 35, N.Y.)

Heath AT-1 transmitter, oscillator coil or winding data needed. (WA4FVI, c/o Mike, 5101 N. 25th Pl., Arlington, Va.)

RCA Radiola III receiver, WD-11 tubes needed. (Edgar Jones III, Box 1015, Staunton, Va.)

Philco Model 41-608 BC and s.w. receiver, data wanted on replacement for XXL tube. (Claude Von Plato, 497 Maplewood Rd., Springfield, Pa.)

RCA Model 811K, power transformer, or suitable replacement type wanted. (Raymond Pritchet, 105 Barrymore Blvd., Franklin Square, N.Y.)

I-177-B tube tester, military surplus, any data for use with post-1953 tubes, and adapters. (Michael Bobrek, 102 Ave. B, New York 9, N.Y.)

Type RC-120 receiver, 2 to 18 mc., made by National Co., for U.S. Coast Guard, about 1941, any technical data. (Terry V. Johnson, 403 Dorothy St., Sikeston, Miss.)

Sound Scriber, ser. PEN-W-UU, recording discs needed, also schematic. (S. J. Muntean, 1537 Paul Ave., Pauls-boro, N.J.)

Steinmetz Wireless Mfg. Co. crystal detector set, variable coil tuning, any technical or historical data. (Jim Tolson, 1805 15½ St., Rock Island, Ill.)

Atwater Kent Model 559 console superhet, power transformer or type number of replacement needed. (Paul Brown, 7982 Twin Oaks Ave., Citrus Heights, Calif.)

Atwater Kent Model 20, oscillator coil needed, also schematic. (James Seaman, 198 Latham Rd., Mineola, L.I., N.Y.)

Bosworth receiver, early '20's, two '01A, three RX201A tubes, one 112A tube needed, also schematic and any data. (Forrest R. Phelps, 35 N. Hill St., Brookville Ohio)

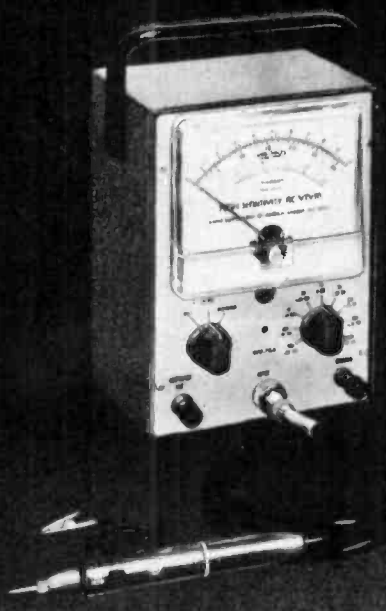
Precision Model 700B tube tester, modern tube data needed, operating instructions, and schematic. (WPE-3ESN, R.334 Phelps St., Scranton 9, Pa.)

RCA-built RAL-7 receiver, military surplus, any technical data. (A. B. Smith, Box 173, Mandeville, La.)

Eicor Mark 11 Wireless Set (transmitter), any technical data. (James Rainford, 813 Fisk Ave., Joliet, Ill.)—30—

TOP PERFORMANCE AT ROCK-BOTTOM COST

With money-saving RCA Electronic Instrument Kits



RCA WV-76A (K)
HIGH SENSITIVITY AC VTVM KIT

Measures AC Voltages .0002-Volt to 500 Volts
Doubles as a Preamplifier

An exceptional two-way kit value! As a high sensitivity AC VTVM the new RCA WV-76A measures AC voltages from 10 mv to 100 v full-scale in nine overlapping ranges; special "low-cap" switch on probe extends upper range limit to 500 v. As a flat-response preamplifier, it provides a 38 db maximum gain on the 10 mv range.

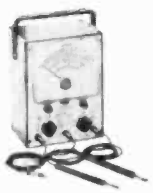
- Flat frequency response ± 1 db from 10 cps to 1.5 Mc with probe on "direct"; and from 10 cps to 500 kc with probe switched to "low-cap."
- High input impedance for accurate measurements in circuits sensitive to loading.
- Easy-to-use, direct-reading decibel scales.
- Pre-assembled shielded probe and cable, all-metal case eliminate stray pickup.
- Large power-supply filter minimizes hum.
- Compact, lightweight, portable.

Kit price: only $57.95* • Factory-wired and calibrated: $79.95*

RCA WV-98C (K)
SENSITIVE VOLTOHMYST® KIT

Special 0.5-volt DC range for transistor circuits. Measures: AC voltages 0.2 to 4200 peak-to-peak—including complex waves—and 0.1 to 1500 rms; DC voltages 0.01 to 1500. Resistances 0.2 ohm to 1,000 megohms. Pre-assembled, AC/DC-OHMS probe. Big 6½" meter. AC, DC accuracy: ±3% FS.

Kit: $57.95* Factory Wired: $79.50*



RCA WV-77E (K) VOLTOHMYST® KIT

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

Kit: $29.95* Factory Wired: $43.95*

RCA WV-38A (K)
VOLT-OHM-MILLIAMMETER KIT

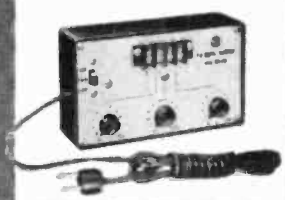
Accurately measures AC and DC volts, ohms, DC current, and decibels. Special 0.25-volt and 1.0-volt DC ranges. 5¼" meter in plastic case—no glass to crack or shatter. Jacks located below switches to keep leads out of the way. Spring clip on handle to hold leads.

Kit: $29.95 Factory Wired: $43.95*

RCA WO-33A (K) PORTABLE 'SCOPE KIT

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

Kit: $79.95* Factory Wired: $129.95*



RCA WG-30*B (K) TV BIAS SUPPLY KIT

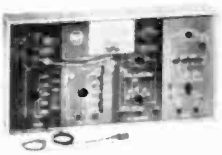
Three separate DC output voltages each adjustable from 0 to 15 volts provide bias voltages for aligning RF, IF and other circuits of color and black-and-white TV receivers. Kit: $11.95*

See them all at your Authorized RCA Electronic Instrument Distributor

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

RCA WE-53A (K) TRANSISTOR-RADIO DYNAMIC DEMONSTRATOR KIT

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

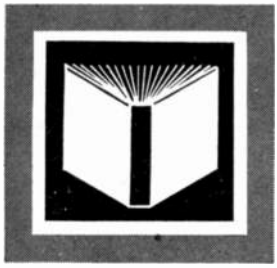


RCA WE-65A (K) VOLT-OHM-MILLIAMMETER DYNAMIC DEMONSTRATOR KIT

A functional, accurate V-O-M laid out on panel board for instruction and demonstration. Each basic circuit separately color coded. Measures AC volts, DC volts, DC current and ohms. One of the most useful test instruments in electronics. Kit: $37.95*

*User price (optional)

RCA The Most Trusted Name in Electronics



POP'tronics Bookshelf

BASIC MATHEMATICS

by Norman H. Crowhurst

This is a hard-cover version of an earlier four-volume soft-cover series, in which the original "pictured text" format is retained. Author and illustrator have tried hard to present mathematics from the simplest arithmetic through elementary calculus as a unified whole, with much emphasis on graphical illustrations of basic concepts. In a large degree, they have succeeded, although in some instances the effort to get visual appeal onto each page is painfully labored. Throughout, the subject matter deals with real problems, which both stresses the practical value of math, and adds interest. It is the sort of book well adapted to self-study, since the author has carefully covered many points often left by other texts for an instructor to explain.

Published by John F. Rider Publisher, Inc., 850 Third Ave., New York 22, N.Y. 557 pages. Hard cover. $14.50.

COMPUTER CIRCUIT PROJECTS YOU CAN BUILD

by Lee Boschen

Out of the scores of good books that Howard Sams publishes each year, they should certainly be permitted one "goof." Just why this book is called "Computer Projects" defies the imagination. A stroboscope is not a computer; a "magic lamp" is not a computer, nor is a "signal flasher." Mr. Boschen's book is a compilation of 14 do-it-yourself projects, only five of which are in the general realm of computers. The remaining circuits are interesting, but not what the book title might lead the unwary reader to expect.

Published by Howard W. Sams & Co., Inc., 4300 W. 62nd St., Indianapolis 6, Ind. 144 pages. Soft cover. $2.95.

GENERAL ELECTRONICS CIRCUITS

by J. J. DeFrance

This book is directed mainly toward engineering technicians, and is meant for use as a classroom text. Students will need a fair grasp of d.c. and a.c. theory, algebra, basic trigonometry, and vector diagrams, to get full benefit from the circuit analyses presented. Nevertheless, because of the thoroughly detailed explanation of the basic electronic circuits covered, this reviewer feels that the book can be valuable for study without an instructor, provided that the reader has the background noted above. Beginning with five chapters on a.c. power supplies, the book covers both vacuum tube and transistor versions of the basic "building block" circuits which, in combination, make up practically all modern electronic devices and systems. Use of review questions carefully correlated to the text should add to the effectiveness of the book.

Published by Holt, Rinehart and Winston, Inc., 383 Madison Ave., New York 17, N.Y. Including index, 526 pages. Hard cover. $7.95.

Capsule Reviews

ABC'S OF ELECTRONIC TEST EQUIPMENT *by Donald A. Smith.* Another of the elementary books for the novice electronics experimenter, this one is competent as far as it goes, although it must, of necessity, quickly skim the subject. *Published by Howard W. Sams & Co., Inc., 4300 W. 62nd St., Indianapolis, Ind. 96 pages. Soft cover. $1.95. . . .*

REGISTRY OF TRANSPORTATION RADIO SYSTEMS. Here is a listing by licensees and operating frequencies of the approximately 13,000 fixed stations in this category. Taxicabs, railroads, auto emergency, and motor carriers are included. *Published by Communication Engineering, Box 629, Mineola, L.I., N.Y. 104 pages. Soft cover. $5.00.*

THE OSCILLOSCOPE, Second Edition

by George Zwick

The wiggly green line on the cathode-ray tube screen probably tells the smart technician more about what is going on in a circuit than any other indicating device. In presenting the principles of the oscilloscope, the author has done a creditable job of explaining the circuits that generate the wiggly line in scopes of the sort used to service entertainment receivers and audio amplifiers. A sizable part of the book is devoted to methods of using the oscilloscope

(Continued on page 38)

FREE

LAFAYETTE RADIO ELECTRONICS

1964 CATALOG NO. 640

422 Giant-Size Pages

LAFAYETTE

"WORLD'S HI-FI & ELECTRONICS SHOPPING CENTER"

GIVES YOU MORE IN '64!

MORE STEREO HI-FI • MORE C.B. EQUIPMENT • MORE TAPE RECORDERS
• MORE HAM GEAR • MORE TEST EQUIPMENT • MORE TOOLS • MORE BOOKS
• MORE P.A. EQUIPMENT • MORE RADIO & T.V. ACCESSORIES

MORE BUYING POWER—choose from Lafayette's three Easy-Pay Credit Plans.
NO MONEY DOWN, up to 24 months to pay, as little as $5 monthly.

LAFAYETTE 120-WATT ALL-TRANSISTOR STEREO AMPLIFIER

KT-900WX Kit **129.50**

LA-900WX Wired **189.50**

- 22 Transistors (11 Power Types), 10 Silicon Diodes, 4 Germanium Diodes

LAFAYETTE DELUXE C.B. TRANSCEIVER

109.50

- Officially Approved for use in Canada
- 8 Crystal-Controlled Receive and Transmit Positions

LAFAYETTE 4-TRACK STEREO RECORD/ PLAYBACK TAPE DECK

RK-140WX less case **99.50**

Imported

114.50 RK-143WX with case

- Built-In Transistorized Record/ Playback Preamps
- Records Sound-on-Sound

LAFAYETTE AMATEUR COMMUNICATIONS RECEIVER

KT-320 Semi-Kit **64.95**

HE-30WX Wired **79.95**

- 4-Band Coverage
- 8 Tubes plus Rectifier Tube Imported

LAFAYETTE 3-TRANSISTOR C.B. "WALKIE-TALKIE"

10.95 each

2-for-21.00

HA-70L Imported

- Up to ¼ Mile Reliable Communications
- Ideal for Kids

Mail the Coupon for Your FREE 1964 Lafayette Catalog

LAFAYETTE MAIL ORDER & L. I. SALES CENTER
111 Jericho Turnpike, Syosset, L.I., N. Y.

OTHER LOCATIONS

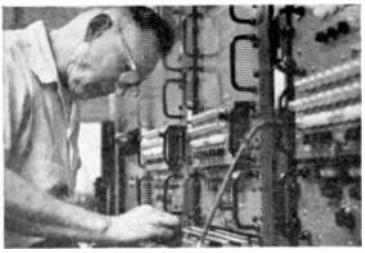
Jamaica, N. Y. — Newark, N. J.
Scarsdale, N. Y. — Plainfield, N. J.
New York, N. Y. — Paramus, N. J.
Bronx, N. Y. — Boston, Mass.
Natick, Mass.

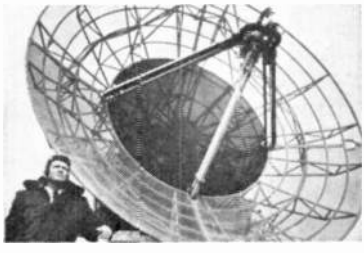
LAFAYETTE Radio ELECTRONICS Dept. IJ-3
P. O. Box 10, Syosset, L. I., N. Y. 11791

☐ Send me Stock No. ..... shipping charges collect.
$ ..... enclosed.
☐ I would like to order Stock No. ..... on the Easy-Pay Credit Plan.

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

☐ Send me the FREE 1964 Lafayette Catalog 640





Wide choice of Home Training courses in Electronics:

- Autotext
  - Introduction to Electronics
  - Introduction to Semiconductors
- TV Servicing
- Color TV
- Communications Electronics
- FCC License Preparation
- Mobile Communications
- Automation Electronics
- Electronic Fundamentals (also available in Spanish)
- Computer Programming
- Transistors
- Electronic Drafting
- Industrial Electronics
  - Automatic Controls
  - Industrial Applications
  - Nuclear Instrumentation
  - Digital Techniques

RCA Institutes Home Training Courses are complete step by step easy-to-understand units. You get prime quality equipment in the kits furnished to you, and all of it is top grade. It's yours to keep and use on the job.

Liberal Tuition Plan. RCA Institutes Home Training Courses are available under a liberal tuition plan that affords you the most economical possible method of home training. You pay for lessons only as you order them. If, for any reason, you should wish to interrupt your training, you can do so and you will not owe a cent until you resume the course. No long-term obligations!

Set Your Own Pace. RCA Institutes Home Training takes into consideration your own ability, finances and time. You learn at your own speed, in the most effective manner, with personalized instruction every step of the way. You get theory, experiment, and service practice beginning with the very first lesson. All lessons are profusely illustrated—a complete training package in every way.

CLASSROOM TRAINING

RCA Institutes Resident Schools in New York City, Los Angeles and RCA Technical Institute in Cherry Hill near Camden, N. J., offer classroom training that will prepare you to work in rewarding research and production positions in many fields of electronics. No previous technical training required for admission. You are eligible even if you haven't completed high school.

Free Placement Service. RCA Institutes Resident School graduates are now employed in important jobs at military installations, with important companies such as IBM, Bell Telephone Labs, General Electric, RCA, in radio and TV stations and in communications systems all over the country. Many other graduates have opened their own businesses. A recent New York Resident School class had 92% of the graduates who used the FREE Placement Service accepted by leading electronics companies, and had their jobs waiting for them on the day they graduated!

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

SEND POSTCARD FOR FREE ILLUSTRATED BOOK TODAY! SPECIFY "AUTOTEXT", HOME STUDY OR CLASSROOM TRAINING.

RCA INSTITUTES, INC. Dept. PE-03

A Service of Radio Corporation of America,
350 West 4th St., New York 14, N. Y.
Pacific Electric Bldg., 610 S. Main St., Los Angeles 14, Calif.

The Most Trusted Name in Electronics

Bookshelf

(*Continued from page* 32)

in service work, and to analysis of typical displayed waveforms. The value of the numerous illustrations is marred by a few exaggerations that amount to inaccuracies, and by some poor captions, at least two of which are transposed.

Published by Gernsback Library, Inc., 154 W. 14th St., New York 11, N.Y. Soft cover. 224 pages. $3.65.

SCIENCE PROJECTS IN ELECTRICITY

by Edward M. Noll

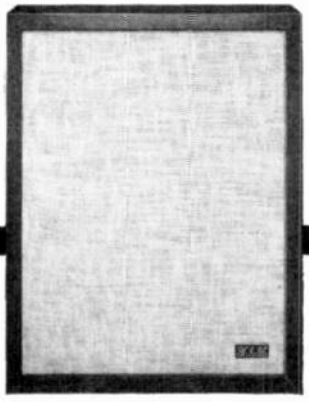
An elementary primer on electricity, this book should find its greatest audience among students at the elementary-junior high school level. A number of projects are described, mostly of the "light bulb-electromagnet-crystal radio" variety, but the emphasis is on the principles that make these devices operate rather than on the devices themselves. "Science Projects" should prove helpful to teachers or would-be electronics hobbyists.

Published by Howard W. Sams & Co., 4300 West 62nd St., Indianapolis 6, Ind. Soft cover. 144 pages. $2.95.

Free Literature

Hi-fi fans, hams, CB'ers, and anyone with an interest in electronics will want a copy of Lafayette Radio's new 1964 catalog. The 422-page annual, said to be the largest in the firm's history, describes the latest equipment of all major manufacturers. It can now be obtained from Lafayette Radio Electronics, P.O. Box 600, Syosset, L.I., N.Y. . . . A new 48-page catalog listing 1500 replacement transformers and coils for TV, radio, and hi-fi is available from Stancor Electronics, Inc., 3501 W. Addison St., Chicago 18, Ill. Much helpful information is included. . . . Also on the subject of transformers is an eight-page brochure from Central Transformer Company, 900 W. Jackson Blvd., Chicago 7, Ill. This publication deals with transformer design and how to determine your transformer requirements. . . . A real "assist" for tape fans is a tape timing chart published by Saxitone Tape Sales, 1776 Columbia Rd., N.W., Washington, D.C. The time for every conceivable footage, from speeds as low as 15/16 i.p.s. to speeds as high as 15 i.p.s., is given for full-track, dual-track, quarter-track tape recorders. —30—

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

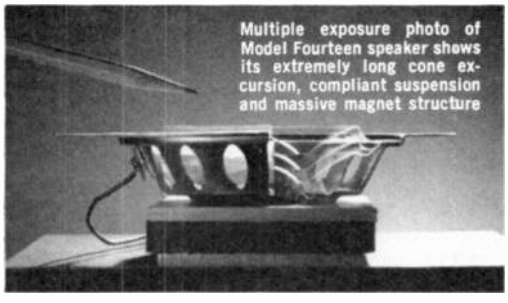


KLH Model Fourteen
18 x 14 x 3¾"
$49.50*

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

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

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



Multiple exposure photo of Model Fourteen speaker shows its extremely long cone excursion, compliant suspension and massive magnet structure

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

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

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

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

*Slightly higher west of Rockies

KLH RESEARCH AND DEVELOPMENT CORPORATION
30 CROSS STREET, CAMBRIDGE 39, MASSACHUSETTS

KLH Research and Development Corporation, P-2
30 Cross Street, Cambridge 39, Massachusetts
Please send information on KLH Model Fourteen and franchised KLH dealers to:
Name _____
Address _____

Let's start with scopes—essential for the experimenter. EICO has an excellent variety to choose from. The new full performance 430 General Purpose compact with 3" flat-face CRT; the 427 General Purpose DC scope; and one of the best thought of scopes in the DC wide band field, the 5" CRT 460.

If you work with transistor circuits, EICO has the team for you: the 1020 Power and Bias Supply with 0.005% ripple; and the 680 Transistor & Circuit Tester which combines transistor parameter measurements with a 20kΩ/V multimeter for dc voltage (to 50v) and resistor measurements.

If you're interested in RF you'll need a good, wide coverage RF signal generator with built-in audio modulation such as the EICO 324 (150 kc-435 mc), and a good VTVM such as the EICO 222 or peak-to-peak VTVM the 232. Use either one with RF VTVM probe PRF-11.

If you're interested in audio, EICO has an excellent Sine and Square Wave Audio Generator ranging from 20 cps to 200 kc, the 377. You'll also need an AC VTVM. The 12-range EICO 250 (measures 100 μV to 300V) is an excellent choice. It has a panel switch that converts it to a broadband amplifier with 60 db gain and over 5V undistorted output. The EICO 261 AC VTVM and Wattmeter has 11 ranges (measures 1 mv to 1000V) and it includes a tapped 4, 8, 16 and 600 ohms power resistor handling up to 80 watts as well as load compensated wattmeter ranges. In general you will need an EICO 222 or 232 VTVM as well, for measuring up to 1500 VDC or AC, and for resistance measurements.

If you like to draw materials from a "junk" box, you'll need a Resistance-Capacitance Bridge, EICO 950B, which measures capacity from 10 μμf to 5000 μf, resistance from 0.5 ohm to 500 meg., and contains a continuously variable 0-500 VDC supply for a sensitive capacitor leakage test. Complementing it is the 955 for in-circuit capacitor short—open testing, and capacity measurements with unique shunt resistance balancing.

For trouble shooting audio, IF, and RF circuits, the 147A Multi-Signal Tracer has both RF & audio inputs with demod & direct probes, noise locator circuit, wattmeter, substitution tests, & eye-tube and speaker monitors. And for testing tubes nothing beats the economical EICO 628 Emission Type Tube tester. The new 667 Dynamic Conductance Tube and Transistor Tester is the best in the field. Both test all the new tube types including Nuvistor, Novar, 10-pin, Compactrons, etc.

Other handy items are EICO substitution and decade boxes: EICO 1100 covers EIA resistance values from 15 ohms to 10 meg.; the 1120 EIA capacitance values from 100 mmf to 0.22 mf. The 1140 combines both 1100 and 1120 in one box and permits series or parallel combinations as desired. The 1171, a Precision Decade Resistance Box, covers 1 to 99,999 ohms in 1-ohm steps; and EICO 1180, a precision Capacitance Decade Box, covers 100 mmf to 0.111 mf in 100 mmf steps.

If you want to know how a circuit performs with varying line voltage, or to correct for varying line voltage during an experiment, the EICO 1078 Metered Variable Auto-Transformer AC Bench Supply provides 0-140 VAC continuously variable, from 120 VAC line input with a 7½ amp. current rating. Output current and voltage are separately metered.

If you're an experimenter or technician, you'll find that EICO test equipment can make any job easier. You can also be sure, that when you select EICO instruments, as a kit or factory-wired, you get the most performance for your dollar.

See the most complete line of test instruments (kit and factory-wired) at your distributor.

A guide to what the well equipped experimenters' workbench looks like

PRICES OF EICO EQUIPMENT (k=kit; w=wired)—**430** (k. $65.95; w. $99.50); **427** (k. $63.95; w. $109.95); **460** (k. $89.95; w. $129.50); **1020** (k. $23.95; w. $29.95); **680** (k. $25.95; w. $39.95); **324** (k. $28.95; w. $39.95); **222** (k. $27.95; w. $42.95); **232** (k. $49.95; w. $99.95); **PRF-11** (k. $3.95; w. $4.95); **377** (k. $37.95); w. $54.95); **250** (k. $49.95; w. $79.95); **261** (k. $49.95); w. $79.95); **950B** (k. $23.95; w. $29.95); **955** (k. $19.95; w. $39.95); **147-A** (k. $29.95; w. $44.95); **628** (k. $44.95; w. $59.95); **667** (k. $79.95; w. $129.95); **1100** (k. $7.95; w. $12.95); **1120** (k. $6.95; w. $10.95); **1140** (k. $14.95; w. $19.95); **1171** (k. $24.95; w. $29.95); **1180** (k. $17.95; w. $24.95); **1078** (k. $42.95; w. $54.95).

EICO ELECTRONIC INSTRUMENT CO., INC.
3300 Northern Blvd., L. I. C. 1, N. Y.

Send free PE-10

- ☐ 28 page catalog
- ☐ Short Course for Novice License
- ☐ Send 36-page Stereo Hi-Fi Guide for which I enclose 25c for postage and handling.

Name_____

Address_____

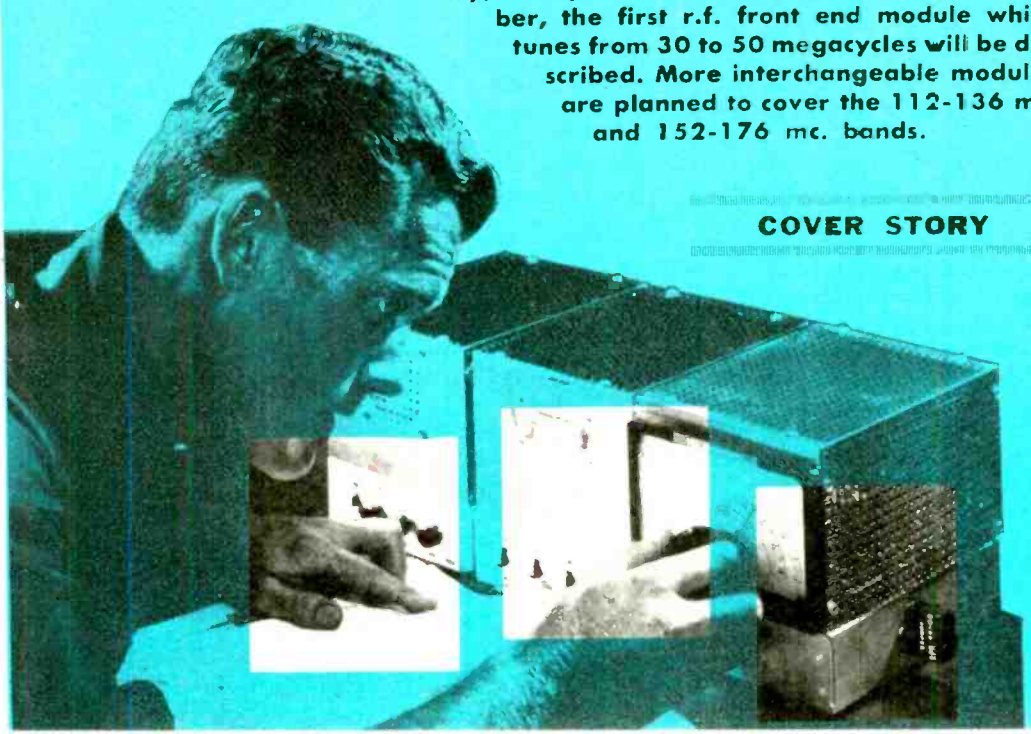
City_____ Zone____ State_____

VHF adventurer

Sensitive multi-band AM/FM superhet constructed with interchangeable front ends—Part 1 of 3

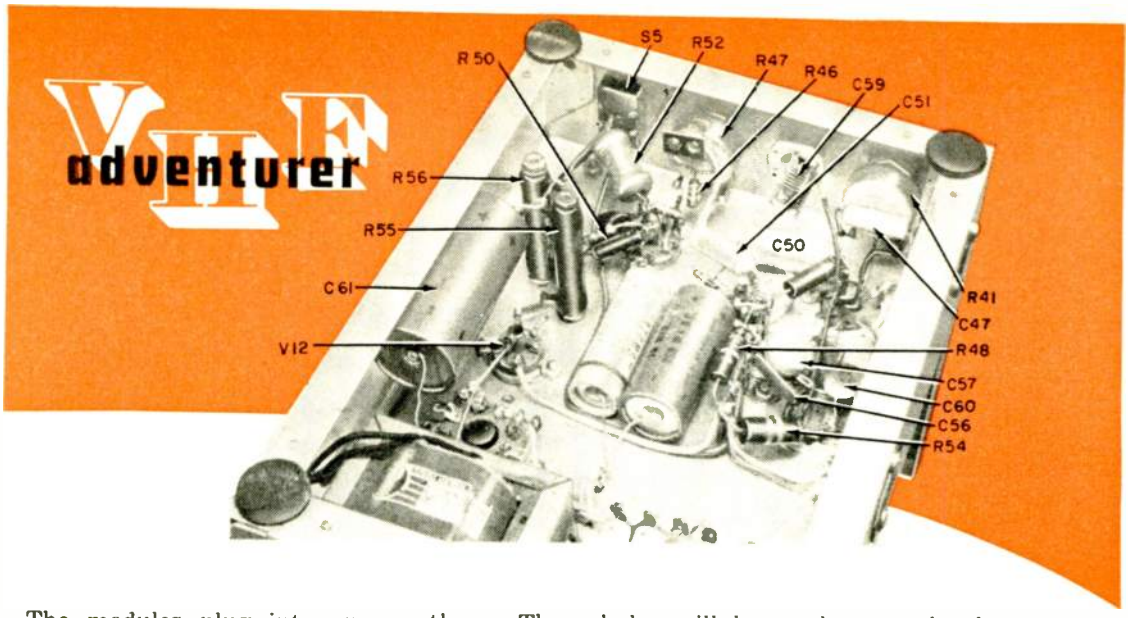
By JAMES G. LEE, W6VAT

HERE IS SOMETHING NEW in the way of radio receiver construction. Designed to fulfill the requests of hundreds of readers for a VHF receiver to listen in on police and fire company units, airplanes, etc., the VHF ADVENTURER can be constructed at home, a module at a time. Part 1 of this article covers the module containing the power supply, audio amplifier, noise limiter and BFO. In next month's installment, we will detail the construction of the i.f. strip, AM/FM detectors and S-meter circuitry, and perform initial alignment. In December, the first r.f. front end module which tunes from 30 to 50 megacycles will be described. More interchangeable modules are planned to cover the 112-136 mc. and 152-176 mc. bands.



COVER STORY

VHF adventurer



The modules plug into one another, and although this method of construction is recommended, there is no prohibition against mounting the components of all three of the modules needed for 30-50 mc. reception on one large chassis. Unlike the simple superregenerative receivers POPULAR ELECTRONICS has published in the past, the VHF ADVENTURER is not a project for the beginner. It will also require a modest amount of test equipment, including a signal generator, audio oscillator, VTVM, and grid dipper.

The Chassis. The author found it convenient to build each of the three modules on a 6″ x 8″ x 2″ chassis. Units having these dimensions appear to be available only from the California Chassis Company. Since the builder may prefer to buy Bud Radio or Premier metal chassis having only slightly larger dimensions, these two alternatives are itemized in the Parts List.

The front and back panels for all three modules are shown on page 45. Before cutting out these panels, get the chassis. If California Chassis Type A-120's are used, the dimensions shown will apply. However, if Premier or Bud chassis are used, the width of the panel must be increased by 1 inch.

Cut out six panels from Reynolds sheet aluminum, available in practically every hardware store. Notch out ½″ squares at each corner and bend up the lips after the holes have been drilled. These holes will be used to retain the wrap-around perforated cover.

In one panel cut out a hole for the 3″ PM speaker. This is the front panel of the audio module. Set the other panels aside until needed.

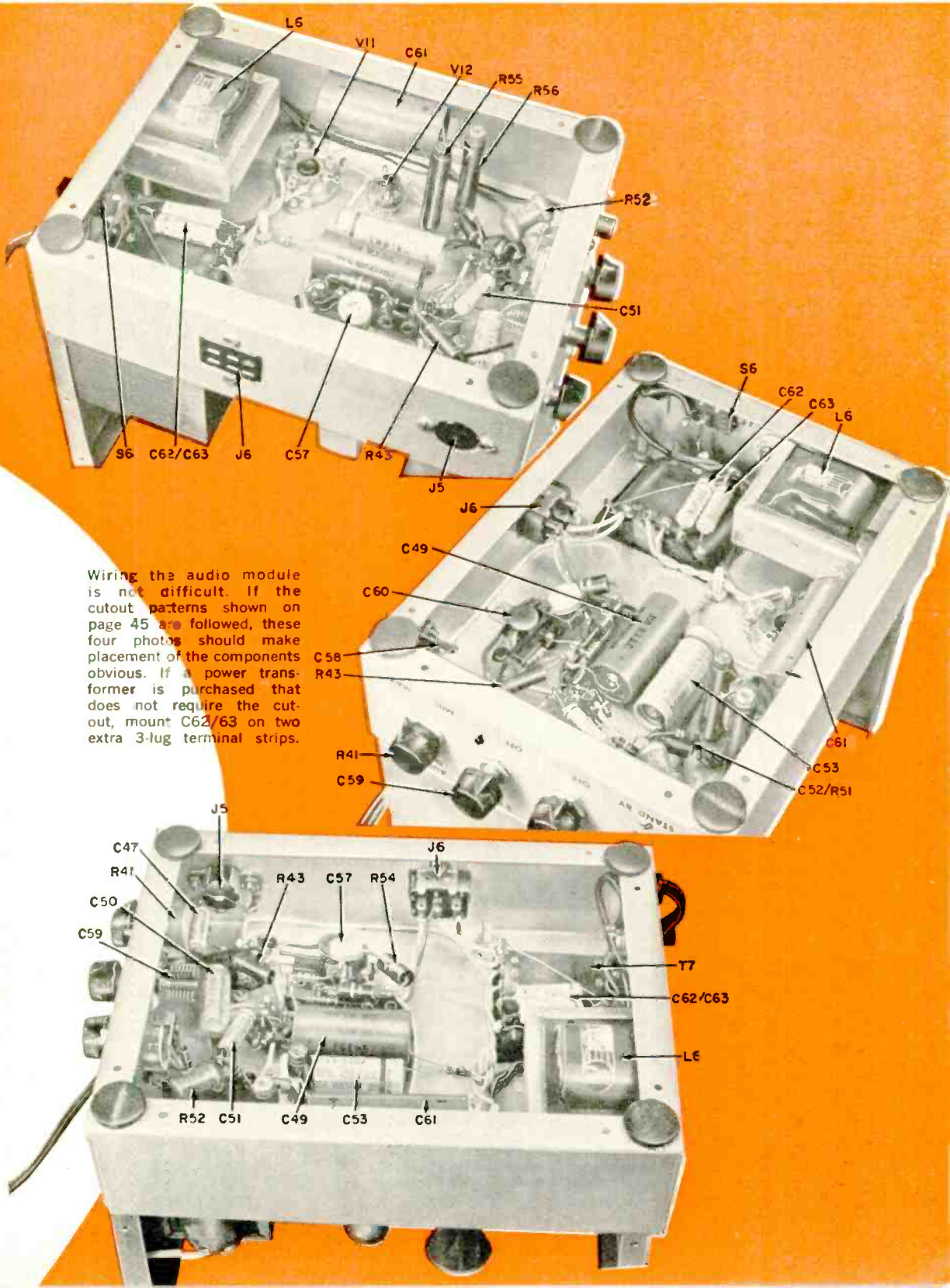
Construction of Audio Module. The arrangement of parts in the audio module is not critical. However, for convenience, the general layout shown in the photographs on these two pages should be followed. As noted in the Parts List, the chassis used by the author may not be commonly available. If one of the slightly larger substitute chassis is used, the builder should find it easy to adjust the cutouts to suit the chassis.

Be sure to obtain all of the parts before cutting into the chassis. This is particularly important if you make a power transformer (*T7*) substitution—some transformers do not need the large cutout, but may be mounted on top of the chassis, with the leads fed through grommeted holes to reach the underside.

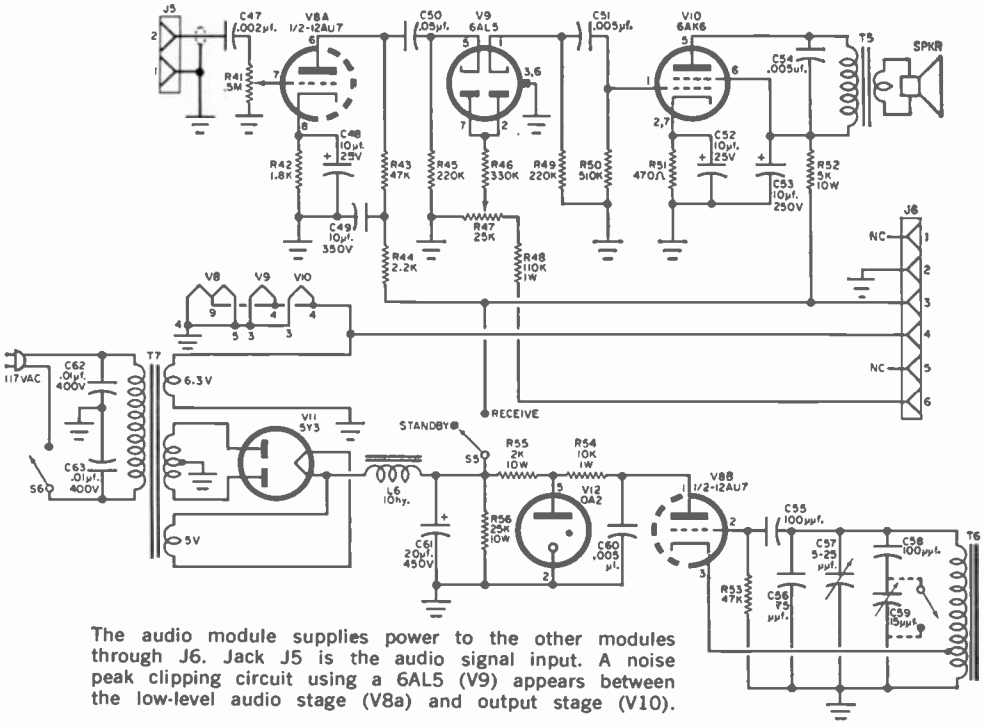
It is always good practice to color-code your wiring. Choose colors for B+ delivery, filaments, grid returns, etc., and stick with them. Should you have to do any trouble-shooting, the colors will make your job that much easier.

Commence assembly by mounting all of the tube sockets and power transformer *T7*. Solder into place *C60*, *C61*, *C62*, *C63*, *L6*, *R54*, *R55*, *R56*, *S5* and *S6*.

(*Continued on page* 46)



Wiring the audio module is not difficult. If the cutout patterns shown on page 45 are followed, these four photos should make placement of the components obvious. If a power transformer is purchased that does not require the cutout, mount C62/63 on two extra 3-lug terminal strips.

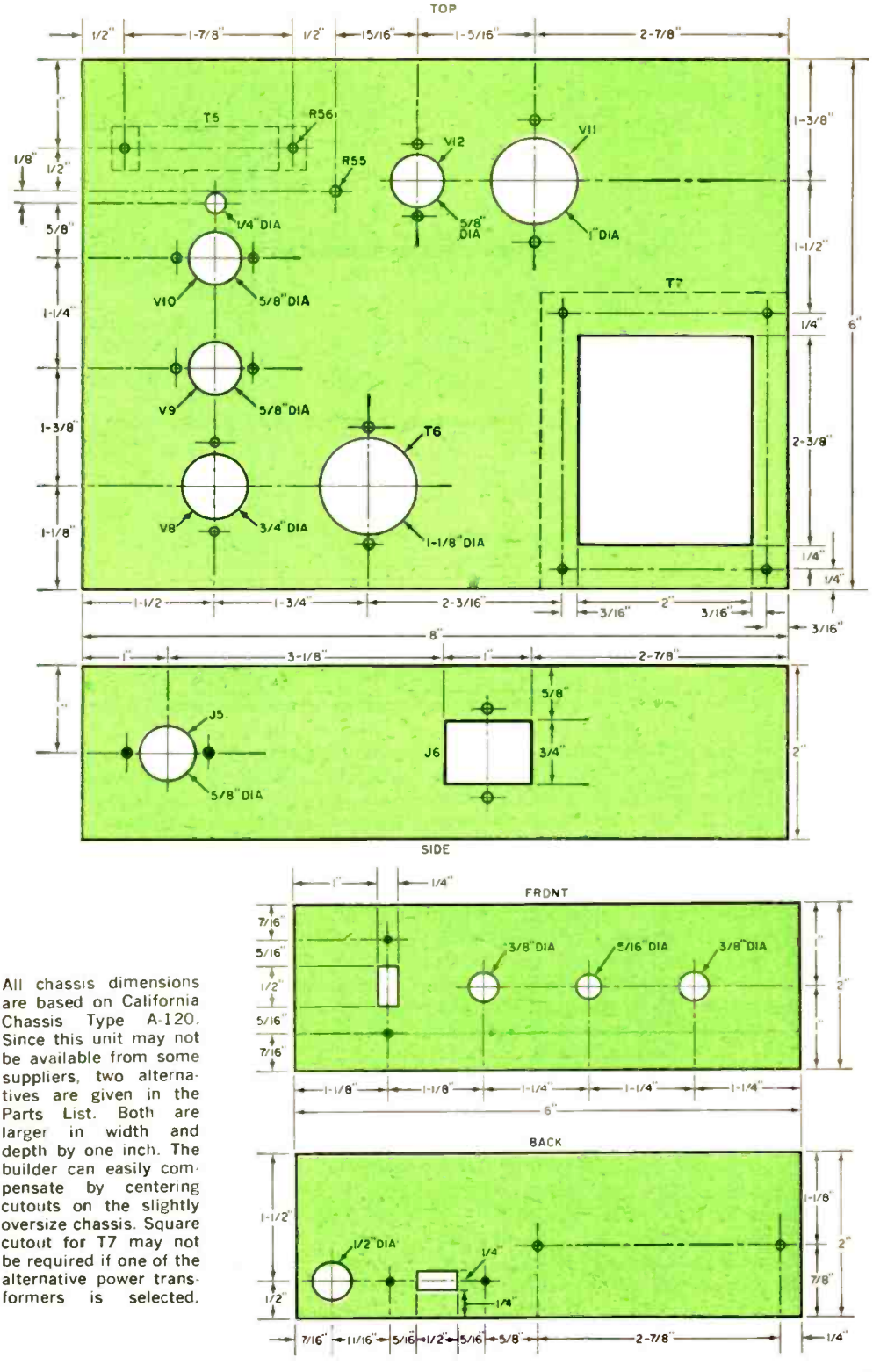


The audio module supplies power to the other modules through J6. Jack J5 is the audio signal input. A noise peak clipping circuit using a 6AL5 (V9) appears between the low-level audio stage (V8a) and output stage (V10).

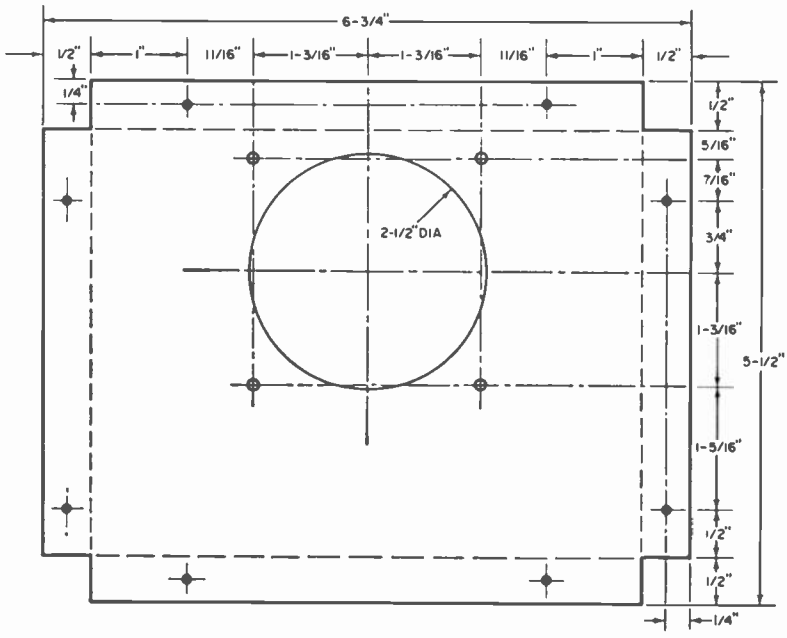
PARTS LIST

C47—0.002-μf., 600-volt tubular capacitor
C48, C52—10-μf., 25-volt electrolytic capacitor
C49—10-μf., 350-volt electrolytic capacitor
C50—0.05-μf., 600-volt tubular capacitor
C51, C54—0.005-μf., 600-volt tubular capacitor
C53—10-μf., 250-volt electrolytic capacitor
C55, C58—100-μμf., 10% mica capacitor
C56—75-μμf., 5% mica capacitor
C57—4.5-25-μμf. ceramic trimmer capacitor (Centralab 822-AZ or equivalent)
C59—15-μμf. miniature variable capacitor (E.F. Johnson 160-107 or equivalent)
C60—0.005-μf., 600-volt disc ceramic capacitor
C61—20-μf., 450-volt electrolytic capacitor
C62, C63—0.01-μf., 600-volt tubular capacitor
J5—Chassis-mounted jack (Cinch-Jones S-302-AB or equivalent)
J6—Chassis-mounted jack (Cinch-Jones S-306-AB or equivalent)
L6—10-h., 90-ma. filter choke (Triad C-7X or equivalent)
R41—0.5-megohm potentiometer
R42—1800 ohms
R43, R53—47,000 ohms } *all resistors ½ watt unless otherwise noted*
R44—2200 ohms } *all resistors ½ watt unless otherwise noted*
R45, R49—220,000 ohms } *all resistors ½ watt unless otherwise noted*
R46—330,000 ohms
R47—25,000-ohm potentiometer
R48—110,000 ohms, 1 watt
R50—510,000 ohms
R51—470 ohms
R52—5000 ohms, 10 watts (IRC Type AA or equivalent)
R54—10,000 ohms, 1 watt
R55—2000 ohms, 10 watts
R56—25,000 ohms, 10 watts
S5, S6—S.p.s.t. slide switch
T5—Audio output transformer, 10,000 ohms to voice coil (Stancor A-3822 or equivalent)
T6—Miniature oscillator coil (J.W. Miller B-121-C or equivalent)
T7—Power transformer; primary, 117 volts a.c.; secondaries, 700 volts CT @ 120 ma., 6.3 volts @ 3.0 amp., 5.0 volts @ 2.0 amp (author used non-standard brand equivalent—except for case dimensions—to Triad R-114B or Stancor PM-8410)
V8—12AU7A tube
V9—6AL5 tube
V10—6AK6 tube
V11—5Y3 tube
V12—OA2 regulator tube
SPKR.—3" PM speaker
1—California Chassis Co. Type A-120 chassis; if not available locally, write to 5445 E. Century Blvd., Lynwood, Calif. (or use Bud AC-406 or Premier ACH-404 which are 1" larger in depth and width, and adjust cutouts accordingly)
Misc.—Line cord, decals, aluminum screening, knobs, screws, nuts, wire, tie points, tube sockets, shields, solder, etc.

EDITOR'S NOTE: The component numbering scheme used in presenting the VHF ADVENTURER, a three-part article, is as follows: The lowest numbers refer to the 30-50 megacycle converter, the next numbers to the i.f. stages and the AM/FM detector. The highest component numbers apply to the audio module, the section of the ADVENTURER described in this issue. Numbering has been arranged in this fashion to simplify construction and the presentation of service data.



All chassis dimensions are based on California Chassis Type A-120. Since this unit may not be available from some suppliers, two alternatives are given in the Parts List. Both are larger in width and depth by one inch. The builder can easily compensate by centering cutouts on the slightly oversize chassis. Square cutout for T7 may not be required if one of the alternative power transformers is selected.



The builder will need six sheet aluminum panels for the three modules. The front panel on the audio module requires a speaker cutout; the back panel is plain. Buy the chassis before cutting out your panels to be sure they fit—see text.

Attach the line cord and, after inserting *V11* and *V12*, turn on the power supply to check voltages. From the junction of *R55* and *R56* to ground, you should get at least +250 d.c. If *V12* is glowing a merry purple, you'll know that the stabilized voltage to feed *V8b* is okay.

Turn off the power supply and wire in the filament leads to *J6*, *V8*, *V9* and *V10*. Begin the audio stage wiring by mounting *T5* and then installing all of the ground leads to *J5*, *J6*, *R41*, *V8*, *V9* and *V10*. Mount a 5-lug terminal strip with one end near *V9* and extending toward the rear of the chassis; the mounting foot can go under the ring that holds *T6* in place. Bring a B+ lead from *S5* to the terminal strip so that you can feed *R44* and *R52*. Also connect B+ to *J6* so that the next module can be powered.

Wiring should proceed from *V10* backwards through *V9*, finally reaching *V8a*. If the photographs are followed exactly, the shielded lead between *J5* and *C47* shown in the wiring diagram will be unnecessary. This area is subject to hum pickup and any lead over ¾" in length should be carefully shielded.

There is no on-off switch for the BFO. In its place, the author carefully bent the tip edge of the last rotor plate of *C59* so that it "short-circuits" when fully meshed. This does not disable the BFO, but simply "pushes" the frequency much lower and out of the range of the i.f. strip. Otherwise, the wiring of the section around *V8b* is straightforward.

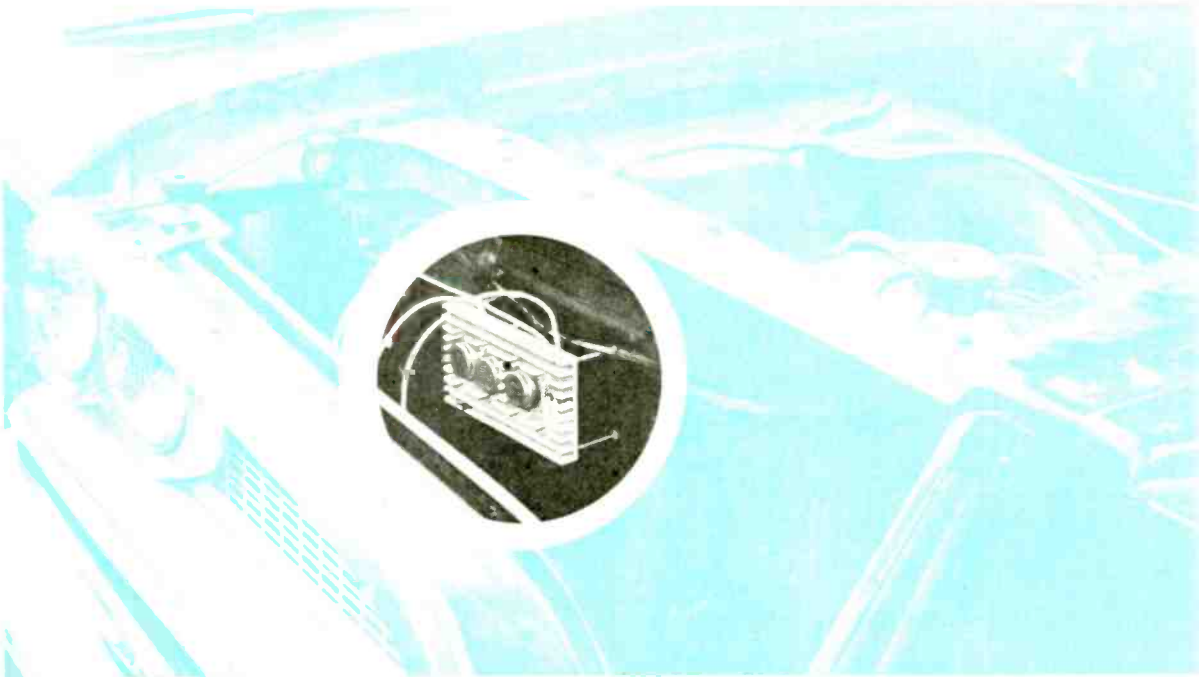
Mount and connect the small speaker, and the audio module is ready for testing. Decals can be added after testing, or at a later date when the entire receiver has been constructed.

Testing. Obviously, you can "prove" that this module is operating by touching pin 2 of *J5*—a loud, buzzing hum should be heard in the speaker. If test equipment is available, feed a 1000-cycle audio signal into *J5* and measure the a.c. output voltage across the speaker leads. A 100-millivolt audio input should enable you to set up a 0 db reading.

As the input frequency is increased to 3500 cycles, the output should drop about 3 db. The same reaction should take place when the audio input frequency is decreased to 250 cycles. Note that the VHF ADVENTURER is a voice-only instrument and not designed for high-quality audio.

The BFO operation can be checked by listening around 4.5 mc. with a short-wave communications receiver. Further adjustment of the BFO must await construction of the i.f. module.

(To be continued next month)



OPERATION PICKUP Mk II

You asked for it! Here's how you can adapt P.E.'s original transistorized ignition system for 6- and 12-volt positive grounds, 6-volt negative grounds

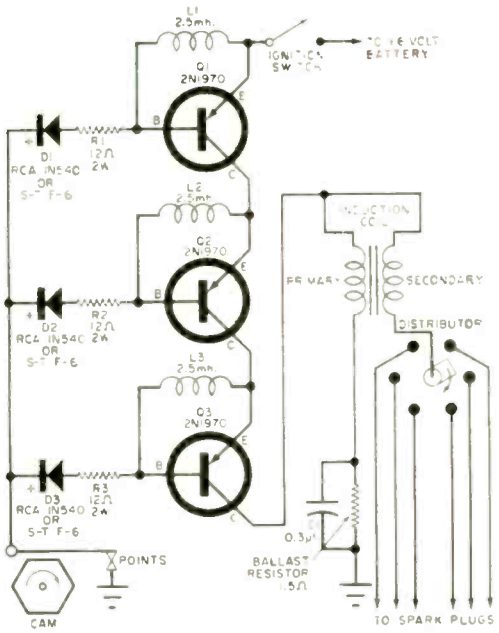
By C. E. RUOFF

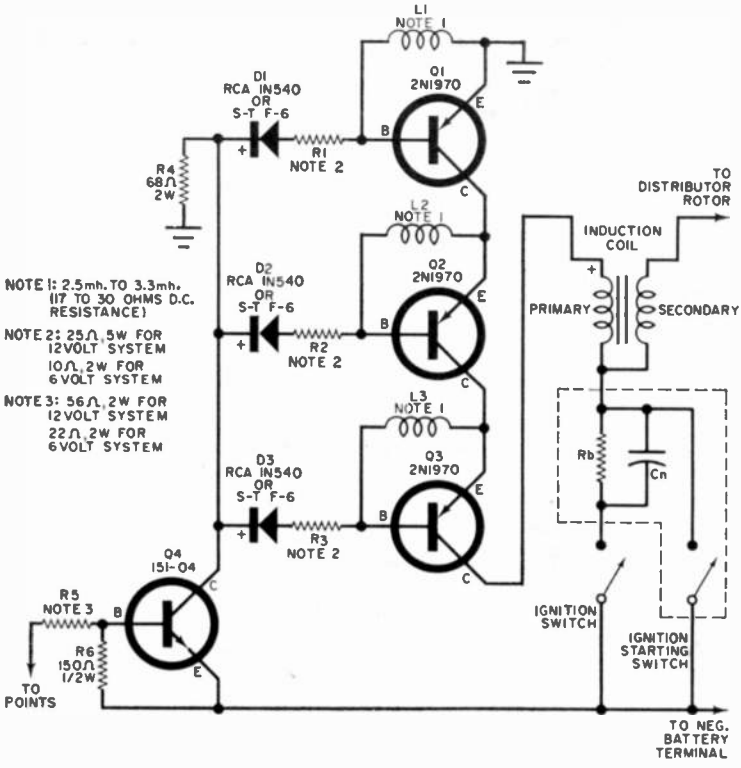
OPERATION "PICKUP" (June, 1963) will go down in the annals of POPULAR ELECTRONICS as the article that created the largest avalanche of reader mail in history. Hundreds of letters, post cards, and phone calls have kept the editorial staff hopping. Reports from users are now coming in, and P.E.'s enthusiastic endorsement of the PICKUP has been verified time and time again.

Six-Volt Negative Ground Cars. In response to hundreds of requests, a schematic diagram for building a 6-volt negative ground system is given at right. It differs from the original PICKUP in that lower values are used for *R1*, *R2*, and *R3*, alternatives are suggested for diodes *D1*, *D2*, and *D3*, and new chokes are specified for *L1*, *L2*, and *L3*.

Although the originally recommended 1N602 diodes appear to work quite well, a greater degree of long-term safety results from use of higher rated diodes comparable to the RCA 1N540 or Sarkes-Tarzian F-6. Good performance is now being obtained (in both 12- and 6-volt negative ground systems) with the Su-

The 6-volt negative ground system only involves changing a few parts values.





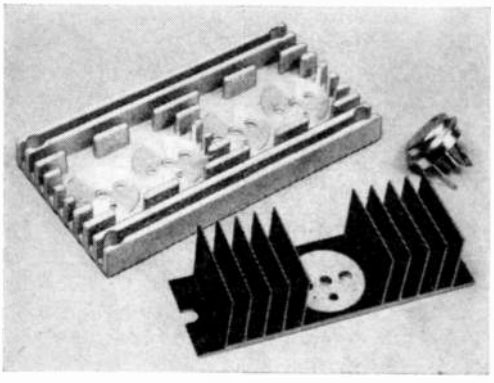
This schematic shows the wiring of either a 12- or 6-volt positive ground ignition system. Cars with 6-volt batteries do not have the ignition starting switch, or resistor Rb and capacitor Cn shown within the dashed lines. The ignition switch in 6-volt cars connects directly to the coil. The capacitor which shunts the breaker points must be removed in all cases.

perex M-25 choke; when it is used, no series resistor is necessary between the base and emitter of the transistors. Some builders have used a Bud Radio CH-1212 choke with satisfactory results.

Positive Ground Cars. A positive ground ignition system requires the addition of a single *npn* silicon transistor. The only transistor suitable for this purpose is the Westinghouse 151-04, which is not commonly available. However, POPULAR ELECTRONICS has made arrangements to have these transistors shipped from Schweber Electronics, Jericho Turnpike, Westbury, L. I., N. Y. The price is $5.80 including packing and mailing. Enclose payment with your order addressed directly to Schweber.

Part value changes to adapt the positive ground system to either 6- or 12-volt cars are noted in the schematic above. Chokes *L1*, *L2*, and *L3* may be the same as used in the 6-volt negative ground system on the preceding page. The capacitor that shunts the points must be removed—as is true with all of the PICKUP systems.

Heat Sinks and Mounting. For convenience in building your PICKUP, Delco



Pre-punched heat sinks save the builder time and trouble. The CESCO HS-4 (upper left) should be used for positive ground systems. The new Delco 7276040 (lower right) has more heat dissipating capability than the original Delco 7281360 sink.

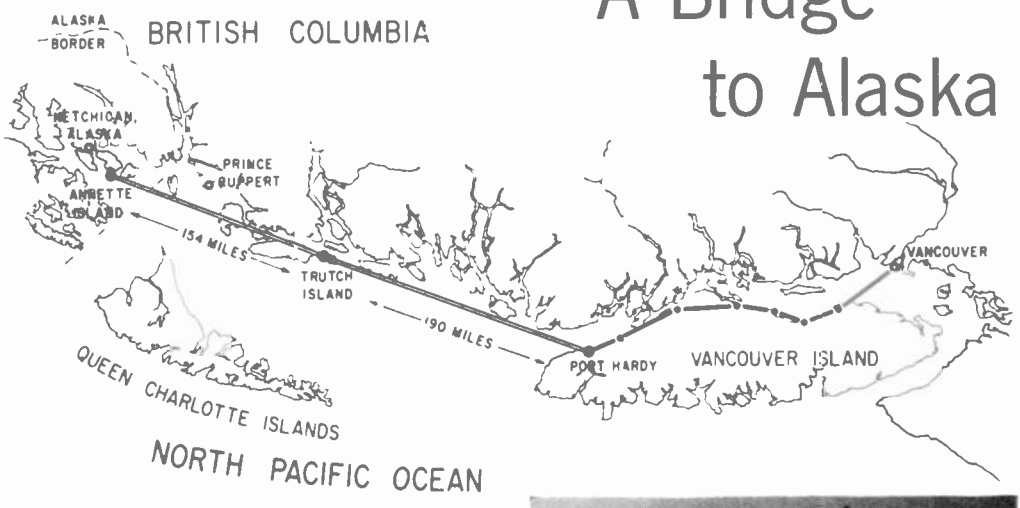
has made available its new heat sink, pre-punched for the 2N1970 transistors; it bears the number 7276040. Still greater convenience results from use of the CESCO HS-4 heat sink which is pre-punched to mount four transistors. The Delco heat sink costs 90 cents (three are required), the CESCO $1.95.

The photograph on the preceding page shows a 12-volt, negative ground system using a CESCO heat sink. Instead of mounting the heat sink on the fire wall, the PICKUP was attached to the sheet

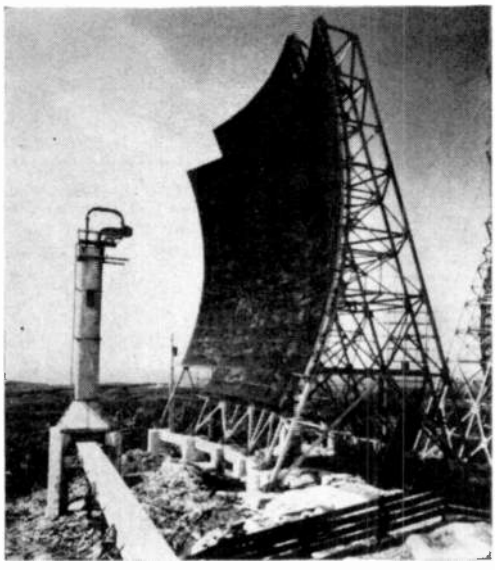
(*Continued on page* 107)

Tropospheric Scatter:

A Bridge to Alaska



The tropospheric scatter network has two legs with a central relay as shown by the map (the link from Port Hardy to Vancouver is conventional microwave). Each antenna—see photo at right—weighs 70 tons and is built of galvanized steel sheets to take winds up to 120 m.p.h.



ONE OF THE FIRST high-capacity commercial tropospheric scatter systems to go into operation will shortly bridge the icy coastal waters between Annette Island, Alaska, and Vancouver Island, British Columbia.

Tropospheric scatter relies on the fragmentary refraction of microwaves back to earth by the troposphere—the turbulent layer of atmosphere extending up to six miles. This type of radio propagation requires very high power and huge transmitting antennas which beam a signal just over the horizon so that refraction occurs several miles above the earth. Highly sensitive receiving equipment is necessary to reconstruct the transmitted signal.

As shown in the map above, the Annette-Port Hardy link required use of a central relay located on Trutch Island. The system includes two transmitters, four receivers and two antennas—70-ton, 60-foot-square monsters—at Annette and Port Hardy, and four transmitters, eight receivers, and four antennas at Trutch Island.

The $5 million, 344-mile link provides 240 channels for voice communications and data transmissions. At Vancouver Island, a conventional 275-mile microwave radio system connects with the city of Vancouver and telephone circuits to the United States. The installation at tiny, storm-tossed Trutch Island, which is manned on a 24-hour basis, necessitated the formation of a community with all utilities for 27 people.

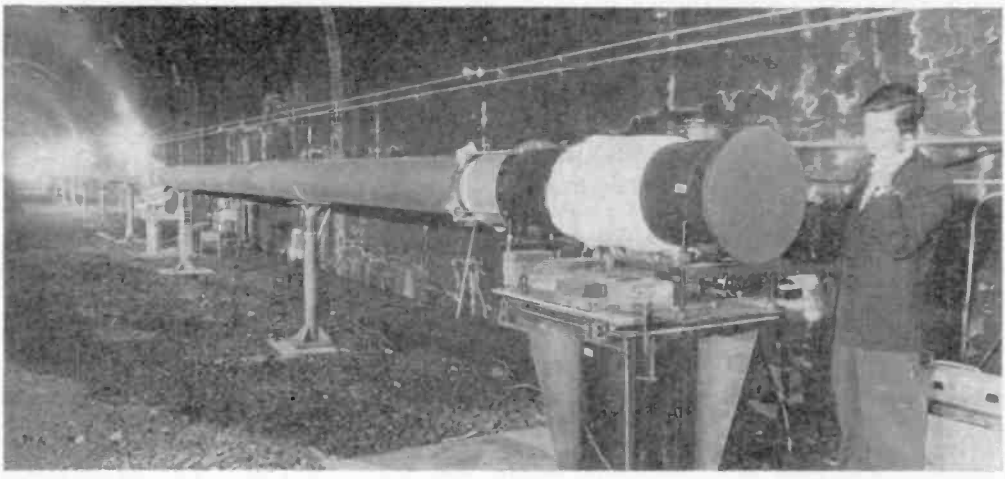
The tropospheric network was constructed by General Telephone & Electronics Corp. and its subsidiaries. -30-

POPULAR ELECTRONICS news

Radio-Controlled Dog. Named "Dog of the Year" by the Alexandria, Va., Kiwanis Club, "Mucho" offers a paw to his pal and handler, Eugene Yoakum. Yoakum devised "radio control" technique whereby Mucho takes voice commands from him up to a mile away. Efforts were made to jam radio and substitute orders, but dog takes only Yoakum's.

Super-Mobile. Can you match this? K2HQE, Vince Leon of Massapequa, L.I., can run a kw. from his Cadillac, on 80 through 2 meters, using AM, SSB, c.w., or Duplex TV. Rig includes two 3-kw. generators, six 12-volt batteries, 21 whips, 7 speakers, 22 meters, 175′ of RG-8/U, recorder, TV set.

Drawing A Line. How do you draw a straight line two miles long without deviating more than 1 mm? Physicists are learning how in an abandoned railroad tunnel south of San Francisco so that answer can be incorporated in two-mile linear accelerator being built by Stanford University.



Split-second timing is vital in dozens of operations from firing moon rockets to checking hot rod performance at the local drag strip. Equip yourself to make highly accurate time checks by building the . . .

ELECTRONIC STOP WATCH

By FRED BLECHMAN, K&UGT

FOR YEARS the standard device for accurate elapsed time measurement in sporting events and industrial processes has been the hand-held stop watch. This works well for many purposes, but it has its shortcomings and limitations. For one thing, it can't very well be operated remotely, and most models are limited to a total elapsed time of fifteen minutes, when the hands are again on zero. And you do have to remember to wind it, of course.

Also, pricing a good jeweled-movement stop watch capable of tenth-second accuracy at the local jeweler's will probably get you a quotation of $25.00 or more.

For less than $21.00 you can build this electronic stop watch that will time events in seconds and tenths, up to a total of more than 27 *hours*, yet can be reset to zero in seconds. Readout is entirely in Arabic numerals, with no unnumbered dial marks to interpret, and remote control can be added for about $4.00, with safe isolation of the control circuit from the power line.

You can time almost any kind of race or

ELECTRONIC STOP WATCH

sporting event, and scores of other things like free-flight model airplane endurance flights, photographic time exposures or developing processes, phone call duration, lab experiments, and . . . but the list of potential uses is endless.

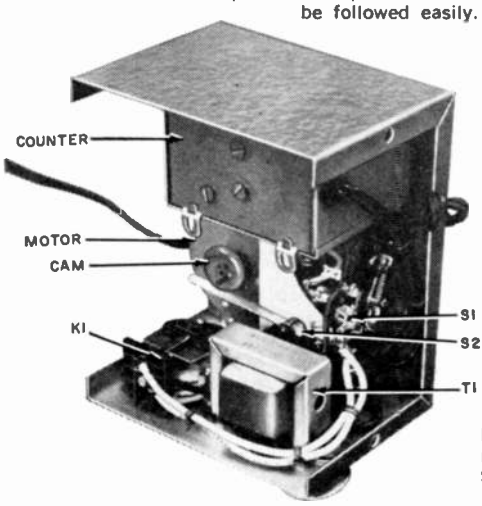
How It Works. The heart of the electronic stop watch is a 600-rpm synchronous motor. The shaft speed of this motor is directly controlled by the *frequency* of the 60-cps a.c. line voltage (not the voltage), which is maintained by the utility company to an accuracy of 0.1 of 1 per cent, or better. At 600 rpm, the motor shaft makes 10 revolutions per second. A plastic cam mounted on the shaft opens and closes a snap-action switch ten times per second. Each switch closure advances an electronic counter one digit, indicating the lapse of 0.1 second.

Since the counter has six digits, 99,-999.9 seconds can be counted without interruption—a total of 27.77+ hours. The control switch has a standby position (marked *STDBY*) between the *OFF* and *TIME* positions. In this position, the motor is started and allowed to get up to full synchronous speed, which requires about one second. If this were not done, the timing during the first second would be slow, causing a serious error in measuring duration of events that last no more than a few seconds.

Note also that when the switch is moved from *TIME* to *STDBY* at the end of a timing operation, the motor continues to run, and the unit remains in readiness for the next timing operation.

With the switch at *STDBY*, the timer can also be controlled from a remote point (if you elect to include this feature) by merely closing a switch to initiate a timing period and opening it at the termination. This can be done either manually or automatically by the mechanism of the operation being timed, such as the rise of a starting gate. Since the remote line carries only the current needed to close a relay, it is not necessary to shield

Fig. 1. The author's layout of parts is compact, and can be followed easily.



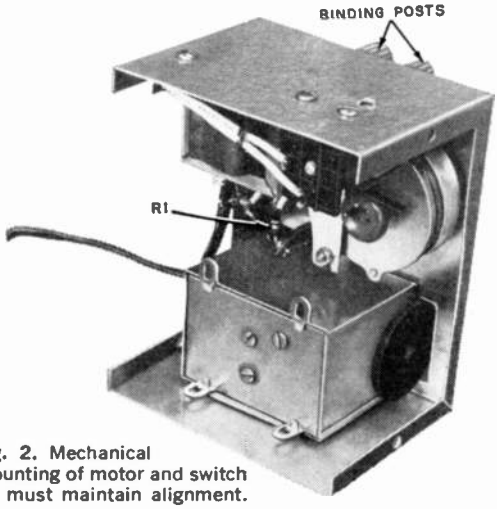


Fig. 2. Mechanical mounting of motor and switch S2 must maintain alignment.

it, and it can have several ohms resistance without affecting operation.

The pilot lamp provides a visual alerting signal to let the user know that the unit is standing by, or actually counting. In a noisy environment (such as a drag strip), the muted clicking of the leaf switch can't be heard when the unit is at *STDBY*.

Construction. For correct electromechanical operation, three of the component parts are critical. The motor must be a 600-rpm unit of the *synchronous* type, and it must have sufficient torque to operate the switch. The smallest, lightest, and least expensive motor filling these requirements, and having the added advantage of ready availability, is specified in the Parts List.

In order to use the motor called for, the operating force required by the snap-action switch must be very small. The switch specified requires an operating force of only four grams, and comes with the necessary leaf actuator already attached.

The 6-digit electrically operated counter has a built-in full-wave bridge rectifier circuit, which serves two important purposes. It converts a.c. line current to d.c., which is required by the counter actuating coil for operation at the ten-counts-per-second rate used. It also provides a conductive path across the coil

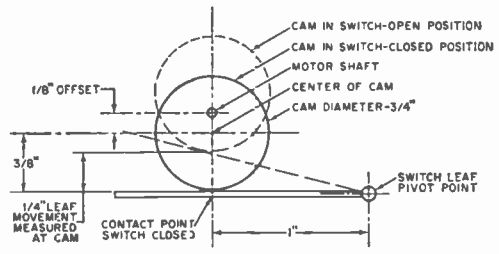


Fig. 3. Dimensions shown must be followed closely to insure correct cam and switch action.

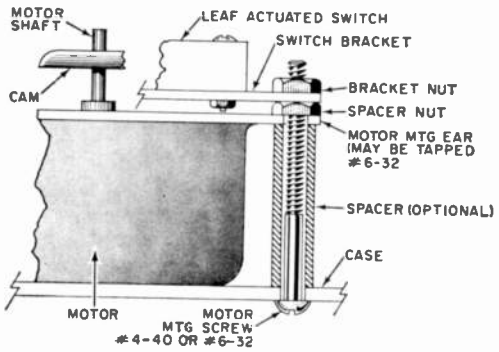
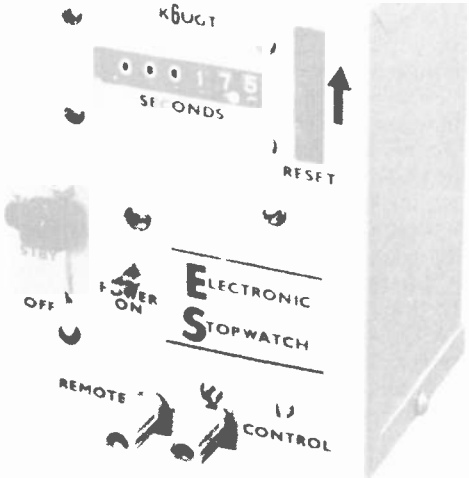


Fig. 4. Use of spacer tube and nut will avoid risk of bending motor case and misaligning cam.

terminals to dissipate the transient voltage generated when the actuating voltage is interrupted by action of the motor-driven switch. If you want to substitute another counter for the one specified, it *must* have a similar bridge rectifier circuit.

The layout of the author's unit is shown in Figs. 1 and 2. Since wiring is not critical, the layout can be altered to suit the constructor's preferences. However, good mechanical positioning and rigidity between the motor shaft and the snap-action switch is very important. The necessary mechanical relationship between these parts is shown in Fig. 3.

The control switch may be a rotary type if desired, but the lever switch specified allows more precise start-stop control. Another alternative would be to use a push-button switch as a means for starting and stopping the actual timing function, with the lever switch controlling the off and standby conditions. If a push-on, push-off type of switch is used, the Electronic Stop Watch will require less relearning on the part of users who



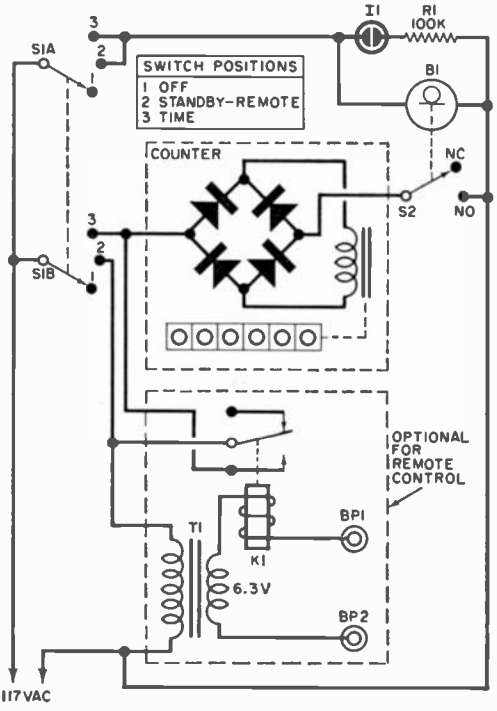


Fig. 5. Wiring is not critical but it must be kept clear of the cam and snap-action switch.

PARTS LIST

I1—NE-2 neon panel lamp
R1—100,000-ohm, ¼-watt carbon resistor
S1—2-pole, 3-position lever switch, non-shorting (Centralab PA-7001 or equivalent)
S2—Miniature snap-action switch, with integral leaf (Acro 2CMD1-2AXX-A24)*
1—117-volt a.c., 6-digit type counter (Lafayette F-553)*
1—600-rpm, 20-inch/ounce synchronous motor (Synchron Model 630, Herbach & Rademan H1-26)*
1—5" x 4" x 3" aluminum utility box (Premier PMC-1005 or equivalent)
Misc.—Line cord and plug, panel marking decals, sheet metal screws, machine screws and nuts, terminal strip

Optional for Remote Control

BP1, BP2—Insulated binding post
K1—6.3-volt a.c. relay (Advance GIIA-1C-6AC or equivalent)
T1—6.3-volt, 0.75-ampere heater transformer

**Do not substitute for these parts. Equivalent items may be used for all other parts.*

are familiar with the ordinary mechanical stop watch.

The counter specified comes with a removable escutcheon plate that allows additional mounting flexibility; it was not used in the author's unit. In quiet surroundings, the counter is a bit noisy when it is running. If the sound is undesirable, insulate the counter from the panel with soft rubber grommets, and wrap the counter with a layer of styrofoam or foam rubber.

The filament transformer, relay, and *REMOTE CONTROL* terminals are optional parts, necessary only if you want to use the remote control feature. The parts are small, and can be added to the basic unit without difficulty. However, be sure to insulate the terminals and the contacts of relay *K1* from the box, if a metal box is used.

The motor may be mounted in any position. The four motor mounting ears can be tapped for *6-32* screws, or *4-40* screws and nuts may be used. Take care not to overtighten the screws as the thin motor case is easily bent. Spacers of aluminum or brass tubing can be used as mounting standoffs, as shown in Fig. 4, if desired.

The cam consists of a heavy plastic button with a 1/16" hole drilled ⅛" off center. It should make a gentle force-fit on the motor shaft. Cement it permanently in position with epoxy or a similar strong adhesive.

Make a simple sheet-metal bracket to hold the snap-action switch in the required position with respect to the cam, as shown in Figs. 3 and 4. If you make elongated holes in the bracket, they will permit some adjustment of the cam-to-leaf spacing. Don't stray too far from the dimensions shown, or the motor may be stalled by excessive friction or mechanical interference.

Follow the schematic diagram of Fig. 5 when you are ready to wire the unit. There are no critical points, but it is advisable to mechanically anchor the wiring so that it cannot interfere with operation of the motor and snap-action switch.

Operation. The control switch is set to *STDBY* when timing operations are to be started. The motor reaches synchronous speed in about one second, and a rapid, quiet clicking of the snap-action switch will be heard. To start a timing

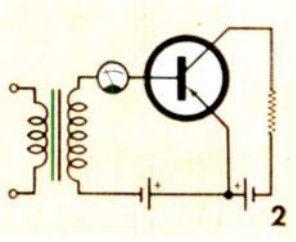
(*Continued on page* 110)

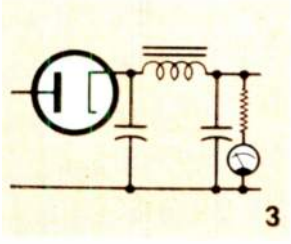
ELECTRONIC CURRENT QUIZ

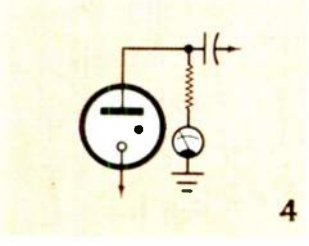
By ROBERT P. BALIN

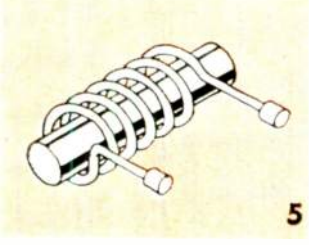
Despite the fact that any electric current is a movement of electric charges, a variety of odd names have been devised for currents that operate specific electronic circuits or parts. See if you can match each special current name (A-J) listed below with the circuit of the component (1-10) to which it relates.

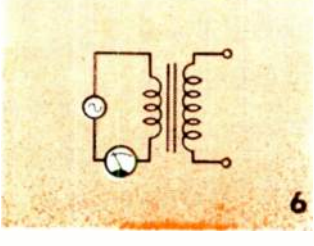

1


2

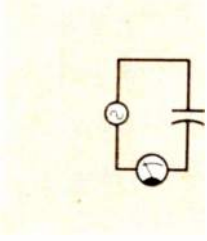

3

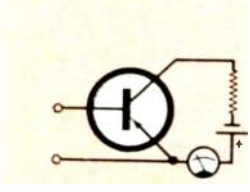

4

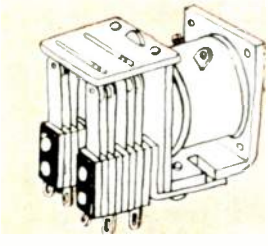

5


6


7


8


9


10

(*Answers on page* 102)

A Pull-in current ____
B Exciting current ____
C Bleeder current ____
D Eddy current ____
E Dark current ____
F Bias current ____
G Leading current ____
H Leakage current ____
I Field current ____
J Beam current ____

THE CLOUD SENTINEL

Watch far-off flashes of lightning, small storm discharges, and fair weather currents as they animate the meter needle

BOLTS OF LIGHTNING have frightened, puzzled, and fascinated mankind from the beginning of recorded time. These bright, intense flashes of electricity between clouds and earth, or between concentrations of opposite polarity within clouds, may pass average currents as high as 30,000 amperes. Not so familiar as visible and audible discharges, however, are the infinite number of unspectacular discharges which pass varying and continuous currents so small that even sensitive microammeters have difficulty detecting them.

These tiny currents, which pass through any conductor rising above the earth's surface, flow during both fair weather and foul. With a device that shows the direction of current flow and the amount and rapidity of the changes constantly taking place, it is possible to predict the approach of a storm, and to "see" far-off flashes of lightning as they occur. Day-to-day observations can be correlated with weather conditions for a science fair project, or just to satisfy your curiosity.

"The Cloud Sentinel" is a simple, easy-to-build device which you can use

By H. E. SANDERS, W4CWK

PARTS LIST

B1—Size AA dry cell
B2—Size D dry cell (two required)
M1—0-50 μa. meter (Lafayette TM-200, $4.95)
Q1—Pnp transistor (G.E. 2N508 or 2N107)
R1—1.5-megohm, ½-watt resistor
R2, R5—2200-ohm, ½-watt resistor
R3—10,000-ohm potentiometer, log taper
R4—500-ohm potentiometer, linear taper
S1—S.p.s.t. snap-action switch
S2—S.p.s.t. slide switch
S3—2-pole, 3-position lever switch
1—Battery holder for AA cell (Keystone #139 or equivalent)
1—Battery holder for two D cells (Keystone #176 or equivalent)
1—Transistor socket
1—3" x 4" x 5" Minibox (Bud CU-3005A)
Misc.—2" x 3½" component mounting board, plastic pill box cap, knobs, wire, bracket, rubber feet, solder, hardware, panel decals

Antenna Ground System

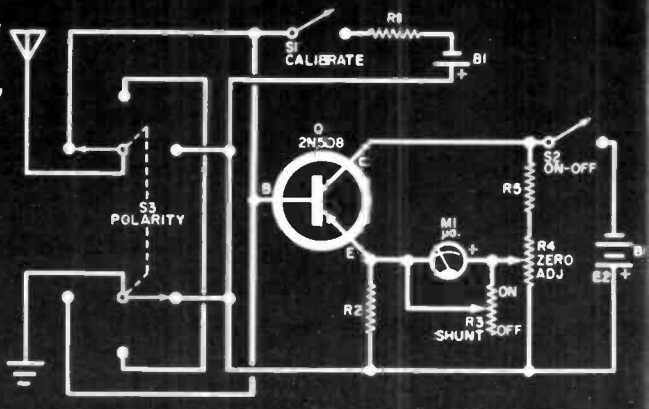
1—30'-50' length of #14 insulated solid copper wire
1—30'-90' length of microphone cable (Belden #8401)
1—3' length of #14 galvanized ground or guy wire
1—10'-40' antenna mast
1—5' length of ½" galvanized steel pipe
Misc.—Wood plug to fit in top of mast, screws, solder, mast platform, guy wire, insulators (as necessary)

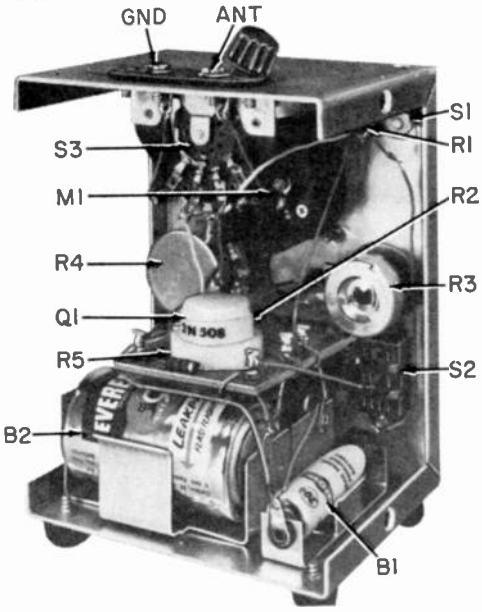
to detect cloud-earth currents as low as several hundredths of one microampere as they pass through your antenna-ground system.

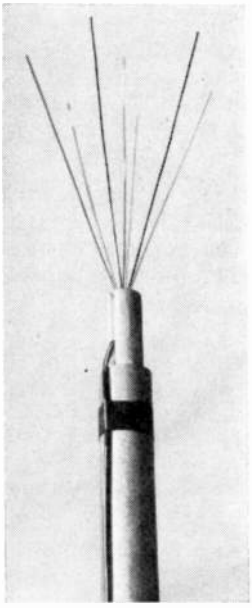
How It Works. The Cloud Sentinel is essentially a basic d.c. current amplifier circuit which has been expanded to include a meter shunt to allow the operator to reduce amplification as a storm approaches and electrical activity increases. Another switch permits reversing the polarity of the input in the event of cloud-earth polarity reversals.

Transistor *Q1*, resistors *R2* and *R5*, potentiometer *R4*, switch *S2*, and battery *B2* form the d.c. current amplifier, with meter *M1* and shunt potentiometer *R3* providing current indications. On the author's unit, a current amplification of 30 is obtained with *R3* in "off" position. With *R3* in the "on" position there is no noticeable meter movement. Various in-between settings allow the operator to choose any desired amplification factor.

Switch *S3* connects the antenna and ground to the transistor's base and emitter with a choice of polarities. With *S3* in its neutral position, the antenna is connected directly to ground. Switch *S1*,







Completed Cloud Sentinel is shown above, the parts layout at the right. Parts values and arrangement are not at all critical; principal requirement is sensitive meter. At far right is a photo of antenna used by the author (see text). Use #14 bare copper wire for spikes, insulated wire for the lead-in taped to mast.

Q1, *R2*, *R5*, and several tie points, and is attached to the front panel with a ½" x ½" x 2" bracket. Battery holders for *B1* and *B2* are screwed to the bottom of the box with ¼" space above them to provide clearance for wiring the transistor. Mechanical details, parts layout, and lead dress are not critical, and may be altered as desired.

Although not absolutely essential, it is a good idea to surround the transistor with a thermal barrier. For the prototype, papier-mâché was made by soaking newspaper in water. A plastic pill box lid was filled loosely with this mixture and pressed down over *Q1*.

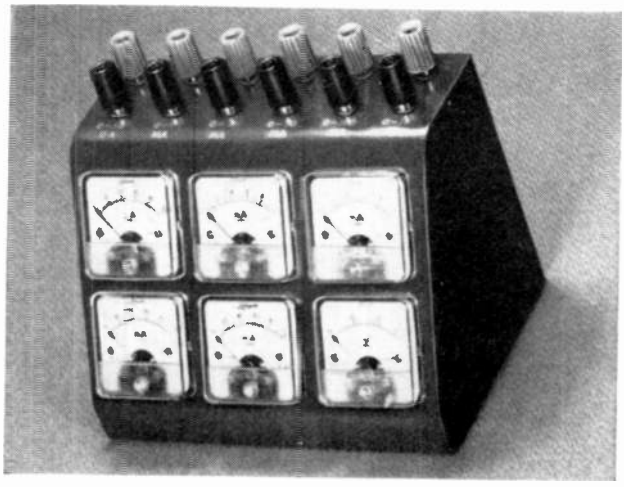
resistor *R1*, and battery *B1* provide a known current of one microampere to the amplifier for calibration purposes.

Construction. The prototype Cloud Sentinel was built into a 3" x 4" x 5" Minibox which provided ample space for easy assembly with the miniature meter and batteries specified. The on-off switch (*S2*), meter *M1*, and potentiometers *R3* and *R4* are mounted on the front panel, and the antenna-ground terminal board and polarity-reversing switch, *S3*, are fitted on the top. The calibrate switch, *S1*, is a microswitch mounted behind the front panel at the left top corner, and is actuated through a hole in the top of the unit.

A small 2" x 2½" piece of component mounting board is used as a chassis for

Parts Substitutions. Resistance values specified for the Cloud Sentinel may be altered within reason. The author satisfactorily used a large surplus 50-0-50 microammeter in a breadboard version of the Sentinel, which eliminated the need for polarity-reversing switch *S3*. A multi-position switch and a series of resistors in place of *R3* would permit the operator to switch from one known amplification to another and eliminate the need for the calibration circuit. With minor resistance changes which can be worked out by the reader, up to 6 volts

(*Continued on page* 97)



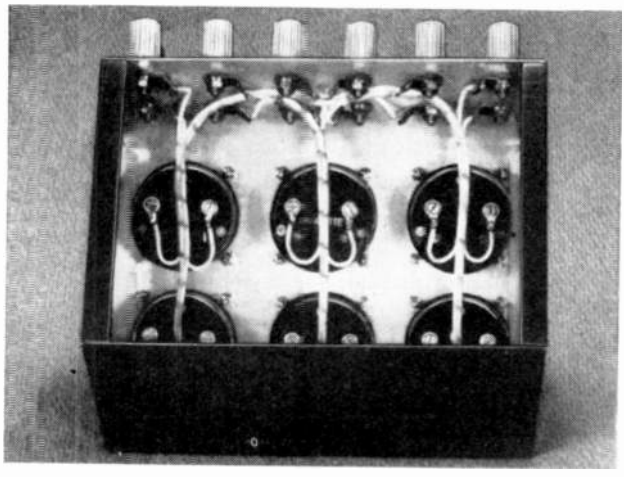
MULTIPLE METER TEST SET

"CONNECT A VOLTMETER across the power supply and prepare to meter the input to the amplifier. Adjust the value of the *Q2* bias resistor for a base to emitter voltage of —0.1 volt, making sure that the collector current does not exceed 12 ma." At about this point, you curse the writer of the instructions as a bloated plutocrat—he and all his test equipment vs. your lonely VOM.

Anyone who constructs electronics equipment as a hobby is well aware of the measurement problems involved. Voltage readings are not too difficult to take, but measurement of current at a number of points in the circuit is a different matter. Invariably the circuit must be opened, a meter inserted, a reading taken, the circuit closed up and the meter moved to the next point.

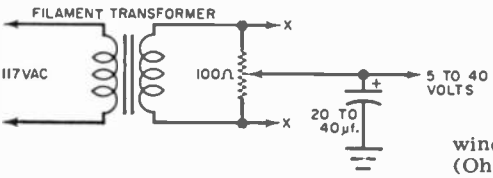
The compact little instrument shown here is a convenient answer to the problem of how to make several simultaneous measurements. Its cost is surprisingly low since use is made of imported meters—the author obtained his from Lafayette Radio via mail order. Besides a 0-15 volt d.c. meter, the cabinet holds one 0-50 μa. (d.c.), one 0-1 ma., one 0-5 ma., one 0-50 ma., and one 0-100 ma. meter. The cabinet is a Premier ASPC-1202 with a sloping front.

—Roy E. Pafenberg



Mount the six meters in a logical pattern so that the scales increase from left to right and top to bottom. Bring the meter leads out to insulated terminals or binding posts on the top ledge of the cabinet. Use color-coded terminals so that red indicates the plus meter lead and black the minus lead.

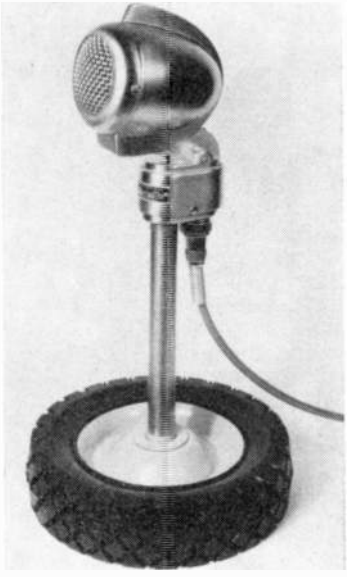
Audio Aids



POSITIVE BIASED HEATERS

If you're experimenting with high-gain preamp stages, hum and noise problems can be considerably reduced by means of the "positive heater bias" trick used by audio engineers. Don't connect the transformer heater winding to ground. Instead, wire a 100-ohm, 10-watt (Ohmite Dividohm) adjustable resistor across the heater winding, and run a lead from the tap to a source of 10-to-30 volt positive bias, such as a tap on a voltage divider from the B-plus line to ground. Bypass the tap with a 20-40 μf. electrolytic capacitor, and adjust the tap point for minimum hum. You'll be surprised at the improvement.

—Kenneth Bohn

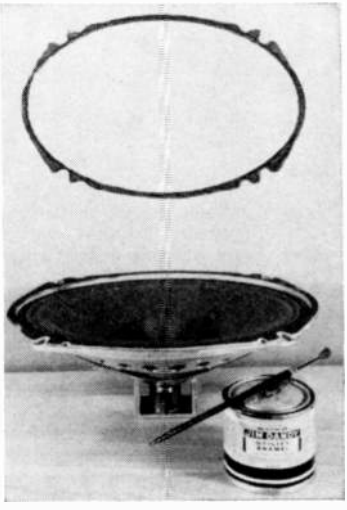


SPORTS CAR MIKE STAND

Do you have a friend with a taste for sports cars as well as ham radio or tape recordings? Tell him to make one of the mike stands shown at left. Sears-Roebuck sells a rubber-tired wheel (recently catalogued as #8732 and selling for $1.49) that makes an ideal base. A regular Atlas AD-8 extension tube is used to support the mike. Since the AD-8 has threads on both ends of the tube, saw off those that will be closest to the wheel. To fit the AD-8 to the hub of the wheel, force-fit a 4" wood dowel into the AD-8 tube, leaving half the length to pass through the hub. Snug the dowel into the hub and cement in place with epoxy resin. *—Art Trauffer*

RECORD DUST REMOVAL

When your hi-fi stereo records get dusty (from lint, hair, cigarette ashes, etc.), there is a simple way to clean them. Go into the kitchen and "borrow" your wife's box of thin-sheet Saran Wrap plastic. Tear off sheet about 6" wide and crinkle it in your fingers while holding it about 1" above the record. Start the turntable and let it revolve slowly. The static electricity generated in the Saran Wrap will attract almost all of the loose dirt and dust. *—Phil Manley*



OVAL SPEAKER CUTOUT

There's no trick to accurately cutting out a circular speaker opening using the intersecting line method —from the mounting holes—but an oval or elliptical speaker is something else again. The following practice is somewhat obvious, but maybe you've forgotten about it. Turn the speaker up and carefully paint the cardboard gasket—black is a good color. Press the gasket against the baffle and you have an outline of the speaker opening that can be used as a sawing line. (See photo.) The paint won't hurt the cardboard gasket, but be sure to let it dry before mounting—it might otherwise hold the speaker gasket permanently in place!

—Carl Dunant

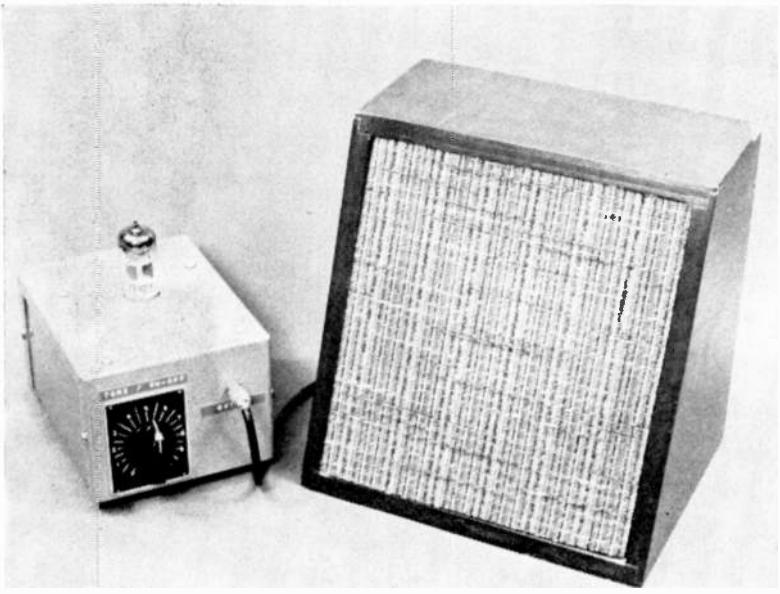
THE SQUEALER

By **FRANK A. PARKER**

Another starved current circuit application—an audio oscillator

AMAZING AS IT SOUNDS, this starved circuit vacuum-tube audio-note generator has a plate supply of only 5 volts! What's more, the 100-microampere plate current drain beats many transistor circuits. In a unit similar to the "Starved Circuit Amplifier" which appeared in POPULAR ELECTRONICS, July 1961, on page 69, the single 12AT7 dual-triode does not need the usual high-voltage plate supply transformer. Plate voltage is taken off the same 6.3-volt winding used for the tube's heater. In the author's model, plate voltage was reduced to an unbelievable 3 volts before the *Squealer* was silenced.

The output of this easy-to-build unit can be varied from 20 cycles to



Coupled to a 3-transistor amplifier in the speaker enclosure, the Squealer had a resounding wallop. If the Squealer's output circuit was broken with a telegraph key, this arrangement could be used for code practice.

about 12,000 cycles with a single control. Audio output voltage is high enough to drive any hi-fi amplifier to full volume. The *Squealer* makes a fine auxiliary audio source in the shack. And, in emergencies, or for mobile use, it can run from a 6-volt battery.

About the Circuit. The *Squealer* uses dual triode *V1* in a modified multivibrator oscillator circuit. Coupling between stages is through the cathode connection, resistor *R2* being common to both triodes. Feedback is maintained by capacitor *C1*, which together with potentiometer *R3* determines the *Squealer's* audio output frequency. The upper frequency limit can be pushed to 15,000 cps or higher by decreasing capacitor *C1* to about 0.01 μf. or lower. Resistor *R1* serves as a plate load for *V1a*; audio output is tapped off the same plate via capacitor *C2*.

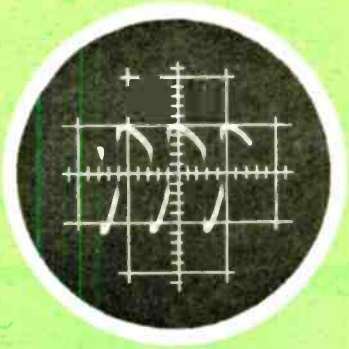
The *Squealer* is isolated from the power line by filament transformer *T1*. The same transformer is also used in a standard half-wave rectifier circuit with diode *D1* and *RC* filter *C3*, *C4*, *R5*. Resistor *R4* protects *D1* against current surges. For battery operation, a 6-volt d.c. source is connected between point *A* and ground. Useful output can be obtained with a d.c. source as low as 3 or 4 volts operating *V1*'s plate and heater.

Experimenters will realize how this circuit differs from the previously mentioned "Starved Circuit Amplifier." The latter circuit produced a high signal gain through the use of a 4.3-megohm plate load resistor. Furthermore, the gain could only be obtained by forcing a voltage drop of several hundred volts across the plate load resistor. This circuit is "starved" in a different sense—deriving its voltage from the heater line (6 vs. 250 volts) and feeding through a small plate load resistor (47,000 ohms vs. 4.3 megohms). The effects are largely the same, however.

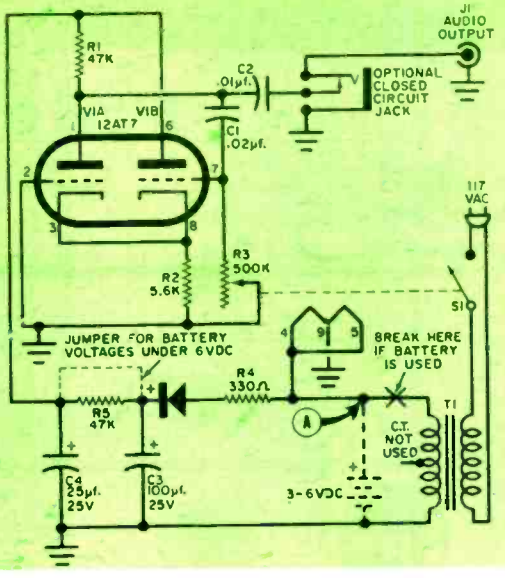
Construction. The *Squealer* fits neatly in a 5″ x 4″ x 3″ aluminum box. Parts placement is not critical but layout might well follow the author's setup for easiest assembly.

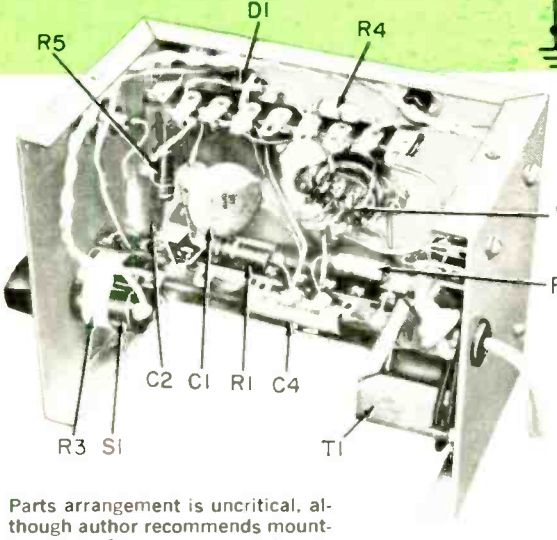
All parts are mounted on the cover half of the box. The tube is mounted topside in the center of the box. If desired, the filament transformer can also be mounted on top of the box but the author chose to mount it at one end as shown.

Most of the resistors and capacitors and the diode are soldered to a pair of 9-lug terminal strips (visible in the photo at right) on either side of the tube socket. Potentiometer *R3* and audio output jack *J1* are mounted on the end of



Waveform of the audio note generated by the Squealer is not a true sine wave. As the diagram at right illustrates, plate voltage is taken from half-wave rectified heater supply.





Parts arrangement is uncritical, although author recommends mounting most of the components in outside wraparound of aluminum box.

PARTS LIST

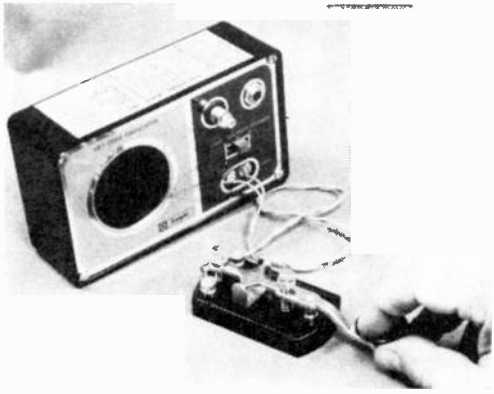
C1—0.02-μf., 200-volt disc capacitor
C2—0.01-μf., 200-volt disc capacitor
C3—100-μf., 25-volt electrolytic capacitor
C4—25-μf., 25-volt electrolytic capacitor
D1—Silicon diode, 50 PIV, 100 ma., or higher
J1—RCA-type phono jack
R1, R5—47,000-ohm, ½-watt resistor
R2—5600-ohm, ½-watt resistor
R3—500,000-ohm potentiometer (with switch S1)
R4—330-ohm, ½-watt resistor
S1—S.p.s.t. volume control switch (ganged with R3)
T1—Filament transformer: primary, 117 volts a.c.; CT secondary, 6.3 volts @ 0.6 ampere, CT not used (Stancor P6465 or equivalent)
V1—12AT7 tube
1—5" x 4" x 3" aluminum box
Misc.—9-pin miniature tube socket, terminal strips, knob, dial plate, hardware, wire, solder, etc.

the box opposite the transformer. Since no pilot lamp is employed, a dial plate is used with the potentiometer as an on-off indicator and to spot the different output frequencies.

Operation. The *Squealer* works fine with both crystal and medium- to high-impedance dynamic headphones. If it is to be used for code practice, a closed-circuit telephone key jack can be optionally inserted between capacitor *C2* and output jack *J1*. As an audio source for hi-fi amplifiers, an ordinary shielded cable terminated with a pair of RCA-type phono plugs will do.

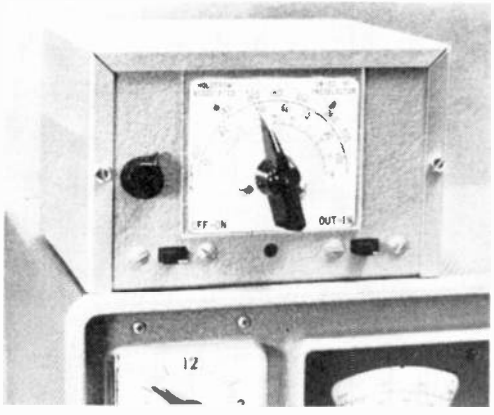
If desired, the *Squealer* can be operated from a 6-volt battery. Simply connect the battery between point *A* and ground as shown on the schematic. Be sure to disconnect the 6.3-volt secondary of *T1* before connecting the battery since the transformer winding represents a d.c. short for the battery. To increase the audio output with supply voltages under 6 volts, short out resistor *R5* with a wire jumper. -30-

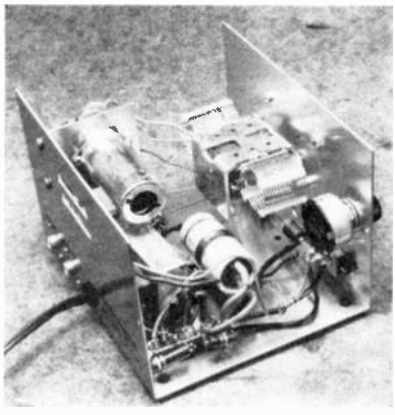
Product Reviews



CODE PRACTICE OSCILLATOR

It's going to be pretty difficult to beat the low cost and practicality of the Model LC-1 code practice kit. Sold by Allied Radio Corp. (100 N. Western Ave., Chicago 80, Ill.) for $7.95, this two-transistor CPO, operated from a single type "C" cell, has just about everything. The audio tone is clean, sharp, and plenty loud. There's a speaker and phone jack on the front panel of the plastic case, and, if that isn't enough, you can also practice using a high-intensity light bulb. Allied Radio even sends along a fine key with the LC-1 and a printed copy of the International Morse code to fasten to the case for reference purposes.





SHORT-WAVE PRESELECTOR

A relatively uncommon item is a preselector, or outboard r.f. stage, designed for the SWL. Holstrom Associates (Box 8640, Sacramento 22, Calif.) has come up with the easy-to-wire Model SK-20 kit—your Editors assembled it in under two hours. Selling for $18.98 (postpaid), the SK-20 is a bargain you can scarcely afford to miss. Notable is the fact that it continuously tunes from 3.5 to over 30 mc. without bandswitching. It is sufficiently broadbanded so that fine tuning is unnecessary, and signal strengths were down only about six S-units with the preselector mistuned about 3 mc. Peaked on the nose, the preselector adds at least three S-units to a signal. In our tests with a Hammarlund HQ-100, the SK-20 brought barely readable signals up out of the background without adding any noise of its own (good signal-to-noise ratio). Its stability seems excellent and there is no evidence of regeneration. A gain control and "in-out" switch are provided.

SURE CURE for HAM/CB MOBILE NOISE

Do-it-yourself kit offers the ultimate in shielded ignition noise suppression

SPARKING is the chief villain in the generation of automotive electrical noise and interference. Your car is full of spark noise sources—plugs, distributor points, regulator contacts and generator brushes. Radio waves are created whenever a spark is made to jump between two contacts. In almost all ignition systems, these radio waves tend to peak in intensity around the 11-meter CB channels and 10-meter ham band. This unhappy fact is due to spark gap width, aided and abetted by the capacity and length of ignition wiring.

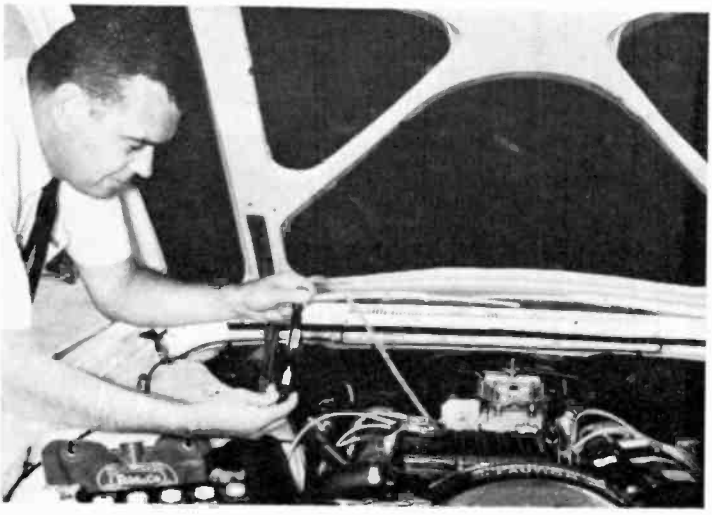
Short of turning off the automobile engine, the mobile operator must employ three separate methods of noise elimination: (1) arc suppression, (2) filtering, and, most important (3) shielding.

Arc Suppression. Ignition noise generation can be drastically reduced by a high resistance in series with the spark plugs. Some automobile manufacturers use resistance ignition wire, while others recommend resistor-type spark plugs. Unfortunately, the resistance which reduces the noise generating current flowing through the plugs can also reduce engine performance. In conquering one evil, another is created. Thus, maximum ignition noise suppression cannot be accomplished with resistor plugs or resistance wiring. Nor does resistance overcome the problem of "radiation" of the ignition noise which in many ways is the primary concern of the mobile operator.

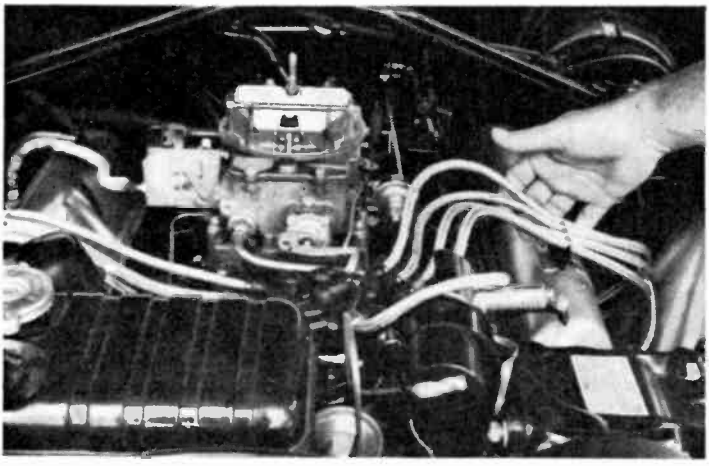
Filtering. Every mobile ham or CB station operator is well aware of the necessity of installing coaxial bypass capacitors at the generator and voltage regulator. The generator bypass effectively reduces the "whine" and the capacitor at the regulator cuts out much of the "buzz" or "hash." In very severe cases, some r.f. filtering of the field terminal at the regulator may be called for.

Shielding. Were it not for the metal body of the car and fire wall between the engine and the mobile

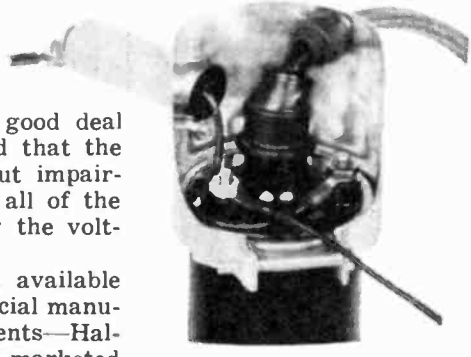
By JOHN D. LENK



The "Eliminoise" kit includes metal shields for the spark plugs and braid that is cut to length and slipped over the spark plug wiring (see photo on the preceding page).



Newly shielded spark plug leads are clamped together and attached to a special shield bracket at the distributor. The kit does not include bypass capacitor for generator or voltage regulator.

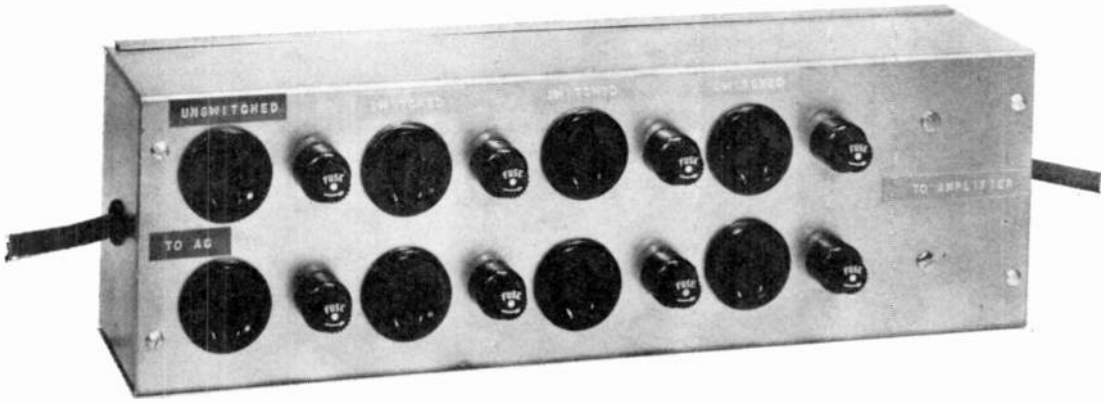


A partial shield is clamped around the ignition coil. The lead from the coil to the distributor is shielded; lead from the points is fed through a special bypass capacitor.

receiver, the interference problem would be a good deal worse. Automotive engineers are now convinced that the best way to reduce ignition interference, without impairing engine performance, is to completely shield all of the spark plug wiring, the distributor, and possibly the voltage regulator.

Automobile noise suppression kits have been available to hams and CB'ers for several years. A commercial manufacturer of industrial noise suppression components—Hallett Mfg. Co.—has assembled a kit that is being marketed by the E. F. Johnson Co. as their "Eliminoise." Consisting of all the parts you need to shield the ignition system, it is a low-cost item (about $12) that can be installed on any 6 or 8-cylinder car in just about an hour.

If you're after those weak signals—and what ham or CB'er isn't—investigate the "Eliminoise" as an adjunct to your present generator filtering. —30—



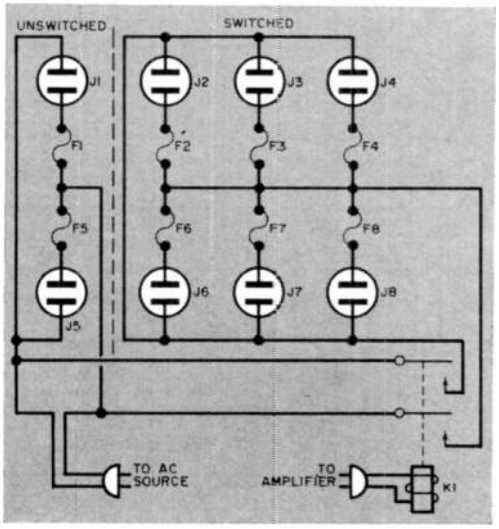
More Switched Outlets for Hi-Fi

ANY hi-fi component system, especially one which has grown over the years, is bound to have a number of a.c.-operated devices to be switched on and off. There are preamplifiers and power amplifiers, record players and turntables, tape decks and tape recorders, multiplex adapters, antenna rotators, etc. If each device must be switched on and off individually, it's no wonder that the uninitiated feel they need an engineering degree to operate the equipment.

This headache is partially solved by the switched outlets on most amplifiers. But, invariably, there are not enough outlets, and the current rating of the amplifier on-off switch might be exceeded if you start feeding other components from a cube tap. To surmount this problem, the author built a relay-operated multiple outlet box. It contains eight outlets (*J1*–*J8*), six switched on and off by the amplifier, and two which are "hot" at all times. This handy outlet box can be placed out of sight on the floor away from the low-level phono and tape signal cables that might be susceptible to a.c. hum pickup. The a.c. cord connecting the outlet box to the amplifier can be any convenient length. All of the outlets—switched or unswitched—are protected by 3AG cartridge fuses (*F1*—*F8*)—1- to 3-amp values, depending on power requirements.

Construction of the outlet box is straightforward. The a.c. receptacles are Amphenol Type 61-F. A Greenlee number 732 1-11/64" key punch is used to knock holes in the aluminum box. The fuse holders are all Bussman Type HKP mounted in ½" holes. The s.p.d.t. relay (*K1*) can be any standard make with a 115-volt a.c. coil and contacts rated at 15 amperes at least—the author used a Line Electric Series LG, but a Guardian 2400AC would certainly work as well and is more readily available.

—R. L. Conhaim



Six switched and two unswitched outlets, all protected by fuses, are provided by the outlet box. A slide cover box, LMB Model 17, was used in the prototype, but a Bud Minislide box (Type MS-3051) will make a satisfactory substitute.

Hi-Fi Lab Check

Lafayette "Criterion" KT-900
Transistorized Integrated Stereo Amplifier

Manufactured by Lafayette Radio Electronics, 111 Jericho Turnpike, Syosset, L.I., N.Y.

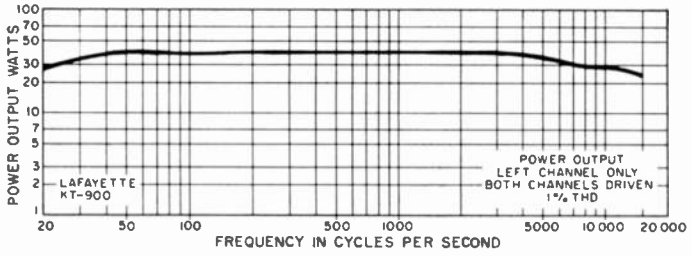
Price: $134.50 (kit)

THIS is the third of four transistorized stereo amplifiers offered by the same number of manufacturers to hi-fi enthusiasts. Unlike the Heathkit* and Realistic** previously reviewed, the KT-900 is as easy to assemble as the simplest vacuum-tube stereo amplifier. This encouraging evaluation is enhanced by the fact that the KT-900 has an attractive, low-silhouette appearance, performance reasonably close to the manufacturer's claims, and produces the low-hum clean sound one would expect from a transistorized amplifier.

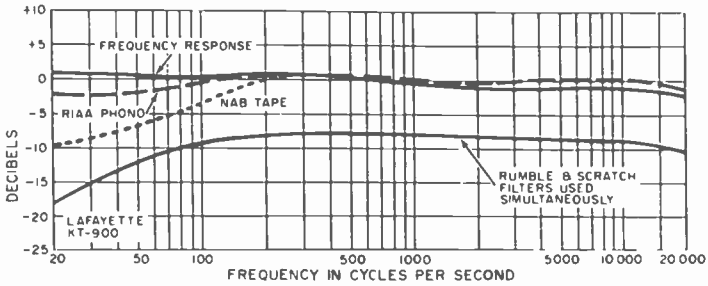
Heathkit AA-21, April 1963, p. 74
**Realistic Model 208, May 1963, p. 74*

CIRCUIT REPORT: The maximum optimized rating of the KT-900 is 60 watts per channel. To realize this power, four transistors are used in the power output stage of each channel driven by two more power transistors and two chains of five small signal transistors—making a total of 22 (including two more transistors in the power supply). The solid-state power supply uses eight silicon diodes; six other diodes appear in the circuit as protective devices.

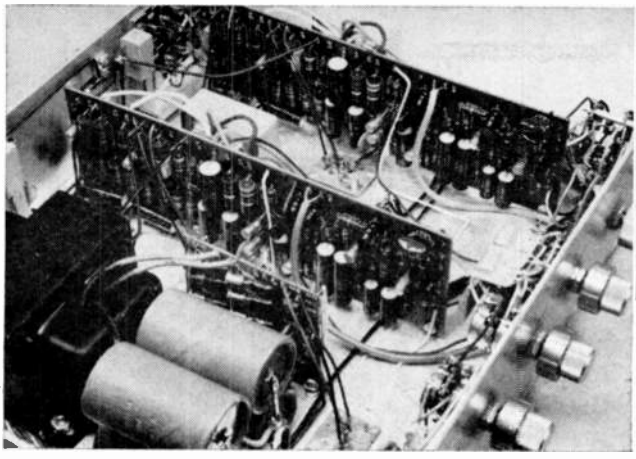
No output transformers are employed in the KT-900, and the user must be careful not to short-circuit the speaker output terminals or leave them untermi-

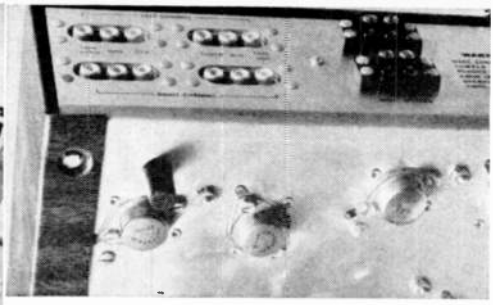


This power response curve was made with both channels driven. Output was measured with a simulated 8-ohm load. Considerably more power output can be obtained by driving one channel and leaving the other quiescent, which may account for the discrepancy between the manufacturer's claim and the results that are shown here.



In this family of curves, the overall frequency response is compared with RIAA phono equalization. Tape equalization appears somewhat inadequate below 200 cycles. The use of both rumble and scratch filters simultaneously lessened the effectiveness of the scratch filter which, used alone, worked well.





With 95 per cent of all the components mounted on printed circuit cards, construction of the KT-900 is remarkably easy. All power-handling transistors are mounted on metal bottom of the chassis, which serves as an expansive heat sink.

nated. Hi-fi enthusiasts with multiple speaker systems should make arrangements to use T-pads on each speaker rather than a switching system. This is possibly one of the few disadvantages of transistorized amplifiers compared to vacuum-tube designs.

Provision has been made for five stereo signal inputs, including tape head, two phono inputs, tuner, and auxiliary. A "tape out" jack is available for direct tape recording, circumventing the amplifier tone controls. The a.c. power input is 35 watts (no signal) to 200 watts with both channels driven to full output.

HIRSCH-HOUCK LAB CHECK: It is no small feat to design an amplifier of this size and weight which can deliver 100 watts continuous power from two channels with only 2 per cent harmonic distortion. Frequency response was nicely flat with all tone controls in their indicated flat positions—about ±1.5 db from 20-20,000 cycles. The RIAA phono equalization was good, although tape equalization dropped off below 200 cycles.

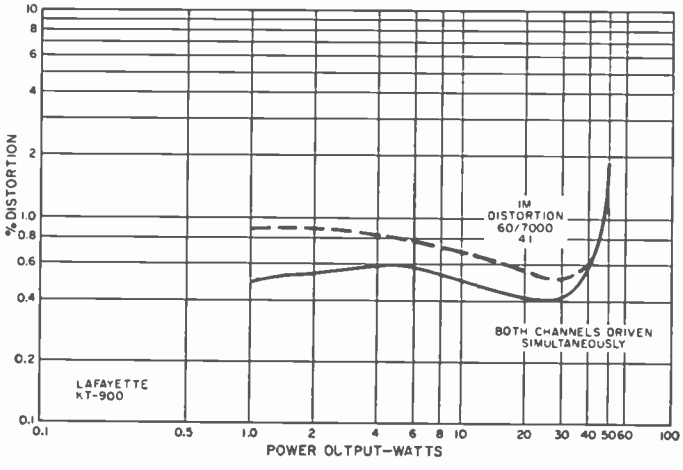
The concentric volume controls tracked very well when set at the same gain level. Tracking error increases sharply when the initial levels are offset by a few db. This fact makes it mandatory to use two speakers of identical characteristics. No provision is made in the KT-900 amplifier for a center channel takeoff.

Rumble and scratch filters worked well singly, but apparently should not be used simultaneously. Hum and noise was over −68 db down at 10 watts output. The graphs at the bottom of these pages complete the Hirsch-Houck Lab Check.

IN CLOSING: The only major fault that could be found with the KT-900 was the absence of a method of paralleling or blending phono inputs. This would be advantageous in playing mono phono-

(*Continued on page* 98)

Measured with an 8-ohm load, the IM distortion level is below 1 per cent up to 46 watts per channel (both channels being driven). The dashed line is for the right channel, the solid line for the left channel.



On the Citizens Band

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

SOME Citizens Band operators are aware that the Civil Air Patrol has a channel in the 11-meter band—precisely, 26.62 megacycles. But we seriously wonder how many operators in all the areas of communication combined are aware of the fact that the CAP has the largest civilian communications network in the world. We learned this fact, and many other interesting facets of this well-organized service association, during a lengthy chat with Warren Anderson, Executive Officer with Group 11 of the Northern Illinois CAP. And we also swapped some illuminating correspondence with Read W. Wynn, Director of Public Information, CAP National Headquarters, Ellington Air Force Base, Texas.

THE CAP STORY

It all began December 1, 1941, when a national organization of air-minded civilians met in Washington, D. C., to help the Office of Civil Defense on the home front. During the early days of World War II, with CAP personnel flying patrol missions off the Atlantic and Gulf Coasts as junior partners of the Army Air Corps' anti-submarine command, CAP supervision was transferred to the War Department "for the duration."

Following the war, the CAP undertook the mission of organizing its voluntary resources of manpower and equipment, so useful in search and rescue work, to meet local and national emergencies. Equally important were the CAP objectives of motivating the youth of America toward leadership and public service, and of furthering this nation's air and space supremacy through a systematic aerospace education and training program.

Public Law 476 passed in 1947 by the 79th Congress established the CAP as a federally chartered, nonprofit corporation. Public Law 557 passed by the 80th Congress further established the organization as the official Civilian Auxiliary of the United States Air Force. About one-half of today's CAP members are adults, and about one-half are teen-agers (cadets). Women and girls account for some 20 per cent of the members.

Recent highlights of CAP activities through its 52 wings (each state, the District of Columbia, and Puerto Rico), are:

(1) Special national activities, such as foreign cadet exchanges, drill competitions, and programs on such subjects as jet aircraft, space missiles, and air traffic management.

(2) A working agreement with state Civil Defense agencies for assistance in the event of a national emergency.

(3) Seven aerospace education texts, prepared by CAP-USAF educators, in use by more than 500 high schools as science electives.

(4) Sponsorship of more than 100 college and university aerospace education workshops for nearly 6000 teachers during the summer of 1961.

(5) National search and rescue work, during which the CAP annually logs more than half of the sorties (flights) and flying hours of the combined military services and civilian agencies participating.

(6) Operation of 4000 light aircraft and 3500 vehicles owned by CAP members and the corporation.

Cadet members of the Civil Air Patrol obtain a thorough working knowledge of many types of communications through on-duty assignments—at local airports, for example—along with class instruction.

The mobile radio communications center at left, actually a converted bus for living on the road, contains over $30,000 worth of electronic gear suitable for use on CAP emergency missions. Photo below shows CAP cadets manning a home communications unit.

Scenes like the one in the radio-equipped truck below occur throughout the 52 U.S. divisions of this well-organized service association.

During search and rescue operations, CAP radio operators are permitted to use 5 watts output on 26.62 mc. —right next to the CB frequencies.

(7) Operation of some 14,000 licensed radio stations—fixed, mobile, and airborne—a nation-wide network!

Communications instructions given to CAP members cover many different types of equipment operating on various frequencies with assigned purposes. For example, the CAP is allotted frequencies near the edges of the 2-meter band, 143.91 mc. (a training frequency with a 10-watt power limit) and 148.14 mc. (50 watts). They also operate on 2374 kc. and in the vicinity of 4.5 mc. (a number of specific frequencies are used) for wing control, including the transmission of regional and long-haul traffic. During search and rescue operations, the CAP utilizes either 2 meters or their near-Citizens Band frequency of 26.62 mc., where, unlike CB'ers, they may use a full *5-watt output.*

The CAP radio stations are licensed under Subpart S, Part 9, of the FCC Rules and Regulations. They may communicate only with other CAP stations and *may not* talk with stations licensed in other services, either direct or cross-band. Of course, all operators on the CAP frequencies must be members of the Civil Air Patrol.

When we asked about communication activities on an area basis, executive officer Anderson informed us that the Illinois unit initiates two "air" roll calls a day (as do many other CAP units) for the relaying of CAP and Air Force traffic. During flights at a height of about 5000 feet, Anderson claims that their 11-meter CAP transceiver easily covers two or three states.

Thus, to tie the Civil Air Patrol's activities together, both on the ground and in the air (or *on* the air), their efforts add up to a most worthwhile public service pro-

CB on a tractor can be part and parcel of modern-day farming. See text for the details of Bill Haskins' effective CB setup.

gram—thanks to the well-organized, well-trained CAP personnel who voluntarily give of their time and skills. A tip of the wing to CAP members across the nation—we're happy to have them on board the 11-meter band!

CB on a Tractor. Obviously, a CB tractor installation can present a multitude of problems, especially when one considers that the unit must be mounted out in the open. Furthermore, noise suppression in a powerful tractor can cause innumerable headaches. In fact, even with proper suppression, the average tractor engine still purrs loud enough to run a close race with any receiver signal attempting to reach a pair of ears with any degree of intelligibility.

But Bill Haskins, 17W6510, modern-day farmer in Doniphan, Neb., needed a communications system to keep him in touch with his family and business activities during long hours of work in the fields. So incorporate a CB rig he did—despite the problems.

Bill's CB unit, mounted on top of the dash, is a Johnson "Viking" encased in a cylindrical housing that Bill made for protection against field and weather conditions. The special housing looks so professional that it takes a close second look to make sure it isn't part of the original equipment supplied by the manufacturer of the diesel.

Within the sturdy mounting Bill has attached an all-weather speaker which supplies enough volume to be heard over both the chatter of his engine and the sounds of the broadcast radio mounted at his side. Easy access to the unit can be had through a swing-open door to which the speaker is attached. At the opposite end, a 1" plastic pipe connects the forward end of the case to the air breather stack; it pulls enough air through the case to eliminate any possible heat problem. For an antenna, Bill uses a base-loaded type designed to clip on automobile rain gutters.

Bill has used this setup with good results for the past three years. Each fall he removes the set from the tractor and mounts it in his combine cab for use during the corn and milo harvest season. To complete his CB system, Bill has another set in his pickup truck in addition to the transceiver in his home.

One thing is obvious: Bill Haskins is one of a type who, if things aren't exactly right, go out and make them so. Old MacDonald never had it so good!

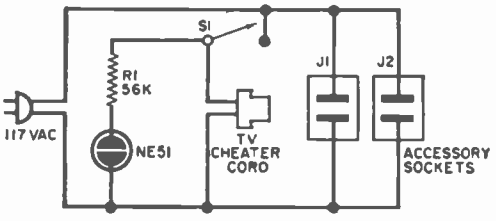
Club Chatter. The *Static Pusher,* official publication of the Static Pushers CB Radio Club of Rockford, Ill., celebrated its first birthday in July after a very successful year of growth. Edited by Jack Waterson, 18B1902, the *Static Pusher* is one of the better papers to come off the CB presses across the nation. Within the pages of its birthday issue was news of the first Northern Illinois CB picnic held at White Pines State Park near Oregon, Ill. Approximately 200 CB'ers and their families were in attendance at what turned out to be a highly successful gathering. Walkie-talkies and portable units seemed to dominate the grounds that day—with one exception. A DeKalb, Ill., group erected a magnum base station antenna on a piece of pipe and secured the guy wires to picnic tables; a 12-volt auto battery served as their power source. A portable?

A "first" is claimed by a newly organized young peoples' Citizens Band club in Memphis, Tenn. President Johnny Wampler announced that the club, named the Memphis Megamites, is probably the first organization of its kind in the United States with membership open to all persons between the ages of 16 and 25 living in the Memphis and Mid-South area. . . . And from New York comes word of another of the younger CB groups, the Kadets of America. This group not only participates in emergency storm communications and CB drills, but in parades, Little League baseball, and drill competitions. They also publish a very neat and well-organized news bulletin called the *Star Anchor*—with paid ads!. . . . And a third young people's group that has been brought to our attention, also in the state of New York, is the Rescue 14 Club. Parties interested in joining this group should contact Richard Belgard, secretary, at 1383 Luddington Rd., East Meadow, N. Y.

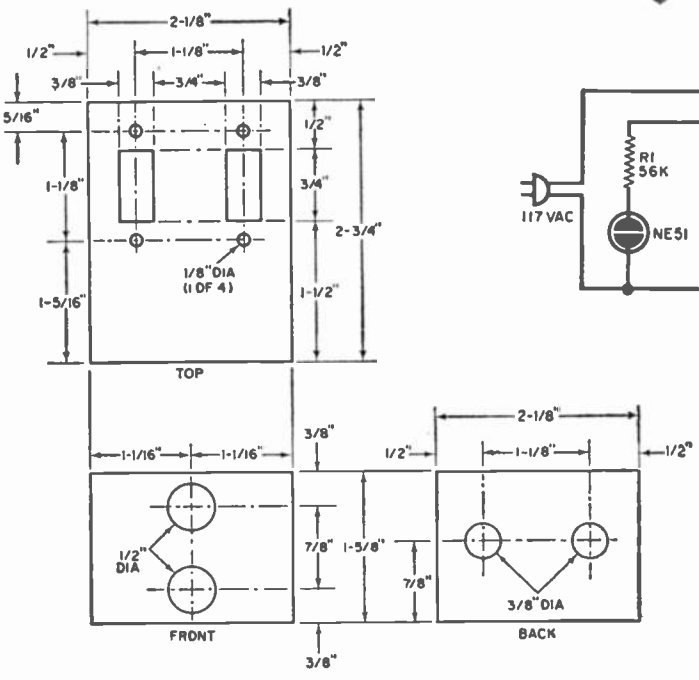
Two new club newspapers have joined

(*Continued on page* 101)

Cheater Cord De Luxe



If your junk box doesn't contain the parts for the indicator light, buy a preassembled unit. Extra bright neon bulbs are available in most radio stores for a few cents more.



Chassis cutouts and drilling notations are based on use of Premier PMC-1000 utility box.

THE FAMILIAR TV interlock, which disconnects your set from the a.c. line when you take the back off, can be a nuisance when it comes to servicing. Assuming that you have a "cheater cord," you often have to scramble around to find a place to plug it in. And you also have to find an outlet for, say, a soldering iron and a VTVM. If you're tired of stringing extension cords all over the room, here's a gadget that will make the job easier. The "Cheater Cord De Luxe" supplies the TV set with power and has a safety pilot light to indicate when it's on. Two accessory sockets (*J1* and *J2*) not controlled by the switch (*S1*), take care of your trouble-shooting equipment.

The Cheater Cord De Luxe can be constructed in an aluminum box measuring 2¾"x2⅛"x1⅝" (Premier PMC-1000). You'll need two a.c. accessory sockets (chassis mount), s.p.s.t toggle switch, a.c. line cord, and the business end of a TV cheater cord. The indicator lamp can either be purchased preassembled (Dialco 95408) or made up from junk box parts using an NE-51 and a 56,000-ohm resistor (*R1*). Keep in mind that the box will be connected to the 117-volt a.c. line and carefully insulate all connections. —*James A. Fred*

Transistor Topics

By **LOU GARNER,** Semiconductor Editor

THE TRANSISTOR'S unique characteristics—small size and light weight coupled with minute voltage and power requirements—make it ideally suited to many biological and medical research applications. The transistor's availability has, in fact, led to the development of entirely new types of specialized medical research instruments and therapeutic devices. Of these, one of the most interesting classes consists of subminiature devices designed to be implanted directly within a living human or animal body. There are two general types of electronic "implants": (a) measuring devices which telemeter (broadcast) information about body conditions, such as temperature, blood pressure, etc., and (b) pulse sources used to stimulate muscles or organs, such as the heart.

While advanced medical instrumentation may seem far removed from the hobbyist's field of interest, this is not really the case, for the techniques developed and used in biological research can be employed directly in Science Fair projects as well as in home-built gadgets. The technique of using electronic "implants" could be applied in a simplified, but similar, manner in a high school biology class. Or the general methods employed could be modified and used in various R/C projects.

Early electronic implants had built-in power sources, generally mercury batteries with an effective operating life of several months. Circuit power requirements were kept to a minimum to maximize battery life. But even with long-lived batteries and low-drain circuits, repeated surgery was necessary when tests or experiments were carried out over a long period of time.

Today, there is a trend towards *externally* powered implants—not by means of wires projecting from the subject's body, but by means of radiated energy. The basic technique is illustrated in Fig. 1(a). A low- to medium-power r.f. transmitter radiates energy which is picked up, rectified and used to power the implanted circuit.

In most cases, circuit implants are kept as simple as possible, both to insure relia-

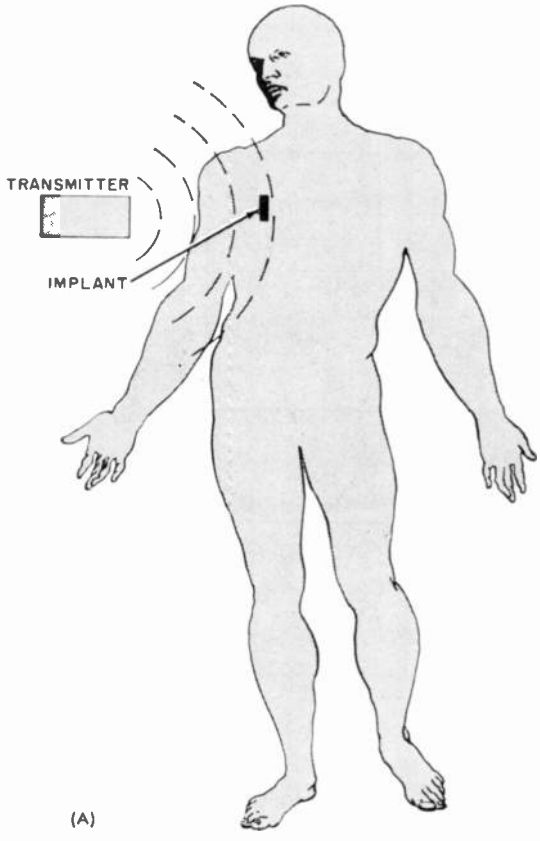
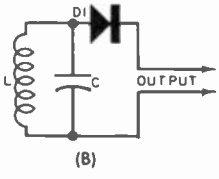


Fig. 1. One of the latest bio-medical techniques is the use of externally powered "implants" in living bodies. Basic technique is shown at (A), the circuit of a typical implant at (B).



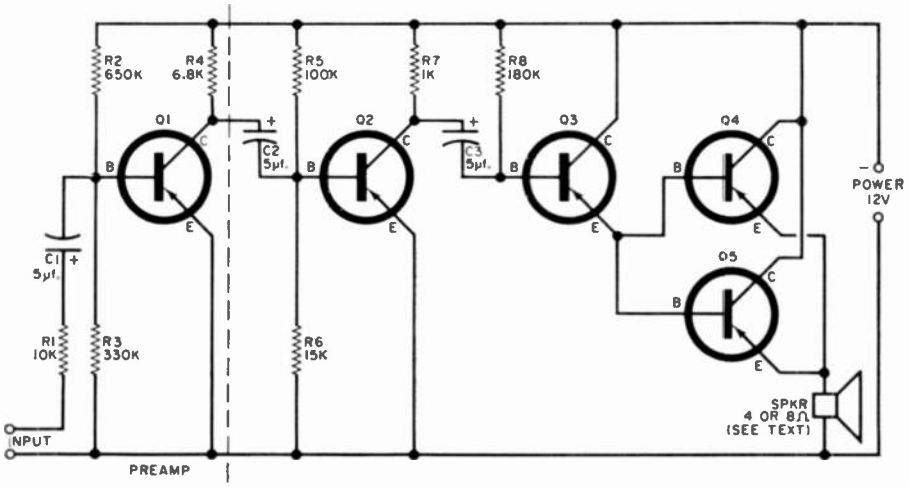


Fig. 2. Medium-power audio amplifier circuit submitted by reader Norman Huffnagle uses five pnp transistors. Modifications can be made to suit individual needs as described in text.

bility and to keep size and weight to a minimum. As an example, consider the heart stimulator (or "pacemaker") implant circuit illustrated in Fig. 1(b); it consists of a tuned circuit (*LC*) and a small diode (*D1*). In operation, the pacemaker is driven by an external transmitter which delivers a *pulsed* r.f. signal. Each r.f. pulse is picked up by the tuned circuit and rectified by the diode into the d.c. pulse needed to stimulate the heart muscles. The energy transfer efficiency, in a typical unit, averages about one to two per cent.

Physically, biological implants are extremely small; one commercial unit, for example, requires only 0.05 cubic inch and weighs but three grams. They are usually imbedded in epoxy resin or similar nontoxic, but durable, plastic material and placed within the body in a position where they will not interfere with muscle action or bear against vital organs or nerve centers.

The day may come when remotely powered implants are used not just for medical research but for the day-to-day care of permanent patients in hospitals and sanitariums. And, in another field, the imaginative hobbyist should have no difficulty in discovering dozens of uses for r.f.-powered devices or in creating new applications for this latest research technique.

Reader's Circuit. We have featured relatively few medium-power audio amplifier circuits in the past, not because of a lack of interest in them, but because very few such circuits have been sent in by readers. It is with real pleasure, then, that we pass on the circuit shown in Fig. 2. A 3-4 watt amplifier circuit suitable for a variety of applications, it was submitted by reader Norman Huffnagle (2717 Carpenter Ave., Des Moines, Iowa). Norm is quite enthusiastic about its performance and writes that he uses a dual-channel (stereo) version in connection with a Miracord turntable and Shure M-33 cartridge.

Referring to the schematic diagram, *pnp* transistors are used throughout, with the common-emitter configuration employed in the first two stages (*Q1, Q2*) and a modified common-collector (or emitter follower) configuration in the driver (*Q3*) and output (*Q4, Q5*) stages. A combination of both *RC* and direct coupling is used.

In operation, the input signal is applied through limiter resistor *R1* and coupling capacitor *C1* to the preamp stage, *Q1*. The preamp's base bias is supplied by voltage divider *R2-R3*, with *R4* serving as the stage's collector load. The amplified output signal obtained from *Q1* is applied through interstage coupling capacitor *C2* to the pre-driver stage, *Q2*. Again, base bias is supplied by means of a voltage divider, *R5-R6* in this case, to insure stable operation. Resistor *R7* serves as *Q2*'s collector load, with the amplified signal appearing across this resistor applied to the driver-output stages (*Q3, Q4, Q5*) through coupling capacitor *C3*. Transistor *Q3*'s base bias is supplied through *R8*.

A rather unique direct-coupled arrangement is used in the driver (*Q3*) and output (*Q4-Q5*) stages. The output stage is made up of two power transistors in parallel, with their input circuits serving as the driver's emitter load. Transistor *Q3*'s emitter current, then, provides base bias for *Q4* and *Q5*. Finally, the output stage's emitter load is a loudspeaker's voice coil.

Standard, readily available components are used throughout. The resistors are half-

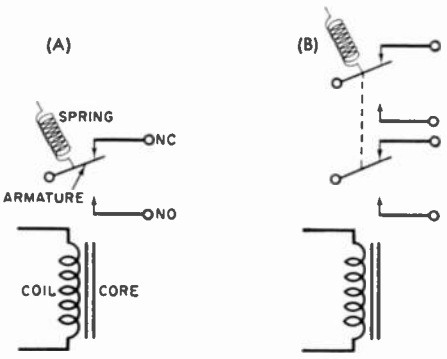


Fig. 3. Symbols for electromagnetic (A) s.p.d.t., and (B) d.p.d.t. relays. See Transitips for information on how to select substitute relays.

watt units, while *C1, C2* and *C3* are 25-volt electrolytic capacitors. Transistor *Q1* and *Q3* are type 2N1265's, *Q2* a type 2N466, *Q4* and *Q5* type 2N297A's. An 8-ohm loudspeaker is used. Power can be supplied either by dry batteries (such as a 12-volt lantern battery or eight flashlight cells in series) or by a suitable, well-filtered a.c. power pack.

Several modifications may be made in the basic circuit to meet individual needs. If the input signal is greater than 7 millivolts, the preamp stage (*Q1*) may be omitted. Type 2N155 output transistors may be used (*Q4, Q5*) if a 4-ohm loudspeaker is employed.

According to Norm, the circuit is not overly critical as far as layout, wiring, or exact component values are concerned, although good wiring practice should be followed. A reasonably clean layout should be selected, with signal leads kept short and direct. The output transistors (*Q4, Q5*) should be mounted on suitable insulated heat sinks to insure good stability and prevent thermal runaway.

Norm cautions that some difficulty may be encountered with the preamp stage (*Q1*) in a few instances (depending on individual transistor gain). He suggests adjusting the value of the load resistor (*R4*) experimentally for optimum performance. And if oscillation occurs, he suggests adding an additional 6800-ohm, ½-watt resistor between the juncture of *R2* and *R4* and the −12-volt bus.

Transitips. Electromagnetic relays are used extensively in transistorized control and alarm circuits, but unfortunately, a specified relay may not always be available. Some time ago, for example, we featured a "Sound Relay" using a commercial unit which could no longer be obtained by the time the column appeared in print, and a number of prospective builders were quite disappointed. However, it is a relatively simple matter to select a substitute relay *provided* that the unit's basic specifications can be met—by checking catalogs, technical data sheets, or other sources.

The typical relay is a fairly simple electromechanical device. Referring to Fig. 3(a), it consists of metal core, coil, pivoted soft iron armature, and one or more sets of contact points. The armature is held in an "open" position by a small spring. In the case of double-throw (d.t.) relays, one contact is *normally closed* (NC) until the relay is energized, while the other is *normally open* (NO). When power is applied to the relay's coil, a magnetic field is set up, pulling the armature to the NO contact against the spring's tension.

Except where physical size or the exact location of mounting holes are critical, the relay's most important characteristics are: (a) number and type of contacts, (b) contact rating, and (c) coil specifications. The majority of transistor projects employ single-pole double-throw (s.p.d.t.) contacts, as shown in Fig. 3(a), although double-pole, double-throw (d.p.d.t.) units may be specified in a few cases, as in Fig. 3(b). As a general rule, too, contact ratings are not critical except where moderate to large amounts of power are to be handled.

From an operational viewpoint, a relay's *coil specifications* are the most important factors in selecting a substitute unit. As a rule, these specifications are given in terms of: (1) d.c. resistance, and (2) sensitivity. The first value is given in ohms, while the second may be expressed in terms of power (watts or milliwatts), voltage, or current. Regardless of the terms used by different manufacturers, coil sensitivities may be equated in similar values by the application of Ohm's law for power.

For example, let's assume a relay has a 4000-ohm coil and requires a current of 1.0 ma. to operate. Applying Ohm's law,

$$E = IR = 0.001 \times 4000 = 4 \text{ volts, or}$$
$$P = I^2R = 0.001^2 \times 4000$$
$$= 4 \text{ milliwatts (.004 watt)}$$

One manufacturer may specify the relay as "4000-ohm, 1.0-ma. coil," another as "4000-ohm, 4-milliwatt coil," and still another as "4000-ohm, 4-volt coil." Yet *all three are identical* as far as basic operational sensitivity is concerned, and *all will work equally well* in a given circuit.

A relay's basic sensitivity depends on a number of design factors. In most cases, however, a relay's sensitivity can be adjusted over small limits by adjusting contact spacing and spring tension. The closer

(*Continued on page* 100)

Monthly Short-Wave Report

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

NORTH AMERICAN ALLIANCE OF SWL CLUBS

SOME MONTHS AGO, in the October, 1962, column, we mentioned the possibility of organizing an alliance of clubs in North America similar to the Swedish "DX-Alliansen." Since then there has been considerable discussion on the subject among various clubs and individuals, and the general consensus appears to be quite favorable to the organizing of such a union.

Currently being considered is a group made up of delegates from organized clubs; representation of those who do not carry any club membership would also be a possibility. The basic purpose of the group would be to promote a greater degree of cooperation between the various SWL organizations which exist in this country, said cooperation being sadly lacking at present.

Before going any further, we would like to point out that we are not running for any office in this as yet unorganized group. Our only ambition is to help it come into being and assist in whatever way we can.

A few of the problems that would have to be faced include: How many representatives should be admitted from each club—one per club or on a ratio-to-membership basis? On what subjects would cooperation be desired or needed? Should the group be a clearing house for information to be passed on to each club for its own use, or just meet to talk over administrative problems? The latter point might be a "snagger," for many club officials are hesitant to allow anyone, including their own members, to make suggestions, offer advice, or "interfere" in any way. Perhaps the alliance would be nothing more than just a "club of clubs."

On the other hand, the group conceivably might become a sort of judicial body, passing judgment on various items or activities which might have a tendency to make our fraternity look bad at times. In this case, it could turn out to be something like a world court, with SWL's not paying attention to a particular decision unless they wanted to, or unless they agreed with the decision. Such an alliance, however, would

DX Awards Presented

The following DX'ers have qualified for awards this month (150, 75, 50, and 25 countries verified). Congratulations, and welcome to the Awards List!

One Hundred Fifty Countries

Jack Perolo (PY2PE1C), Sao Paulo, Brazil

Seventy-Five Countries

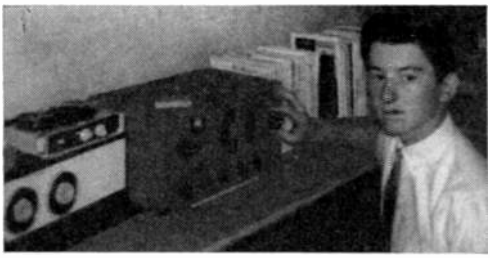
Robert Eddy (WPE8EQW), Newport, Ohio

Fifty Countries

Alan Imprescia (WPE2HUH), New York, N. Y.
Johnnie Adams (WPE5AFU), El Dorado, Ark.
Jerome Kozik (WPE2AHJ), New York, N. Y.
Serge Neumann II (WPE6AKA), Culver City, Calif.
Clarence Bugbee (WPE1UO), Manchester, N. H.

Twenty-Five Countries

Edward Tilbury (KL7PE1K), Eagle River, Alaska
Paul O'Connor (WPE8EUK), Canton, Ohio
Bradley Neff (WPE2KAJ), Olean, N. Y.
Robert Binau (WPE3DTP), Williamsport, Md.
Ralph Morrissey (WPE2JFZ), Bronx, N. Y.
Paul Moyer, Jr. (WPE9FCX), Des Plaines, Ill.
Charles Crepas (WPE9ESN), Glen Ellyn, Ill.
Kurt Leonhardt (WPE9FL), Tinley Park, Ill.
Arthur Boyers (WPEØLG), Topeka, Kan.
Bill Wilson (WPE3DUC), Folcroft, Pa.
Stan Head, Jr. (WPE8YC), Columbus, Ohio
John Toikkanen (WPE8FFD), Conneaut, Ohio
Jerry Drott (WPE4ECG), Charleston, Miss.
Douglas Ready (WPE2KBB), Staten Island, N. Y.
Duane Giese (WPE9FNU), Oshkosh, Wis.
Charles Flynn (WPE2IWE), Huntington Station, N. Y.
Walter Grubb (WPEØCSG), Dubuque, Iowa
Richard Podkul (WPE2FTI), Trenton, N. J.
Louie Stober (WPE7OO), Tigard, Oregon
Michael Brumberger (WPE2HNZ), Brooklyn, N. Y.
Fred Marzec (VE1PE6Z), Summerside, P. E. I.
William Barthell (WPE5CCF), Norman, Okla.
Michael Deckman (WPE3EBS), Lancaster, Pa.
Robert Mattson (WPE2EMS), Bronx, N. Y.
Robert Zulinski (WPE8FAV), Berkley, Mich.
Michael Banner (WPE2FFH), Watkins Glen, N. Y.
John Geery, Jr. (WPE2ESZ), Rochester, N. Y.



James Mac Farlane, Jr., WPE6DIX, Granada Hills, Calif., currently has a record of 31 countries heard, 28 verified. His receiver is a Lafayette HE-10; a Knight Span Master does stand-by service.

In the listening post of Denis O'Keefe, WPØCLL, Omaha, Nebr. (below), there are four receivers—a National 270 ham-band unit, an RCA Strato World III, a VHF and a BCB receiver. To date Denis has 37 countries and 46 states verified.

definitely show the world that SWL hobbyists are capable of policing their own and behaving as adults. Our hamming brothers are quite able to handle their own problems, and it is high time that we SWL's faced up to the fact that we should do so.

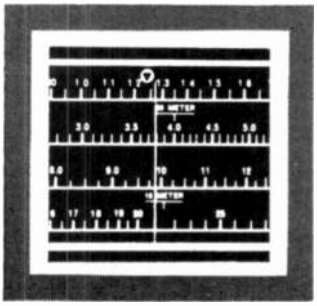
Comments, criticism, and suggestions are sincerely requested. To date we have heard from officials of the Canadian DX Club and the American Shortwave Listeners Club. We would like to hear from representatives of the Newark News Radio Club, the National Radio Club, the North American Shortwave Association, the Worldwide Monitor Radio Club, and any other organized group. And we would also like to hear from interested individuals.

(*Continued on page* 111)

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

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

COUNTRY	STATION	FREQUENCY *(kc.)*	TIMES *(EST)*
Australia	Melbourne	17,840, 15,315, 9580 9580	2030, 2130, 2230 0745
Bulgaria	Sofia	6070 (and/or 9700)	1900, 2000, 2300
Canada	Montreal	15,190, 11,720, 9625	1800 (Caribbean)
East Congo	Leopoldville	11,755	1630, 2100, 2230
West Congo	Brazzaville	11,725	2015
Czechoslovakia	Prague	11,990, 9795, 9550, 7345, 5930	2030, 2330
Denmark	Copenhagen	9520	2100, 2230
West Germany	Cologne	15,405, 11,795 9640, 6160 11,795, 9735, 6145	1010 2035 0000
Hungary	Budapest	11,910, 9833, 7220 9833, 7220	1900 2230
Italy	Rome	9575, 5960	1930, 2205
Netherlands	Hilversum	15,445, 11,950 17,810, 15,445 15,445, 9715 9590, 5985	1030 (Tues., Fri.) 1415 (Tues., Fri.) 1630 (exc. Sun.) 2030 (exc. Sun.)
Portugal	Lisbon	6185, 6025 (and/or 9740)	2105, 2305
Spain	Madrid	9360, 6130	2215, 2315, 0015
Sweden	Stockholm	17,840 11,805	0900 2045, 2215
U.S.S.R.	Moscow	12,020, 11,960, 11,870, 11,860, 11,820, 11,790, 11,730, 11,690, 9760, 9740, 9700, 9680, 9660, 9610, 9570 (may not all be in use at any one time)	1700, 1900, 2000, 2100, 2300, 0040
Vatican City	Vatican City	9645, 7250	1950



Across the Ham Bands

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

TAKE ADVANTAGE OF CHANGING PROPAGATION CONDITIONS

AS THE SUN swings back across the equator, summer static levels are rapidly decreasing and radio propagation conditions, relatively stable during the summer months, are changing rapidly. Are you ready for these changes?

Here's the story. As you know, radio waves tend to travel only in straight lines. Consequently, the curvature of the earth limits radio communication ranges to less than 100 miles unless the waves can be bent or reflected in some manner. Fortunately, the sun does just this, and increases the range to many hundreds and thousands of miles on various frequencies at various times. The trick is to be on the right frequency at the right time.

Maximum Usable Frequency. By bombarding the region between approximately 60 and 300 miles above the earth, the sun produces several charged or ionized layers which are collectively called "the ionosphere." When radio signals strike this region of the atmosphere, they are refracted, in varying degrees, back towards the earth. When the ionization is extremely high, frequencies up to 70 mc. or more may be returned to the earth and thus be usable for "skip" communications. But when the ionization is low, the maximum usable frequency (MUF) may be less than 4 mc.

The time of the day, of the solar month, and of the 11-year sunspot cycle (we are now near the bottom of the current cycle), as well as magnetic and solar storms, all affect the MUF. Because the ionospheric ionization is produced by the sun, it reaches its greatest intensity in the daytime. Also, because the sun is actually closer to the earth in the winter than in the summer, midday winter MUF's are higher than they are in the summer. But winter days are short; therefore, winter MUF's drop off very rapidly at night.

Best Times for DX'ing. As a result of these effects, the 21-mc. band should be open for DX contacts for a few hours

Novice Station of the Month

Mike Truitt, WNØDVS, Greeley, Colo., submitted this month's winning picture in the Novice Station of the Month photo contest, and will receive a free subscription to P.E. for one year. So far, Mike has contacted 28 states, Mexico, and Canada with his efficient station, which features a Drake 2B receiver, a Heathkit DX-60 transmitter, and a Hornet V-75 vertical antenna. If you want to enter our photo contest and try for a similar award, send us a picture of your station —preferably showing you at the controls —with some information about yourself, your equipment, and your activities.

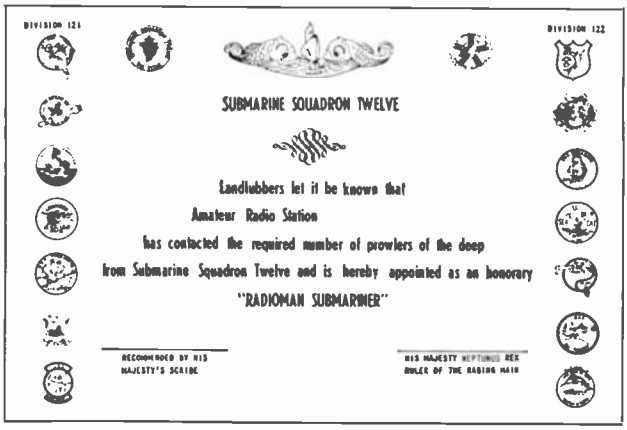
Bob Trotter, KN7VQG, Wenatchee, Wash., has worked 31 states on the 15-, 40-, and 80-meter Novice bands using a Johnson Adventurer transmitter and a Hammarlund HQ-160 receiver.

around noon on many good days for the next several months. But as darkness advances, even the 14-mc. band will usually go dead for DX work, often followed by the 7-mc. band in the late evening, leaving only the 3.5-mc. and 1.8-mc. bands open until dawn. During daylight, the 7-mc. band should be good for distances up to 1000 miles, and 3.5 mc. for up to 200 miles, with signal strengths and distances increasing rapidly on the latter band in the late afternoon.

The unpredictable "sporadic-E" ionospheric conditions, which often make it possible to cover distances up to 1300 miles or more on 50 mc., occur primarily during the early summer, and will be very rare until next summer. But now "atmospheric bending" takes over. When days are warm and evenings are cool—the normal situation in the fall—a layer of warm, moist air usually forms over the cooling surface air each evening as the sun sets. During such a "temperature inversion," VHF and UHF radio signals are refracted back to the earth by the warm air layer, thereby increasing their normal range many times and providing some exciting DX.

The nightly fun usually starts shortly after sunset and may last until midnight. The distances covered range up to 300 miles or more on 50 mc., and to beyond 500 miles on 144 mc. (where the record is over 2500 miles). If you are an early bird, you'll find that temperature inversions also develop in the early morning as the rising sun warms the upper air faster than the surface air.

You'll be able to hang a "Radioman Submariner" certificate of achievement on your shack wall if you work three U.S. Submarine Squadron Twelve stations and comply with rules below.

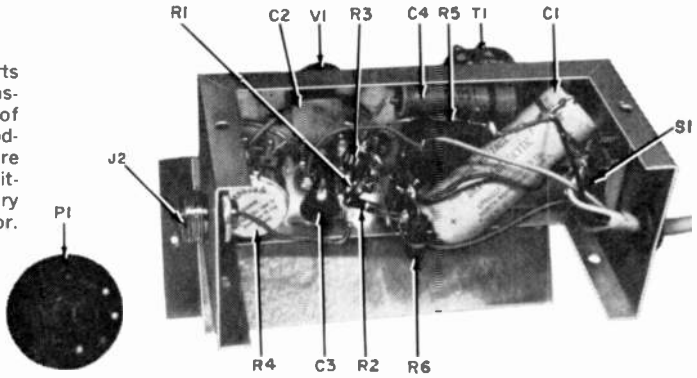


"RADIOMAN SUBMARINER"

U. S. Submarine Squadron Twelve, Key West, Florida, is offering a very attractive certificate of achievement to amateurs in the United States and the rest of the free world. All you have to do is contact two amateur stations on board submarines of Submarine Squadron Twelve and work the Submarine Squadron Twelve club station, W4YVS, or the amateur station on the submarine tender *USS Bushnell* (AS-15). Any mode of operation on any amateur band is permitted.

Contacts with Squadron Twelve submarines made after January 1, 1962, count toward the "Radioman Submariner" certificate, but QSO's with the *Bushnell* or W4YVS must be dated after January 1, 1963, to be acceptable. Submit written proof of your contacts—either QSL's or notarized log entries—with your application; they will be re-

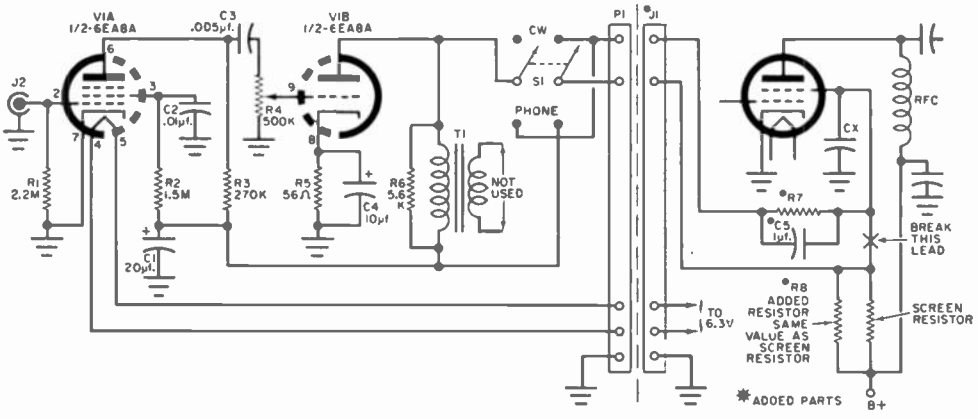
Simple screen modulator converts low power c.w. into phone transmitter. Components to left of dashed line in diagram are in modulator proper; at the right are the modifications in the transmitter tube's screen circuit necessary to accommodate the modulator.



PARTS LIST

C1—20-μf., 450-volt electrolytic capacitor
C2—0.01-μf., 600-volt ceramic capacitor
C3—0.005-μf., 600-volt ceramic capacitor
C4—10-μf., 10-volt electrolytic capacitor
C5—1-μf., 200-volt paper capacitor*
J1—Accessory socket on transmitter*
J2—Single-contact microphone connector (Amphenol 75PC1M or equivalent)
P1—Plug to match accessory socket on transmitter
R1—2.2-megohm, ½-watt resistor
R2—1.5-megohm, ½-watt resistor
R3—270,000-ohm, ½-watt resistor
R4—500,000-ohm potentiometer with audio taper
R5—56-ohm, ½-watt resistor
R6—5600-ohm, 1-watt resistor
R7—2-watt resistor having one-half the resistance value of r.f. amplifier screen-dropping resistor*
R8—2-watt resistor equal in value to original screen resistor*
S1—D.p.d.t. toggle or slide switch
T1—Modulation choke; primary winding of 4-watt, replacement-type speaker output transformer (Stancor A-3856 or equivalent)
V1—6EA8A triode-tetrode vacuum tube
1—2¼" x 2¼" x 5" aluminum box
Misc.—High-impedance crystal or ceramic microphone, 5-conductor cable, tube socket and shield, hardware, etc.

**Components installed in transmitter proper*



turned with your certificate. The address is: President (W4YVS), Submarine Squadron Twelve, Radio Amateur Club, U. S. Naval Station, Key West, Fla.

ONE-TUBE SCREEN MODULATOR

The simple modulator shown here will convert any of the currently available, low-power c.w. transmitters into low-power phone transmitters. Referring to the diagram, the signal from the microphone is amplified in the pentode section of the 6EA8 tube and drives the triode section as the modulator, which is choke-coupled to the r.f. amplifier tube's screen circuit. Operating the modulator at a higher voltage than the screen assures adequate audio modulation voltage without excessive distortion. Resistor *R6* across the coupling "choke" (the primary of transformer *T1*) loads down any

(*Continued on page* 108)

Short-Wave Broadcast Predictions

OCTOBER 1963

BY STANLEY LEINWOLL, Radio Propagation Editor

THIS MONTH decreased sunspot activity, longer nights, and seasonally decreasing nighttime MUF's will result in significantly increased activity in the lower bands after dark. During the next six months, more DX is expected in the 3- and 4-mc. bands than at any time since minimum sunspot conditions last existed—eight years ago. And medium-wave DX'ers should have more to listen to during the coming months than ever before, since there is now a record number of stations on the air. In particular, stations in the 1000- to 1600-kc. region, which will be propagating off the ionosphere's regular F-layers, should be received best during periods when both transmitter and receiver are in darkness.

TIME (EST)

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

TIME (CST)

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

TIME (PST)

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

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

which twin has the phoney ?

(stylus, that is)

your eye can't tell... but your ear can

PRICE VS. PERFORMANCE

Ruskin said it: "There is hardly anything in the world that some man cannot make a little worse and sell a little cheaper and the people who consider price only are this man's lawful prey." Hear, hear. And not being ostriches, we admit to having seen so-called "stylus replacements for Shure Cartridges" selling for less than genuine Shure Dynetic® Replacement Styli. We bought several and examined them:

LABORATORY FINDINGS

Shure laboratory tests show that the imitation stylus assemblies labeled as replacements for the Shure Model N7D Stylus Assembly vary drastically in important performance characteristics. For example, the compliance varied from a low of 0.9 to a high of 11.5, requiring 9.0 grams to track a record with a low compliance stylus, and 2 grams with a high compliance stylus. The high compliance stylus retracted at 4 grams needle force, allowing the cartridge case to drag on the record surface, thereby becoming inoperative. Response at high frequency (relative to the 1 kc level) ranged from a 5.5 db peak to a drop of 7.5 db. Separation varied from "good" (27 db) to "poor" (16.5 db) at 1 kc. These figures reveal that *there is very little consistency in performance characteristics of the imitation Dynetic Styli.*

In each of the categories shown above, the results ranged from good to poor. As a matter of fact, only 10% of the samples met the Shure performance standards for the Shure N7D Stereo Stylus.

A DIAMOND IS A DIAMOND IS A DIAMOND

Time was when the stylus price was measured by its tip—diamond, sapphire, ruby, etc. All good styli have diamonds today—and it is *no longer an important determinant of price.* Shure Dynetic Styli, for instance, are precision crafted throughout and each is painstakingly inspected dozens of times before it is shipped. Tolerances are incredibly rigid. Rejects are high. These standards and procedures are expensive . . . but, we feel well worth the time, labor and expense because the stylus is, in fact, the *major* factor in the Shure Stereo Dynetic's reputation for unvarying high quality, superb performance, and utmost record protection. Obviously, if you use an imitation Dynetic Stylus, we cannot guarantee that the performance of your Shure cartridge will meet published specifications.

SHURE PROTECTS YOU

Shure offers a full one year guarantee on all Dynetic Styli covering workmanship and materials. And, in addition, Shure protects you in the event of damage through your mishandling the stylus. Repair costs are nominal . . . for the life of the stylus! (This does not cover normal and expected needle tip wear.) When to replace the stylus? No safe "number of hours in use" can be given—however, with normal use, we suggest a new stylus about every 18 months —it pays for itself in increased record life. Or, ask your high fidelity dealer to inspect your stylus periodically.

Literature: Shure Brothers, Inc.
222 Hartrey Avenue, Evanston, Illinois

insist on a genuine

SHURE Stereo Dynetic®

HIGH FIDELITY PHONO STYLUS

look for this wording on the box:

"THIS DYNETIC® STYLUS IS PRECISION MANUFACTURED BY SHURE BROTHERS, INC."

U.S. PATENTS 3,055,988; 3,077,521; 3,077,522; D 187,230

FREE

ALL NEW 1964 GIANT CATALOG

RUSH THIS CARD OR COUPON BELOW

TUBE PARTS ETC. AT LOWEST PRICES

NO MONEY DOWN PLUS NEW REVOLVING CHARGE ACCOUNT

Satisfaction GUARANTEED or your money back!

EVERYTHING IN HI-FI AND STEREO

TOP VALUES IN POWER & HAND TOOLS

100's OF BIG PAGES CRAMMED WITH SAVINGS

100's OF NEW ITEMS LISTED FOR FIRST TIME

SAVE UP TO 50% ON CHOICE KITS

THE NUMBER ONE MONEY-SAVING CATALOG

Send for this big book now and see for yourself the amazing money-saving prices on the latest of everything in Electronics. From parts and tubes to complete Hi-Fi systems, you'll get the most for every dollar when you order from this Giant catalog.

B-A has hundreds of items not listed in any other catalog—and all at unbelievable low prices. You'll find page-after-page of • Tools • Kits • Tape Recorders • Phonos • LP Records • Radios • Ham Equipment • Public Address and Intercoms • TV Antennas and Tubes • Photographic Equipment and Film . . . all backed by B-A's money-back guarantee and rushed to you by the fast efficient service developed by over 37 years of mail order experience. You can buy on B-A's Easy Terms—No money down and up to 24 months to pay if you desire.

BURSTEIN-APPLEBEE CO.

Dept. 21, 1012 McGee, Kansas City 6, Mo.

☐ Rush me the FREE 1964 B-A Catalog.

Name _____

Address _____

City _____ Zone ____ State _____

FREE

GIANT NEW CATALOG

100's OF BIG PAGES CRAMMED WITH SAVINGS

BURSTEIN-APPLEBEE CO.

Dept. IE, 1012 McGee St., Kansas City 6, Mo.

☐ Rush me FREE 1964 B-A Catalog.

SEND FOR IT TODAY

Name .....

Address .....

City ..... State .....

FREE

FREE

GIANT NEW CATALOG

100's OF BIG PAGES CRAMMED WITH SAVINGS

BURSTEIN-APPLEBEE CO.

Dept. IE, 1012 McGee St., Kansas City 6, Mo.

☐ Rush me FREE 1964 B-A Catalog.

SEND FOR IT TODAY

Name .....

Address .....

City ..... State .....

FREE

FREE

GIANT NEW CATALOG

100's OF BIG PAGES CRAMMED WITH SAVINGS

BURSTEIN-APPLEBEE CO.

Dept. IE, 1012 McGee St., Kansas City 6, Mo.

☐ Rush me FREE 1964 B-A Catalog.

SEND FOR IT TODAY

Name .....

Address .....

City ..... State .....

FREE

FREE

GIANT NEW CATALOG

100's OF BIG PAGES CRAMMED WITH SAVINGS

BURSTEIN-APPLEBEE CO.

Dept. IE, 1012 McGee St., Kansas City 6, Mo.

☐ Rush me FREE 1964 B-A Catalog.

SEND FOR IT TODAY

Name .....

Address .....

City ..... State .....

FREE

By
JOHN T. FRYE
W9EGV

High-Toned Hawkshaw

CARL AND JERRY were well settled in their third year at Parvoo University. Tonight Jerry was alone in the room of the H-3 Residence Hall the boys shared, while Carl was over at the Sweet Shop on a Coke date with Jodi, the coed from Florida who was a friend of both boys. Through the open door came the sound of a language student across the hall strumming a guitar and singing softly in Spanish:

I like them all, I like them all,
I like them all in general;
But oh that blonde, but oh that blonde,
But oh that blonde I like the most!

The song died away to be replaced by the staccato sound of Carl's feet vigorously pounding the stairs, and a few seconds later he entered the room and threw himself into a chair.

"Hey, why the worried frown?" Jerry asked. "You been quarreling with our honeysuckle friend?"

"Naw, nothing like that," Carl replied, "but I'm worried about her."

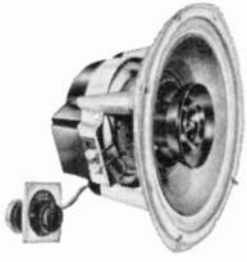
"What's wrong?"

"To put it bluntly, Jodi is afraid she's flipping her wig. She has a friend at that sorority house across the street, and every afternoon she's been parking her car behind H-3 and studying there while she waits for Thelma to get out of class. Yesterday while she was sitting there she got a kind of funny feeling. She couldn't concentrate on the integration of exponential functions she was doing, and she had this weird sensation of fear and anxiety. She was ready to panic when Thelma came, but after they drove away she started feeling better, and was O.K. until this afternoon.

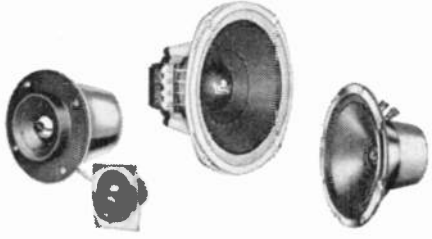
"Today she parked there again. Exactly the same thing happened, only this time it was worse. She got more and more restless and nervous as she sat there trying to study until finally she clapped both hands over her ears

2000 REASONS WHY YOU SHOULD INSTALL UNIVERSITY COMPONENT SPEAKERS

To get right into them...there are the Brandenburg Concertos, the Prague Symphony, Eroica, Petrouchka, La Boheme, the Benny Goodman '38 concert, Jazz at the Philharmonic, Ella singing Gershwin, West Side Story, the soundtrack from Breakfast at Tiffany's, T. S. Eliot reading Prufrock, Waiting for Godot, Lester Lanin's music for dancing —but why not complete the list yourself according to your own tastes and needs? You may even come up with more than 2,000 reasons why University component speakers are the finest you can buy today. They are recognized as the prestige speakers in the popular price range. Anything on record or tape shows you why!



THE 312 INTEGRATED SYSTEM
—a high compliance 12" woofer, patented Diffusicone mid-range and Sphericon super tweeter, all in one. Frequency response: 28-40,000 cps. $73.00 net.



SPECIALIZED INDIVIDUAL 3-WAY SYSTEM
—consisting of the C-12HC 12" high compliance woofer, C-8M mid-range and Sphericon super tweeter. Frequency response: 20-40,000 cps. $91.40 net.

UNIVERSITY LOUDSPEAKERS DESK PE-10
9500 West Reno
Oklahoma City, Oklahoma

Please send me your "Guide to Component Stereo High Fidelity" covering the complete line of University speakers and speaker systems.

Name_____

Address_____

City_____ Zone_____ State_____

U-27R

UNIVERSITY LOUDSPEAKERS *Division of Ling-Temco-Vought*, Oklahoma City, Oklahoma

and burst into tears. She said that seemed to help, because the feeling went away again.

"Now we both know this is not like Jodi, who is about as hysterical as a slide rule. She's really shook, though. I tried to kid her out of it by saying integrating exponential functions is enough to make a temporary lid-flipper out of anyone, but the girl is honestly afraid she's losing her mind."

"Has she seen a doctor?"

"Not yet, but she says she will if it happens again, even though she feels fine, has a good appetite, sleeps well, and so on. Oh yes: She was talking about this thing to Thelma in the sorority house, and one of Thelma's sorority sisters said that something very similar happened to her while she was standing on the sidewalk in back waiting for her date a couple of evenings ago. All at once she got very nervous and depressed and felt she just had to run away from there—even though this was a date with a BMOC she had worked very hard to get. Jodi doesn't put much stock in this, though. She says if you complain of anything from leprosy on down, someone is sure to say she had it first and worse."

"She still has her sense of humor; that's a good sign," Jerry commented with a grin. "Let me get this straight: this afternoon she clapped her hands over her ears and burst into tears. Right?"

"Yeah, but why?"

"I have a hunch that's so far out I don't want to discuss it yet. Do you think you can get Jodi to park there again tomorrow afternoon and give us a chance to do some investigating?"

"Sure," Carl said confidently. "She'd do anything to get this business cleared up."

"Fine, but don't ask her until I find out if I can borrow a piece of equipment from the high voltage lab. I'll know at lunch tomorrow."

THEY left it at that and got down to studying. At noon the next day Jerry gave the green light to Carl, who promptly went to see Jodi and arranged for her to study behind the residence hall that afternoon.

When Carl showed up behind the

BUILD 20 RADIO CIRCUITS AT HOME with the New PROGRESSIVE RADIO "EDU-KIT"®

A Practical Home Radio Course

only $26.95

Reg. U. S. Pat. Off.

Training Electronics Technicians Since 1946

Now Includes

- ★ 12 RECEIVERS
- ★ 3 TRANSMITTERS
- ★ SQ. WAVE GENERATOR
- ★ SIGNAL TRACER
- ★ AMPLIFIER
- ★ SIGNAL INJECTOR
- ★ CODE OSCILLATOR

- ★ No Knowledge of Radio Necessary
- ★ No Additional Parts or Tools Needed
- ★ EXCELLENT BACKGROUND FOR TV
- ★ School Inquiries Invited
- ★ Sold in 79 Countries

YOU DON'T HAVE TO SPEND HUNDREDS OF DOLLARS FOR A RADIO COURSE

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL.

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

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

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build 20 Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the complete price of $26.95. The Signal Tracer alone is worth more than the price of the entire Kit.

THE KIT FOR EVERYONE

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

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

PROGRESSIVE TEACHING METHOD

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

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

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

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instruction necessary to build 20 different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, instruction Manuals, hook-up wire, solder, selenium rectifiers, volume controls and switches, etc.

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

FREE EXTRAS

• SET OF TOOLS

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

SERVICING LESSONS

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

FROM OUR MAIL BAG

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

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

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

PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.

UNCONDITIONAL MONEY-BACK GUARANTEE

ORDER DIRECT FROM AD—RECEIVE FREE BONUS RESISTOR AND CONDENSER KITS WORTH $7

☐ Send "Edu-Kit" postpaid. I enclose full payment of $26.95.
☐ Send "Edu-Kit" C.O.D. I will pay $26.95 plus postage.
☐ Rush me FREE descriptive literature concerning "Edu-Kit."

Name.....

Address.....

.....

PROGRESSIVE "EDU-KITS" INC.
1186 Broadway, Dept. 609D, Hewlett, N. Y.

residence hall several minutes before Jodi was due to arrive, Jerry was sitting in the back seat of the boys' car which was parked parallel to the back of the residence hall. He was holding a strange-looking object in his lap.

"Hey, what kind of a crazy mixed-up weapon is that?" Carl asked, taking it from Jerry's hands and examining it. "It has a rifle stock and a telescope sight, but no gun barrel. And what are these little round doohickeys mounted in a circle around the sight? Don't tell me this is a death-ray gun or I'll know you've flipped *your* lid!"

"O.K., so I won't tell you. Actually it's not a gun at all. It's an ultrasonic corona detector developed by the Westinghouse research labs to spot the high-voltage corona leaks from transmission lines and other equipment. You know about corona. It happens whenever voltages are so high that some current escapes the conductor, especially at any sharp point or discontinuity, and radiates into space. Corona discharge wastes power and causes a lot of radio and TV interference, so power companies always try to locate and eliminate it. Finding one, though, is not always so easy. Sometimes it shows up as a blue glow in the dark with hissing, snapping noises, but in other cases it can't be seen or heard.

"One thing *all* coronas do is produce ultrasonic vibrations, and the detector takes advantage of this fact. Those twenty gadgets in a circle around the sight are ultrasonic transducers operating on about forty kilocycles and positioned so that the 'reception beam' is less than two degrees in width. Electrical pulses put out by the transducers are converted to the audio frequency range by transistor circuits and make static-like sounds in this little speaker near the rear of the sight when a corona discharge is being received. At a distance of seventy-five feet, this thing will pinpoint corona sources only a few inches apart on a high tension line. The telescope sight is lined up with the reception path of the transducers so that when sound from the speaker is maximum the cross-hairs of the 'scope are lined-up right on the source of ultrasonic corona discharge—there's Jodi now," Jerry broke off. "Did you give

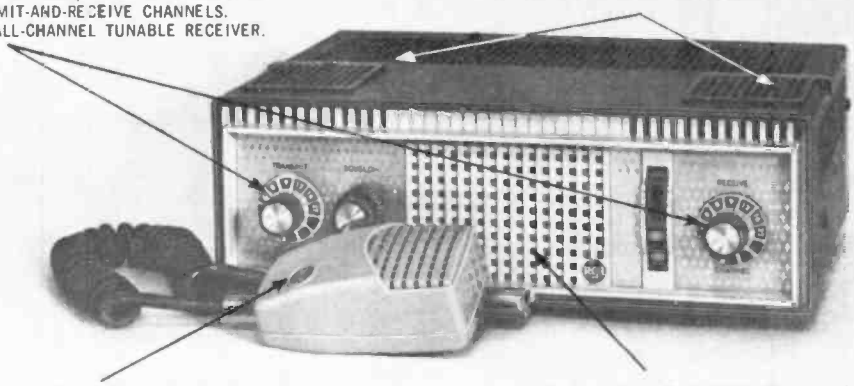
FEATURE FOR FEATURE – DOLLAR FOR DOLLAR
YOUR BEST BUY IN CB RADIO

THE NEW RCA
MARK VIII

27-Mc CITIZENS BAND 2-WAY RADIOPHONE

UP TO 9 FIXED, CRYSTAL-CONTROLLED TRANSMIT-AND-RECEIVE CHANNELS. PLUS ALL-CHANNEL TUNABLE RECEIVER.

CONVENIENT ACCESS TO CRYSTALS FOR QUICK CHANGING.



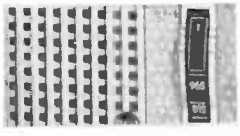
PUSH-TO-TALK CERAMIC MICROPHONE with coiled cord.

EXCELLENT VOICE REPRODUCTION—high intelligibility.

EXCELLENT TRANSMITTER MODULATION CHARACTERISTICS

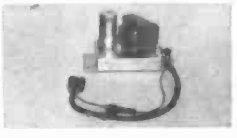
IMPROVED AUTOMATIC NOISE LIMITER reduces effects of ignition and similar interference.

COMPACT AND LIGHTWEIGHT 3½" high, 9 pounds. Fits easily under any auto dashboard.



Continuously tunable receiver picks up any of the 23 C-B channels. Tunes either by channel number or frequency.

Illuminated working channel. Pilot lamps behind the fixed-channel dials show the channels being worked.



Separate mobile power supply. (Optional) 6- or 12-volt, for car or boat. All units contain AC power supply.

Channel-marker kit. Select channels best for your area, then mark them with the self-adhering labels included.

ONLY $149.50*

*OPTIONAL LIST PRICE

Get all the Facts Before You Buy.
Mail Coupon Today. Paste on 4¢ Post-Card.

RCA ELECTRONIC COMPONENTS AND DEVICES
Commercial Engineering Dept. J-133R
415 South Fifth Street, Harrison, N. J.

Please send more information on the RCA Mark VIII C-B Radiophone

Name_____

Address_____

City_____ Zone_____ State_____

RCA **The Most Trusted Name in Electronics**

her the little box and tell her to read the instructions inside?"

"Sure, sure," Carl said impatiently, watching Jodi, who was looking very pretty in a bright red scarf, as she parked her smart little white convertible behind the residence hall. "I don't see why all this mystery is necessary. Nor do I see any connection between Jodi's moods and a corona discharge. There aren't even any high tension wires around here."

"You just keep your eye on Jodi and let me know if she opens that box and does anything with what's inside," Jerry instructed. He had slid down onto the floor of the car so that he could look through the telescope sight at the windows of the residence hall without being conspicuous.

"She must be getting that feeling again," Carl reported after a minute. "She's shaking her head and rubbing the back of her neck. She's opening the little box and taking something out of it. What was in it, earrings? She seems to be putting something on her ears."

Jerry was too busy to answer. Quickly but carefully he was aiming the sight of the corona detector at one open window after another of the residence hall. As he centered the crosshairs of the telescope on a second-floor window almost directly opposite where Jodi was parked, the little speaker of the instrument gave forth a loud crackling sound easily audible to Carl in the front seat. Moving the sight up or down or to the right or left of the window caused the sound to die out.

"I think this is the point where you're supposed to exclaim triumphantly, 'Aha!'," Carl offered with heavy sarcasm. "What do we do now?"

"We get out of here and into the building without attracting attention," Jerry said, laying the corona detector on the seat. The boys sauntered slowly to the door of the residence hall, but once inside, they dashed up the stairs to the second floor and ran down the hall to the door of the room from which the ultrasonic waves were coming. Cautiously Jerry tried the knob. The door was locked.

"We've got to get in there without arousing their suspicions, and we've gotta do it fast," Jerry whispered. "Do you know the name of either of the guys in this room?"

"Yeah. Both are freshmen, and one of

them is Victor Brown," Carl whispered back. "I met him at the radio store last week. He's kind of a hi-fi nut."

"Fine! Good old Victor's going to get a telephone call in a few seconds. When he comes out to answer it, you go in—fast. I'll be right behind you."

JERRY went to the telephone booths in the hall and dialed a number. He spoke into the transmitter, and almost immediately Carl heard the buzzer inside the room with the locked door signaling a telephone call for one of the occupants. The door was unlocked, and a tall, thin, weak-chinned boy stepped into the hall. Before he could close the door behind him, Carl rudely pushed him to one side and stepped into the room. Jerry was right on his heels, shoving Victor ahead of him.

Peering out the window across the room was a big hulking youth with a bristling crew-cut. On a table beside him was a large audio amplifier, and feeding into it was an instrument Carl recognized at a glance as an audio oscillator. A wire ran from the amplifier to an extra-heavy-duty speaker unit attached to the rear of a long, narrow-throated horn aimed out the window directly at Jodi in her convertible. Glowing pilot lamps on both oscillator and amplifier showed they were operating, but not a sound was heard coming from the speaker.

The big youth wheeled around at the sound of scuffling and took a threatening step or two toward the door until he sized up Carl's brawny frame and saw Jerry behind him. Jerry ran over and turned off the oscillator, but not before he noticed that it was operating around 35 kc.

"What do you two think you're doing?" he asked the two freshmen sternly.

"We're just having a little fun," Victor answered the upperclassman nervously. "Joe's dad used that king-sized tweeter for some ultrasonic testing in his factory. We were playing around with it on this hundred-watt hi-fi amplifier and decided to see what happened when we turned the beamed output on that girl down there in the car. It seems to kind of bug her."

"Sounds just like a couple of stupid freshmen," Carl commented. "You may

be injuring the girl. High-powered ultrasonic waves shouldn't be fooled with. And don't lie to us. This isn't the first time you've used that thing on human beings."

"We did try it two or three other times," Victor confessed, "but we sure didn't want to hurt anyone. Are you going to turn us in?"

Carl and Jerry exchanged glances. The minds of both went back to their first week in Parvoo and the night they wired the mailbox for sound and were unlucky enough to have the president of the university for their first victim.

"Not if you take that thing apart right now and never use it again," Carl said gruffly.

The apparatus was already being dismantled as Carl and Jerry left.

THE BOYS joined Jodi and Thelma, a vivacious red-head, and the four of them went to a drive-in in Jodi's car to get something to eat and to discuss the adventure.

"I've got a friend who worked in the lab of a radio manufacturer during the war," Jerry explained. "He told me about the lab jokers horsing around with high-powered ultrasonic waves. They pointed the horn through the door of the lab at a girl secretary some seventy-five feet away. She acted just like you, Jodi. She got nervous and fidgety and finally broke into tears. Next they turned the beam on an expert man typist. He didn't cry, but he began making one typing error after another.

"All this came back when Carl told me what happened to you. I figure the sound waves affect the ears, even though they don't register as sound. That's why I sent the ear plugs and asked you to use them when you began to feel the ultrasonic vibrations. Carl and I had to have some time to locate the ultrasonic source if there was any, but we didn't want you going out of your ever-loving mind while we were doing it."

"I'm sure glad it wasn't all just in my mind!" Jodi exclaimed. "I just love this little old ultrasonic detector," she drawled as she pressed the gun stock against her cheek.

"That name seems a little common for this gadget," Carl said. "I'd rather think of it as a high-toned Hawkshaw!" –30–

The Cloud Sentinel

(*Continued from page* 58)

can be used to power the amplifier and thereby increase amplification.

You can experiment with different values of *R2*, *R5*, and possibly *R4* for even better results. Because current drain on *B2* is only about 3 ma., smaller batteries can be substituted for *B2*. Possible transistor substitutions include experimenters' *pnp* types such as the 2N107. All switches can readily be changed, as can potentiometer types and values.

Antenna-Ground System. The antenna shown in the photograph on page 58 is made with seven 10″ lengths of #14 bare copper wire filed to points at the top, and soldered together at the bottom. The wires are fitted into a hollow oiled block of wood which insulates them from the mast and supports them so that they point upward. Connect a length of #14 insulated copper wire to this assembly, and bring it down the antenna mast to the base, taping it to the mast at suitable intervals.

A 6′ length of ½″ galvanized steel pipe driven into the ground near the base serves as a ground. Use microphone cable to connect the antenna and ground to the Cloud Sentinel, soldering the antenna lead to the center conductor. Connect galvanized ground wire to the ground pipe, and then to the base of the antenna mast; solder the braid of the microphone cable to this wire.

Be sure that these connections are electrically and mechanically sturdy, then bury the length of microphone cable leading away from the mast in a trench at least 10″ deep for a minimum distance of 30 feet. Finally, bring the end of the cable above ground and connect it to the Sentinel.

Calibration and Use. To calibrate the Sentinel, turn it on, rotate *R4* until the meter is zeroed for ambient temperature, close *S1*, and adjust *R3* until the desired amplification factor is shown on *M1*. Connect the antenna and ground and throw *S3* to *ANT*. If the meter reads down-scale, throw *S3* to the *GND* posi-

tion. During use it will be noted that the meter will frequently deflect down-scale —this shows a temporary reversal of current flow in the antenna-ground circuit and is in no way unusual.

In operation, it will be found that as an electrical storm approaches the meter pointer will wander—aimlessly at first, then rather animatedly as the storm nears. If the storm is at a distance of 15 miles or more, it will normally be impossible to hear the thunder, but the meter will show lightning discharges as fast drops in readings following rather slower build-ups.

As the storm approaches, the pattern continues, but it will be necessary to shunt the meter because peak currents of several microamperes will flow. Typical lightning flashes will be read as increasingly rapid rises in current followed by very sharp drops—possibly necessitating reversing the *ANT-GND* polarity. With some experience, it will be possible for the operator to predict quite accurately both the instant and intensity of each stroke.

Another interesting phenomenon which will be noted is that variations in the temperature of the surrounding air alter the no-signal (zero) position of the meter—up-scale for warmer, down-scale for colder. Temperatures can change very quickly during thunderstorms, and for this reason, zero and calibration should be checked every few minutes.

The Cloud Sentinel can also be used in clear weather to measure what are known as "fair weather currents." During thunderstorms you will note that electron movement is normally from air to antenna to ground. In fine weather, a reverse flow will be registered, but at considerably reduced readings and with the possible need for extended antenna height.

Safety Precautions. The Sentinel is considerably safer than most installations using an antenna. However, the following rules should be observed for absolute safety:

(1) Limit antenna height to 20 feet for monitoring local thunderstorm activity.

(2) Locate the antenna mast near a building or other tall object so that the antenna is within the object's "cone of protection."

(3) Lead the microphone cable away from the antenna by burying it in a covered trench at least 10″ deep and 30′ long.

(4) Operate the Sentinel indoors—in a house, garage, or dry shed.

(5) Should lightning begin striking within two miles of your operating position, suspend operations until the storm passes out of this range.

(6) Ground the base of the antenna mast to the nearby ground.

At first glance it may seem that the above precautions go to mollycoddling extremes. This may be true, but it is strongly recommended that they be observed—they could possibly save your life!

Although parts for the Sentinel catalog at about $13 (including $4.95 for the meter), judicious use of junk box parts and substitutions can cut this total down considerably. The completed unit can also be used as a sensitive laboratory instrument for measuring tiny currents. The amplifier will prove to be quite linear for all factors of amplification if the meter has been accurately zeroed and calibrated prior to use. -30-

Hi-Fi Lab Check

(*Continued from page* 69)

graph records with a stereo cartridge, the vertical groove component being automatically cancelled to reduce rumble. Obviously, the rumble filter accomplishes the same objective, but it has a degrading effect on true low frequency response.

Building the KT-900 can be a 12 - 13 hour project, which is far below the average for stereo amplifiers of this power output rating. All of the power supply and small signal circuitry is constructed on printed circuit cards. These are easily assembled on your workbench, mounted, and the appropriate interconnections made to back and front panels and to the power transistors on the chassis bottom.

The sound of the KT-900 is clean and crisp, and does not show any sign of distress regardless of output volume demands. -30-

Satellites On The Air

The following satellites, launched by the United States, were reported to have beacon and telemetry transmissions as of August 16, 1963. The satellites are listed by their code names, according to frequency; because some transmit on more than one frequency, they appear more than once.

Transit 4A	54.000 mc.
Vanguard 1*	108.023 mc.
Telstar 2	136.050 mc.
Alouette**	136.080 mc.
Relay 1	136.140 mc.
Explorer 16**	136.200 mc.
Transit 4A	136.200 mc.
Tiros 5	136.233 mc.
Tiros 6	136.233 mc.
Tiros 7	136.235 mc.
Explorer 17**	136.316 mc.
Ariel	136.406 mc.
1963 14C (US)	136.410 mc.
Explorer 14	136.440 mc.
Syncom II	136.470 mc.
Explorer 17	136.559 mc.
Alouette**	136.590 mc.
Relay 1	136.620 mc.
OSO 1	136.744 mc.
Syncom II	136.770 mc.
Anna 1B	136.815 mc.
Explorer 16	136.860 mc.
Injun 3**	136.868 mc.
Solar Radiation	136.890 mc.
1963 14B (US)	136.892 mc.
Tiros 6	136.921 mc.
Tiros 7	136.922 mc.
Tiros 5	136.923 mc.
Anna 1B	136.975 mc.
Alouette	136.978 mc.
Syncom II	136.980 mc.

*Transmits only while satellite is in sunlight
**Transmits only upon command from ground stations—not during every pass

Satellites of the Soviet Union have telemetry and tracking transmissions in the 19.990-20.010 mc. band. Whenever a Cosmos series satellite is launched, check Radio Moscow for an announcement of tracking frequencies. Most Cosmos series satellites re-enter the atmosphere in 60-90 days. Cosmos 2 and 8 are in orbit at press time, but do not seem to be transmitting.

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

Transistor Topics

(*Continued from page* 76)

the armature to the core and the weaker the spring, the more sensitive the relay.

To select a substitute relay for a project, then, simply:

(1) Check the original relay's specifications in a catalog, paying particular attention to coil resistance and sensitivity.

(2) Referring to a general catalog, choose a substitute unit with the same electrical specifications, converting coil sensitivity into the same terms where necessary (by using Ohm's law).

(3) If an *exact* substitute is not available, choose a relay with slightly greater (or less) sensitivity, readjusting the relay's sensitivity for best performance by adjusting spring tension and contact spacing.

Product News. Some time ago, Electro Products Laboratories, Inc. (6125 W. Howard St., Chicago 48, Ill.) introduced a new power supply to the service trade, Model EC-3. Selling for only $19.95, this unit is ideal for bench use in checking experimental circuits and hobbyist projects as well as for servicing. It has a built-in voltage/current

meter and can supply 0-20 volts of well filtered d.c. at currents of up to 150 ma. (or 24 volts at 100 ma.). The output voltage is continuously adjustable over its range. In addition, a separate adjustable bias output of from 0 to 6 volts is available. Model EC-3 is supplied with pre-attached clip leads.

Fairchild Semiconductor (545 Whisman Rd., Mountain View, Calif.) has introduced a new planar epitaxial power transistor. An *npn* type, it features a 20-watt power dissipation. Identified as Type 2N2893, the

transistor is suitable for use in audio power applications up to VHF. Cost is relatively high at this time.

That about covers the "semiconductor front" for now. We'll be back next month with more news, info, and other odds and ends . . .

—Lou

On the Citizens Band

(*Continued from page 72*)

the CB fold, and both represent excellent attempts at publishing an interesting, informative compilation of CB material. In the first issue of the *Heterodyne Herald*, published by the Waukesha County CB Club of Oconomowoc, Wis., there were several news-worthy pages along with some excellently reproduced photographs. The Kanawha Valley Communications Club of St. Albans, W. Va., also kicked off their first news attempt—the *News Letter*—with a class "A" job. Kudos to both clubs!

New club listings crossing the OTCB desk for the first time this month include: the Quincy Area CB Club, Quincy, Ill., whose members held an area CB Jamboree August 25. . . . the Fox Valley Citizens Band Sentinels from Elgin, Ill.; in existence for almost two years, the FVCBC has a membership total of 55 to date. . . . the Greater Boston 11 Meter Association from out Massachuettes way, where last Christmas week end members logged over a thousand man-hours and 4000 mobile miles during their collection of $5000 for the Salvation Army. . . . the Cambria County Citizens Communication Club, Johnstown, Pa., a well-organized eastern CB group which publishes an excellent club newspaper (*The Carrier*) chock full of enlightening CB info from Part 19, to club activities, to the tips of your antennas. . . . and the Crystal Wizards Club, Muskegon, Mich., which publishes *The Signal*, has a full complement of officers, and follows suit with the average well-organized CB association.

Before Going 10-7. Doug Benson of WSNY radio, Schenectady, N. Y., informed us that Jerome Patterson of Mount Vernon, N. Y., brother of former boxing champion Floyd Patterson, was recently hospitalized after an auto accident caused the car in which he was a passenger to leave the road on October Mountain in Massachusetts. Use of CB radio installed in the auto brought help from the State Police in a matter of minutes.

A number of readers have requested information on the availability of a CB call book covering Canada, South and Central America. While these people are not contacting these foreign stations, many have been receiving them on "skip" and are interested in logging the calls. If you know where such a listing may be purchased, drop us a line and we'll pass it on to interested CB'ers via this column.

Forward all CB material and pictures to POPULAR ELECTRONICS, Matt P. Spinello, CB Editor, One Park Avenue, New York 16, N. Y.

I'll CB'ing you,

Matt, 18W4689

Current Quiz Answers

(*Quiz on page* 55)

A - 10 The PULL-IN current for a relay is the minimum coil current that will move the armature to the closed position.

B - 6 The EXCITING current in a transformer is the primary current which flows when the secondary winding is open.

C - 3 A BLEEDER current, usually about 10% of the rated output current, flows in the bleeder resistor of a power supply, and improves the regulation of the output voltage.

D - 5 EDDY currents are induced in the work piece by transformer action in the r.f. induction heating process.

E - 4 The DARK current in a photoelectric tube is the current which flows in the absence of light.

F - 2 The d.c. BIAS current in a transistor common-emitter circuit determines the operating point for the signal current.

G - 8 A LEADING current is present in a capacitive circuit because of the current surges into the capacitor.

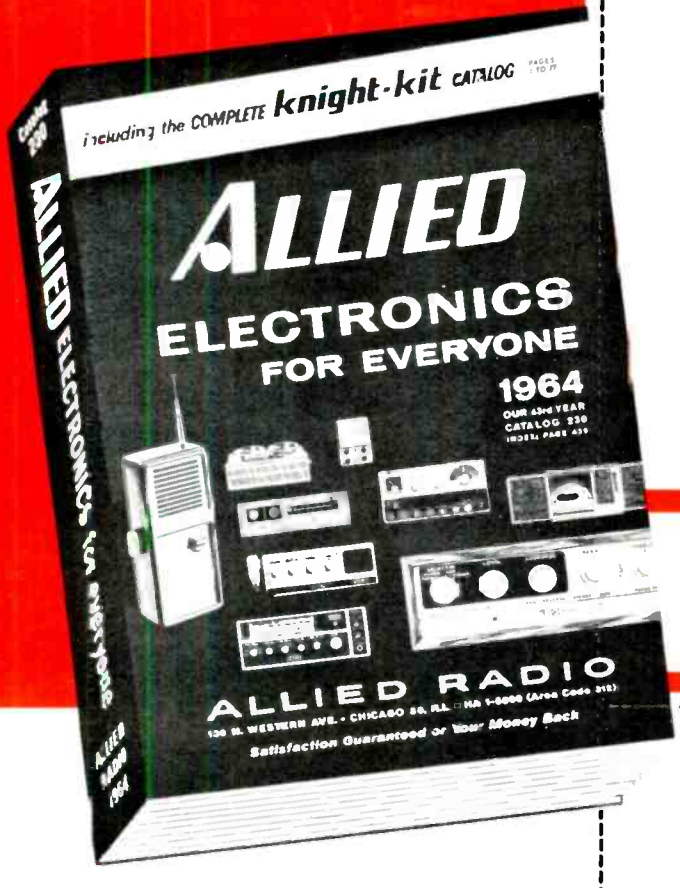
H - 9 The LEAKAGE current, or I_{ceo} in a transistor, is the collector current which flows with zero base current.

I - 7 The FIELD current is the current that energizes the electromagnet of an electrodynamic loudspeaker. It is often obtained by using the field coil as the choke in the amplifier power supply.

J - 1 The BEAM current in a cathode-ray tube is the electron stream which is accelerated toward the fluorescent screen.

FREE

MAIL NOW



send for your money-saving

ALLIED 444-PAGE 1964 CATALOG

WORLD'S LARGEST ELECTRONICS CATALOG

BIGGEST SELECTION • BIGGEST SAVINGS!

satisfaction guaranteed or your money back

NO MONEY DOWN: NOW! MORE BUYING POWER WITH YOUR ALLIED CREDIT FUND PLAN!

SEE OTHER SIDE

For your FREE 1964 ALLIED Catalog, fill in card, detach and mail. (Please give other card to an interested friend.)

SEND CARD TODAY

MAIL NOW

Name _____ (PLEASE PRINT)

Address _____

City _____ Zone _____

State _____

3-K

YOUR **FREE** ALLIED 1964 CATALOG

Name _____ (PLEASE PRINT)

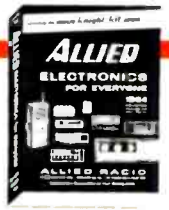
Address _____

City _____ Zone _____

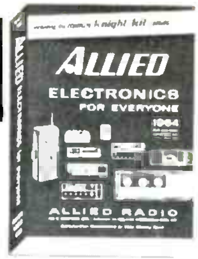
State _____

3-K

YOUR **FREE** ALLIED 1964 CATALOG



MAIL NOW



FREE

SEND TODAY FOR YOUR MONEY-SAVING

ALLIED 1964 CATALOG

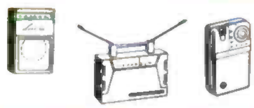
WORLD'S LARGEST · BIGGEST SELECTION · BIGGEST SAVINGS

1964 *knight-kits*®
Over 100 great build-your-own kits: Hi-Fi, Hobby, Citizens Band, Intercom, Amateur, Test Instrument—savings up to 50%.

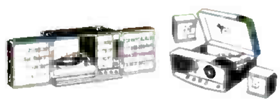
Stereo Hi-Fi
Complete selection of components and systems; latest all-transistor hi-fi; super-value Knight® hi-fi; all the famous makes—save most!

Citizens Band Radio
Latest 2-way radio—no exam required—complete selection of top-value CB equipment, including Walkie-Talkies.

Tape Recording
Largest selection of tape recorders, tape decks, pre-amps and accessories; quality recording tapes at biggest savings.



FM-AM & AM Radios
Best buys in all types of compact transistor radios, including quality FM-AM portables—big money-saving selection.



Phonographs, Accessories
Top values in phonographs; latest Stereo portables; full selection of phono accessories.

Ham Station Equipment
Largest selection of receivers, transmitters, antennas—everything in Ham station gear at substantial savings.

Test Instruments
Save on every type of instrument for home or professional use—all leading makes in stock.

PLUS
- PA Systems & Intercoms
- Big Buys in Tools & Hardware
- TV Tubes, Antennas
- Parts, Tubes, Transistors, Books

satisfaction guaranteed or your money back

NO MONEY DOWN: Now! More Buying Power with Your Allied Credit Fund Plan!

MAIL NOW

FREE SEND CARD TODAY FOR your 1964 Allied Catalog

AND GIVE ONE CARD TO AN INTERESTED FRIEND

PLACE STAMP HERE

To:
ALLIED RADIO
CHICAGO 80, ILLINOIS
P.O. Box 4398

PLACE STAMP HERE

To:
ALLIED RADIO
CHICAGO 80, ILLINOIS
P.O. Box 4398

New Products

FUSED A.C. CONNECTOR

The "SAFE-T-KORD" Model 1480, available from Industrial Devices, Inc., provides fused protection for electrical and electronic work away from a test bench. The a.c. connector consists of a 6′ length of No. 18 line cord with molded plug, and two insulated "Safe-T-Klips," each incorporating an AGX 5-ampere fuse. (*Industrial Devices, Inc.*, Edgewater, N.J.)

FOAM RADIATOR SPEAKER SYSTEM

Several special design features are being offered in a new speaker system announced by Audio Dynamics. Like other, larger, systems in this line, the ADC-12 has a rigid rectangular styrene foam diaphragm covered with aluminum foil. High-compliance molded cloth supports the foam radiator. The internal damping offered by the expanded foam radiator, combined with high stiffness and low mass, is said to give very natural bass and midrange response. The high frequencies are handled by a tweeter with a 1½" Mylar diaphragm driven by a voice coil of the same diameter. Mounted

in a 11¾" x 13" x 23½" walnut cabinet, the ADC-12 has a rated frequency response of 38 to 20,000 cps, 8- to 16-ohm impedance, and can be driven by an amplifier delivering 10 watts or more. Price, $139.50. (*Audio Dynamics Corp.*, Pickett District Rd., New Milford, Conn.)

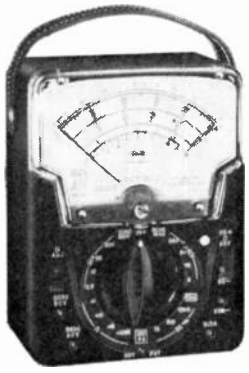
(*Continued on page* 106)

New Products

(*Continued from page* 105)

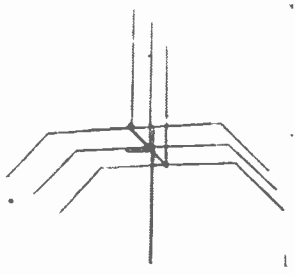
OVERLOAD PROTECTED VOM

There's virtually no need for repairs to Triplett's new volt-ohm-milliammeter since it incorporates a transistorized electronic switching circuit which guards against accidental burn-outs. The high-sensitivity Model 630-PLK (20,000 ohms/volt d.c., 5000 ohms/volt a.c.) features ±3% accuracy on d.c. and ±4% on a.c. A single selector switch makes it easy to change ranges, and the 630-PLK is usable at frequencies through 500 kc. It comes in a black molded case with transparent unbreakable plastic window, complete with leather carrying handle and leads. Price, $79.50. (*The Triplett Electrical Instrument Co.*, Bluffton, Ohio)



TWO-IN-ONE BEAM ANTENNA

With Antenna Specialists' Model MR-77 two-in-one CB beam antenna, the user can select either vertically or horizontally polarized operation by means of a switch at the operating position. The unit provides 7 db forward gain for vertically polarized operation, and 6 db in the horizontal mode. In either mode, the front-to-back ratio is 15 db. Separate coaxial feedlines are used for the two polarization modes. The MR-77 array is 12½' high, with a boom length of 10', and weighs 24 pounds. Both boom and elements are sturdily made of heat-treated aluminum alloy. (*The Antenna Specialists Company*, Cleveland, Ohio)



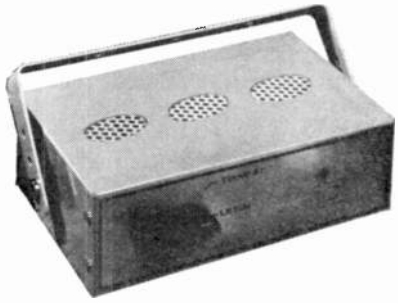
PRINTED-CIRCUIT RADIO KIT

Layout of each component in Olson's 5-tube radio kit is clearly indicated on the printed-circuit board, and easy "Quick-Step" in-

structions reduce the chance of errors in assembly to the vanishing point. A handsome cabinet and built-in antenna are included. Available separately is a kit of five tubes for the radio: 12BE6, 12BA6, 12AV6, 50C5 and 35W4. Radio kit, $8.49. Tube kit (AS-533), $2.28. (*Olson Electronics, Inc.*, 260 S. Forge St., Akron 8, Ohio)

PICKUP CAMPER INTERCOM

The T/C/I "Camper 88" is a new transistorized intercom system designed expressly for "pickup campers." The master unit, installed in the pickup cab, may continuously monitor the remote unit if desired. In the



camper, the remote unit may call but not monitor the master unit. Special shock mounts and adjustable mounting brackets make installation easy. Price, $49.50 a pair, including all necessary wiring and connecting cable. (*Texas Communications*, P.O. Box 35-534, Dallas 35, Texas) -30-

Operation Pickup Mk II

(*Continued from page* 48)

steel wall behind the ornamental radiator grille. This eliminates the possibility of the transistors being heated excessively by the engine and breaking down. The entire system has been liberally coated with a clear plastic Lucite paint for weatherproofing.

Ballast Resistor. If your car has ballast wiring instead of a ballast resistor, the "minus" connection from the ignition coil should go directly to the engine block. This applies only to 12-volt, negative-ground cars. Most 12-volt, positive-ground cars have the circuitry shown in the diagram on page 48 within the dashed lines. In most 6-volt, positive-ground cars, the ignition switch is connected directly to the coil. -30-

Across the Ham Bands

(*Continued from page* 81)

unwanted resonances due to distributed capacitances in the winding so that the combination presents a fairly flat load for the modulator across the audio frequency band.

Construction. A 2¼" x 2¼" x 5" aluminum box easily accommodates the modulator. Following the general parts layout shown in the photograph will keep the input and output separated and minimize feedback problems. Modulation "choke" *T1* is the primary winding of a small, replacement-type, speaker output transformer (Stancor A-3856 or equivalent).

Refer to your transmitter instruction manual and the diagram (p. 81) while carrying out the following steps. If necessary, it is an easy matter to add an accessory socket at a convenient spot on the rear chassis lip of the transmitter to accommodate the modulator plug. You'll need five terminals.

Disconnect the screen-dropping resistor from the r.f. amplifier tube's terminal and connect a 1-watt resistor (*R7*) of half the resistance of the screen resistor between the tube socket screen terminal and the accessory socket; also connect capacitor *C5* across the resistor. Connect the free end of the screen resistor to another terminal on the accessory; at the same time, connect another resistor of the same value across the screen resistor. Check the value of screen bypass capacitor *Cx*; if it is greater than .002 μf., replace it with a .002-μf., 1200-volt mica or ceramic unit. Also connect a pair of wires from the transmitter's 6.3-volt heater circuit to the accessory socket, and ground its fifth terminal to the transmitter chassis. Finally, wire the plug from the modulator to match these connections, and insert the plug in the socket.

Operation. Tune up the transmitter in the normal manner with switch *S1* in the c.w. position. Then put the switch in the phone position; this should cause the amplifier plate current to drop approximately 50 per cent. Now, advance the audio gain control (*R4*) while talking into the microphone until the amplifier plate current increases slightly on voice peaks.

You can check your phone quality and depth of modulation by listening to your signal on your own receiver using headphones. Short the receiver's antenna input terminals to reduce the strength of the incoming signal. Careful adjustment of the r.f. amplifier's grid current and possible experimental adjustment of resistor *R7* will produce the best-sounding phone signal.

News and Views

Don Anderson, WN2GFO, 2022 Arrowwood Dr., Westfield, N.J., will be just getting back from a summer of portable operation on 40-meter and 15-meter c.w. and 2-meter phone when you read this. From his home, Don has 15 states worked on 80 meters with his Hallicrafters SX-140 receiver and Hallicrafters HT-40 transmitter feeding a dipole antenna. On two meters, he uses a Heathkit Twoer to drive a Hy-Gain 5-element beam. . . . **Paul Rowsey, WA4DMB,** 171 E. 29th St., Buena Vista, Va., has tooled up his Knight-Kit T-60 transmitter, Hallicrafters S-120 receiver, and "long-wire" antenna to work 33 states; he has

QSL cards from 30 of them. Paul's pipeline into Ontario has also netted him ten VE3 QSL cards!. . . . **D. O. Easton II,** 849 Calle Aragon, Tucson 2, Ariz., forgot to include his call-sign in his letter to us but his International Crystal 6-meter transmitter knocked off South Dakota, Nebraska, and Texas in two operating sessions. His antenna is a 2-element beam about 15′ high. Of course, the antenna power is a whole 1500 milliwatts (1½ watts). An International converter feeding into the AM tuner of the hi-fi set handles the receiving chores.

Robert J. Barr KN1ZFJ, 67 Hunter Lane, Hazardville, Conn., reports that a wife with an electric hedge trimmer can be a definite hazard around the ham shack. Mrs. Barr was industriously trimming the hedge in the back yard when she heard a dull thud behind her. The thud was Bob's 35′ tower hitting the ground! She had clipped a guy wire. Fortunately, the tower was light; so the accident caused little damage, except to Mrs. Barr's nerves. Bob reports that she passed her Novice exam shortly before the accident; so it *was* an accident and not sabotage. . . .

Dean Schmiedt, WNØFZP, Box 160, Centerville, S.D., started out with a bang. In three weeks on the air, he has already worked 21 states, the Canal Zone, Puerto Rico, and Venezuela. Dean stays on 15 meters most of the time, but he moves down to 40 and 80 once in a while. His equipment consists of a Johnson Viking Challenger transmitter cut down to 75 watts input feeding 80- and 15-meter dipole antennas. and a Hammarlund HQ-100 receiver. . . . While in the "Ø" call area, let's pop in on **Chuck Donaldson, WNØESY,** 8640 West 64th Place, Arvada, Colorado. Chuck runs 65 watts into a Heathkit DX-35 transmitter to excite a 40- through 10-meter dipole and receives on an RME-45 helped along in the selectivity department by a Heathkit HD-11 Q-multiplier. Chuck prefers 40 meters, where he gets many RST589 and RST599 reports from both coasts.

Tom Cote, WN8IBO, 1807 Long Point, Pontiac, Mich., has two transmitters—a home-built one running 30 watts, and a Heathkit DX-20 running 50 watts. A venerable RME-69

Bruce Ludwig, WA8CKS (formerly WN8CKS), operates out of Lima, Ohio, on 2, 6, 15, 40 and 80 meters with his Johnson Viking Challenger transmitter and Hammarlund HQ-170 receiver. Bruce also uses a Heathkit Twoer. Forty states, Canada, the Canal Zone, and Puerto Rico are in his logbook.

takes care of the receiving chores, and a 40-meter dipole couples his equipment to the ionosphere on 40 and 15 meters. Tom has QSL cards from 17 states on the ham shack wall. . . . **Steve A. Corbitt, WN4KFC,** 4055 Three Notch Rd., Mobile, Ala., reports working 43 states and making 26 DX contacts in his first 10 weeks on the air. Steve's equipment rates as a "secret weapon"—he didn't mention what he was using. . . . **Dennis Ardinger, KN3-VMZ/K3VMZ,** 401 Maplewood Drive, Canonsburg, Pa., uses an AMECO AC-1 15-watt transmitter and a Hallicrafters S-19R (Sky Buddy) receiver as QRM fighters. His signal traps are 80-, 40-, and 15-meter dipoles; for some reason, the 40-meter one works better than the other two. Dennis has worked 24 states, including Alaska, and Canada, No. Ireland, Okinawa, and Puerto Rico. He has cards from 17 of the states and Okinawa. Check with him if you need help in getting your ham ticket.

"Lend an Ear Day." The Society of Radio Operators (SRO) of Chicago has undertaken a program of supplying transistor radios to needy persons with a hearing loss who live in Chicagoland rest homes and public institutions. The club has also undertaken to keep the units supplied with batteries. To provide money to buy the receivers, the SRO is holding an "open house" at the Edgebrook Field House, 6100 N. McClellan Ave., Chicago. Manufacturers wishing to display their gear are invited to participate. Space will also be provided for a swapfest of ham gear. For further information, contact A. W. Rutherford, 729 N. Delphia Ave., Park Ridge, Ill.

Until next month, keep your letters, pictures, and ideas coming to: Herb S. Brier, W9EGQ, POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana. 73,

Herb, W9EGQ

Electronic Stop Watch

(*Continued from page* 54)

operation, flip the control switch to *TIME* and leave it there until the event nears the finish. At the exact finish, flip the switch back to the *STDBY* position, and read the time in seconds and tenths of a second. To operate from a remote point, leave the unit in *STDBY*, close the remote switch to start, and open it to stop the timing operation. When the time has been read off, the counter is reset to zero by a few strokes on the thumb wheel.

The author's unit has timed events ranging from sprint races to recording time of long-play tapes, but you can undoubtedly come up with plenty of uses not mentioned here. -30-

Short-Wave Report

(*Continued from page 78*)

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

Aruba—*R. Victoria*, PJA6, has moved from 905 kc. to 900 kc., to avoid QRM from *R. Aeropuerto*, 910 kc., Maiquetia, Venezuela. Station PJA6 was widely reported because of its ability to cut through to N.A. on the split channel.

Australia—The latest English schedule from Melbourne reads as follows: to Indonesia, S. E., S., & S. W. Asia on 21,540 kc. at 2000-0300, on 17,870 kc. at 1930-0400, on 15,220 kc. at 1714-2000 and 0300-0430, on 11,880 kc. at 0330-0900, on 11,840 kc. at 1714-1930, on 9570 kc. at 0459-1230, and on 7220 kc. at 0900-1230; to East Asia & N. W. Pacific Islands on 15,240 kc. at 1559-1915, on 11,810 and 9580 kc. at 0600-0712, and on 11,810 kc. at 0329-0500; to N.A. on 9580 kc. at 0715-0815 and on 17,840 and 15,220 kc. at 2000-2300; to Africa on 11,955 and 9600 kc. at 1200-1400; to British Isles and Europe on 11,710 and 9570 kc. at 0100-0230; to Mid Pacific Islands on 15,315 kc. at 1500-1700, on 15,240 kc. at 2129-0145, and on 7190 kc. at 0159-0712; to S. Pacific Islands on 11,840 kc. at 1500-1700 and on 11,710 and 9570 kc. at 0100-0415.

Monitoring revealed that Melbourne had discontinued its experimental xmsn on 25,735 kc. The station confirmed this fact and gave several reasons, among them the current low sunspot cycle situation.

Basutoland—A new station is ZNE41, Maseru, 3830 kc. Airing what seems to be religious programs in Basuto, it is noted on Saturdays only at 0130-0225 but may s/on as early as 0100. This report is from South Africa; a logging of this station in N.A. will be a formidable challenge.

Bolivia—*R. Corocoro*, Corocoro, has moved from 5962 kc. to 5893 kc. and is noted to 2310 s/off at 2310 with listeners' greetings programs and L.A. music, all Spanish. *R. Colquiri*, Colquiri, operates on 6218 kc. (may vary to 6221 kc.) and is heard around 2100 in Spanish. Station CP15, *R. El Condor*, La Paz, 6212 kc. (a move from 6125 kc.), is noted from 2030 with L.A. music and Union of Railroaders announcements; do not confuse this one with CP18, also *R. El Condor*, 6070 kc.—both stations use the same IS of a starting steam locomotive. *R. Altiplano*, La Paz, is noted on 9505 kc. from 2130 to 0000-0010 s/off, all

Spanish, with music and ID's on the hour and half hour.

Brazil—*R. Guarani*, Belo Horizonte, 6175 kc., is noted around 0110 with a Portuguese ID, Brazilian pop music. Listen for the chimes in the ID.

Ceylon—Colombo was heard on 11,770 kc. at 2030-2100 while KCBR was off the air. A three-note IS and the ID were given often and the entire program was in native language.

Chile—A very cordial letter in Spanish from Sr. Victor Hugo Olguin D. of the "Depto. de Relaciones Internacionales" of *R. Cruz del Sur*, CB138 and CE1185, Plaza Bulnes 47-8° Piso. Santiago, was received in reply to a report on their 11,850-kc. outlet, now back on the air. The stations welcome reports and, in addition to the letter and an QSL card, they also sent along a packet of Chilean stamps. The address given above, by the way, is new.

Colombia—Station HJKJ, *Nueva Granada*, Bogota, normally on 6160 kc., was heard once on 6173 kc. at 0010-0058. Late reports, however, do not indicate a definite frequency change.

Denmark—Copenhagen was found on 9610 kc., a departure from the usual 9520 kc., at 2000-2028 with native language talks and sports reports.

Dominican Republic—HIRM, *R. Sol*, Higuey, operates on 3265 kc. with 1000 watts daily at 0700-2200 (Saturdays to 2300, Sundays to 2000).

Ecuador—According to many reports, HCVC3, *R. Centinela del Sur*, is apparently moving. This one is reported as being heard on frequencies from 6215 kc. to 6250 kc., with most activity centered around 6225 kc. Best after 2000, it is fairly regular and has typical L.A. programs.

Finland—Helsinki has moved to 15,185 kc. (still announced as 15,190 kc.) to avoid interference from *R. Brazzaville* on 15,190 kc. English is broadcast to N.A. at 1530-1600 as follows: each Monday, "Finlandia Mixture"; first and third Friday of the month, "Around The World" (DX program); second and fourth Friday, "Musical Mailbag." These Eng. programs are made in cooperation with the *Finlands DX Club*.

Gan Island—A station which will probably not be audible in N.A. is now in use on this tiny island 600 miles southwest of Ceylon. Operating on the medium waves (exact frequency not known) with low power, it is intended for local reception only. Hours of transmission are 6:00 p.m. to 11:30 p.m. local Gan time. This island is an important stopover for planes of the *Royal Air Force*.

Germany, East—*R. Berlin International*'s latest short-wave schedule shows xmsns at 1230, 1515, and 1700 on 7300, 6115, and 6080 kc., and additionally at 1230 and 1515 on 9730 and 7132 kc., and to N.A. at 2000 and 2130 on 9560 kc. Unlisted xmsns were noted on 11,920 kc. at 2158-2215 with mostly German news and music, and on 17,713 kc. to S.E. Asia at 0255-0300 s/off in English.

Germany, West—The Armed Forces Network operates from Frankfurt with 15 kw. on 872 kc., with relays on 1502, 1304, and 1142 kc. Some of these medium-wave outlets have been reported in N.A. Reports go to Programs Manager, AFN Frankfurt, Frankfurt

NOW...GET THE FINEST STEREO TEST RECORD ever produced for just...$4.98

Featuring Tests Never Before Available To The Hobbyist

UNIQUE FEATURES OF HiFi/STEREO REVIEW'S MODEL 211 STEREO TEST RECORD

- **Warble tones to minimize the distorting effects of room acoustics when making frequency-response checks.**
- **White-noise signals to allow the stereo channels to be matched in level and in tonal characteristics.**
- **Four specially designed tests to check distortion in stereo cartridges.**
- **Open-air recording of moving snare drums to minimize reverberation when checking stereo spread.**

Why We Make the Model 211 Available Now

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

Realizing this, HiFi/STEREO REVIEW decided to produce a record that allows you to check your stereo rig, accurately and completely, just by listening! A record that would be precise enough for technicians to use in the laboratory—and versatile enough for you to use in your home.

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

Stereo Checks That Can Be Made With the Model 211

- **Frequency response — a direct check of eighteen sections of the frequency spectrum, from 20 to 20,000 cps.**
- **Pickup tracking — the most sensitive tests ever available to the amateur for checking cartridge, stylus, and tone arm.**
- **Hum and rumble — foolproof tests that help you evaluate the actual audible levels of rumble and hum in your system.**
- **Flutter—a test to check whether your turntable's flutter is low, moderate, or high.**
- **Channel balance — two white-noise signals that allow you to match your system's stereo channels for level and tonal characteristics.**
- **Separation—an ingenious means of checking the stereo separation at seven different parts of the musical spectrum—from mid-bass to high treble.**

ALSO:
- **Stereo Spread**
- **Speaker Phasing**
- **Channel Identification**

PLUS SUPER FIDELITY MUSIC!

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

All Tests Can Be Made By Ear

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

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

DON'T MISS OUT—SUPPLY LIMITED

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

FILL IN AND MAIL TODAY!

Stereo Test Record
Popular Electronics—Dept. SD
One Park Ave., New York 16, N.Y.

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

Name _____
(Please Print)

Address _____

City _____ Zone _____ State _____

SORRY—No charges or C.O.D. orders! PE 103

Post, APO 757, New York, N. Y. The schedule: 0600-0100.

Guatemala—*R. Club de Guatemala,* 2340 kc., is noted at 2100-0130, all Spanish, with talks and music. This is probably the 90-meter, 150-watt outlet.

Station TGNA, *Transmitiendo Gratas Nuevas Alegres,* Box 601, Guatemala City, has Eng. at 2200-2300 on 720, 5953, 9670, and 11,850 kc., all outlets operating with 5 kw.

Haiti—Station 4VC, *R. Commerce,* Port-au-Prince, off the air for some time, has returned to 9545 kc. and is heard well throughout the day.

India—*All India Radio,* Delhi, is heard well on 15,310 kc. at 2130-2145 with an Eng. newscast.

Korea, North—According to the DX program on Berne (Switzerland), P'yongang operates in Eng. at 1500-1600 on 9750 kc. It was also pointed out that the ID's were not clear but that the news items gave no doubt as to the identity of the station.

Luxembourg—*The Station of the Stars* operates on 1440 and 6090 kc. at 1400-2200 with top hit records and virtually all English. The IS consists of three tones on a gong.

Mauritius—Mauritius Broadcasting Service reportedly operates on 4851 kc. at 1230-1310 in native language. Reception in N.A. at this time and on this frequency is doubtful. Has anyone had any luck?

Mexico—Despite many letters claiming the location of XETRA to be in the immediate Los Angeles area, the xmtr is located precisely at longitude 116° 55′ 49″ West and latitude 32° 27′ 37″ North, or actually in Baja, California, near Tijuana. The studios are in Los Angeles. This information is from Russ Porterfield, managing editor of the station.

Netherlands—English from Hilversum has been noted at 1500 and 1737-1818 in news reports on 15,445 kc.

New Guinea—Port Moresby seems to have moved its 6130-kc. outlet to 5015 kc., as it has been tuned there for some time. It was noted with sports, program summary, and news at 0330-0402 in English.

New Zealand—*R. New Zealand's* schedule reads: to Pacific Islands at 0100-0345 and 1200-1445 on 9540 and 6080 kc., at 1500-2145 on 15,280 kc., and at 2200-0045 on 11,830 kc.;

to Australia at 0400-0645 on 9540 and 6080 kc., at 1500-1730 on 9540 kc., and at 1745-0045 on 11,780 kc.; to Antarctica at 0315-0345 (Sundays only) on 6020 kc.; to Samoa in Samoan at 0200-0215 (Tuesdays only) on 9540 and 6080 kc.; to the Cook Islands and Niue at 0245-0300 (Wednesdays only) and at 0300-0315 (Saturdays only) on 9540 and 6080 kc. Reports go to P. O. Box 2396, Wellington, C. 1., New Zealand.

Papua—*R. WEWAK*, run by the administration of Papua and New Guinea, is on 3335 kc. with 250 watts daily at 0220-0630. The call-sign is VL9CB. Has anyone logged this station?

Paraguay—ZPA11, *R. Charitas*, Asuncion, has returned to the air on 6110 kc. and is noted with an improved signal around 2010, Spanish commercials and music.

Another station in Asuncion has been reported broadcasting on 4900 kc. at 2200 in Spanish.

Peru—A new station is *R. Ondas del Titicaca*, Puno, 4922 kc.; in Spanish, it gives frequent ID's and time checks to past 1900 but is badly QRM'ed by HCQR1, Ecuador. Another new station is OAX7P (?), *R. Onda Azul*, Puno, 4801 kc.; heard at 1600-1730 with classical music, it announces as operating in the 31-meter band. A previously unreported station is OAZ4E, *R. Mineria*, La Oroya, 6195 kc.; L.A. programs have been noted at 0345-0353.

Poland—Warsaw has been noted on an offbeat frequency of 9120 kc. in an unidentified language, possibly Scandinavian, at 1500-1600; then into Italian news. The IS is a piano with a Chopin refrain. Noted Sundays only.

Portugal—Lisbon has been found on 15,305 kc. with Portuguese world news at 1805. The 6025-kc. outlet is noted well at 2000-0215, part of the time to the U.S. in Eng. with the "Voice of the West" program. This has even been heard in the midwest on 755 kc. around 2245.

Sweden—Stockholm's complete Eng. schedule reads: to Western N.A. at 2215-2245 on 11,805 kc.; to Eastern N.A. at 0900-0930 on 17,840 kc. and 2045-2115 on 11,805 kc.; to Africa at 1445-1515 on 11,705 kc.; to Europe at 1700-1730 on 6065 kc. (and at 1830-1900 on medium-wave 1178 kc.); to the Middle East at 1115-1145 on 11,705 and 15,240 kc.; to S. Asia at 0945-1015 on 15,420 kc.; and to the Far East at 0730-0800 on 9620 kc. The "National Program" is also transmitted on a non-directional basis and can be heard in Europe, certain parts of the Middle East and Africa, as well

SHORT-WAVE ABBREVIATIONS

Eng.—English	QRM—Station interference
ID—Identification	QSL—Verification
IS—Interval signal	R.—Radio
kc.—Kilocycles	s/off—Sign-off
kw.—Kilowatts	s/on—Sign-on
L.A.—Latin America	xmsn—Transmission
N.A.—North America	xmtr—Transmitter

POPULAR ELECTRONICS
October 1963
Advertisers Index

as in the Atlantic at 0000-0400 and 1215-1630 on 6065 kc., and at 0400-0700 on 9620 kc.

Thailand—*Radio Station 2-0,* belonging to the Royal Thai Army in Bangkok, is on the air at 1800-0200 and 0500-1200 on 6315 kc. English is given at 1000-1100 with news, commentaries, and music. Has anyone logged this station?

Turkey—Ankara has moved from 7285 kc. to 15,160 kc. for its daily Eng. xmsn to Western Europe and England at 1600-1700. News is given at opening.

Uganda—Kampala is noted on 5026 kc. at a very good level with opening in Eng. at 2300; world news is the first feature.

Venezuela—YVOC, *R. Ecos del Torbes,* San Cristobal, 4980 kc., has moved from 3265 kc. and was noted well at 2200 with some news and L.A. music. A full ID was given at 2215 s/off.

Vietnam, North—English from Hanoi is aired at 2015-2115, 2330-2345, 0500-0530, 0830-0900, 1030-1100, and 0600-0630 on 11,840 and 9840 kc. News is given during each period except the 0600-0630 xmsn which is listed as consisting of "International Music." Reports should be addressed to: The Chief of Foreign Language Section, *The Voice of Vietnam,* 58 Quan Su Street, Ha-noi, North Vietnam.

Clandestine—According to translated Spanish announcements, *Radio Libertad* operates on 1550, 4005, 5650, 6240, 7308, 7454, and 15,050 kc. It is best heard at 1800-2200 with music, news, commentaries, and drama programs. This same source also gives a new address: Apartado correo 26-24, Miami 1, Florida. —30—

SHORT-WAVE CONTRIBUTORS

Dave Siddall *(WPE1EBN)*, Hyannis, Mass.
Stu Turgel *(WPE1EGU)*, Hull, Mass.
Irwin Belofsky *(WPE2BYZ)*, Brooklyn, N. Y.
Fred Willshaw *(WPE2EQN)*, Whitesboro, N. Y.
John Geery, Jr. *(WPE2ESZ)*, Rochester, N. Y.
Daniel Grumet *(WPE2IMF)*, Toms River, N. J.
Emil Vandevelde *(WPE2KHS)*, Oakland, N. J.
Al Quaglieri *(WPE2KMI)*, Albany, N. Y.
Richard Newman *(WPE3ECF)*, Danville, Pa.
George Gorsline, Jr. *(WPE3EFF)*, State College, Pa.
Dave Haibach *(WPE3EQW)*, Erie, Pa.
Bob Olivere *(WPE3EWD)*, Wilmington, Del.
Theodore Templeton *(WPE3EZV)*, Edinboro, Pa.
Grady Ferguson *(WPE4BC)*, Charlotte, N. C.
David Reed *(WPE4FCL)*, Raceland, Ky.
Roy Moore *(WPE4FWH)*, Hazard, Ky.
Rickey Williams *(WPE5BLV)*, Shreveport, La.
Jack Keene *(WPE5BMP)*, Houston, Texas
Marvin Easley *(WPE5CHG)*, Jackson, Miss.
Julian Jorstad *(WPE6DGO)*, Seaside, Calif.
Jim Marksbury *(WPE6EWO)*, San Diego, Calif.
Rulon Guymon *(WPE7BKP)*, Orem, Utah
Bob Zulinski *(WPE8FAV)*, Berkley, Mich.
Marvin Field *(WPE8FRE)*, Benton Harbor, Mich.
Dick England *(WPE8FV)*, Utica, Mich.
Joseph Johnson *(WPE8FVN)*, N. College Hill, Ohio
Mike Kander *(WPE8MS)*, Dayton, Ohio
Jerry Heien *(WPE9BOD)*, Melrose Park, Ill.
Joe Widner *(WPE9EFX)*, New Richmond, Ind.
Charles Signer *(WPE9FSG)*, Elmwood Park, Ill.
Stuart Memering *(WPE9GEX)*, Lafayette, Ind.
Bill Holscher *(WPEØATE)*, St. Louis, Mo.
Jim Wheat *(DL4PE1AN)*, APO, New York, N. Y.
Jack Perolo *(PY2PE1C)*, Sao Paulo, Brazil
David Clark *(VE3PE1CE)*, Toronto, Ont.
David Bennett *(VE7PE1R)*, Richmond, B. C.
Pat McGrath *(6YAPE1A)*, Kingston, Jamaica
W. Britton, Oshawa, Ont., Canada
Carl Hoffmeyer, Pearl River, N. Y.
Joe Piechuta, Meriden, Conn.
Marcia Winslow, Lawrence, Kansas
Sweden Calling DX'ers Bulletin, Stockholm, Sweden

ELECTRONICS MARKET PLACE

RATE 60¢ per word. Minimum 10 words prepaid. December issue closes October 5th. Send order and remittance to Martin Lincoln, POPULAR ELECTRONICS, 1 Park Ave., New York 16, N. Y.

FOR SALE

TV Tuners—Rebuilt or Exchanged $9.95 complete—all types—fast, guaranteed service. Send tuner with all parts to: L.A. Tuner Exchange, 4611 West Jefferson Blvd., Los Angeles 16, California.

GOVERNMENT Surplus Receivers, Transmitters, Snooperscopes, Parabolic Reflectors, Picture Catalog 10¢. Meshna, Malden 48, Mass.

WPE-CB-QSL cards—Brownie-W3CJI—3111A Lehigh, Allentown, Pa. 18103. Catalogue with samples 25¢.

CB WPE QSL Cards, Samples Free. Radio Press, Box 24, Pittstown, New Jersey.

"SPECIAL! WPE-SWL-CB-QSL cards, 3 colors, $2.50 per 100—Free Samples, Garth, Jutland, New Jersey."

SAVE dollars on radio, TV-tubes, parts at less than manufacturer's cost. 100% guaranteed! No rebrands, pulls. Request Bargain Bulletin. United Radio, 1000-E, Newark, N. J.

TRANSISTORIZED Products Importers catalog, $1.00, Intercontinental, CPO, 1717, Tokyo, Japan.

INVESTIGATORS, free brochure, latest subminiature electronic listening devices. Ace Electronics, 11500-L NW 7th Ave., Miami 50, Fla.

CANADIANS—GIANT Surplus Bargain Packed Catalogs. Electronics, Hi-Fi, Shortwave, Amateur, Citizens Radio. Rush $1.00 (Refunded). ETCO, Dept. Z., Box 741, Montreal, CANADA.

TELEPHONE Voice Switch (LS-500). Actuates automatically and unattended any tape or wire recorder. Pictorial installation instructions included. $23.75. Post Paid US. WJS Electronics, 1525 No. Hudson, Hollywood 28, Calif.

GOVERNMENT Sells Surplus: Electronics; Oscilloscopes; Transceivers; Test Equipment; Radar; Sonar; Walkie-Talkies; Boats; Jeeps; Aircrafts; Misc.—Send for "U.S. Depot Directory & Procedures"—$1.00—Brody, Box 425(PE), Nanuet, New York.

INVESTIGATORS! Do your own sound work. Send $1.00 for brochure of latest electronic equipment. WJS Electronics, 1525 No. Hudson, Hollywood 28, Calif.

TRANS-NITION electronic ignition parts kit. Negative ground $25.00. Coil, Manual special $8.50. Manual $2.00. Anderson Engineering, Wrentham, Massachusetts.

TRANSISTORIZED treasure finder kits, assembled models from $19.95. Free catalog. Rellco, Box 10563, Houston 18, Texas.

14 Weather instrument Plans $1.00. Saco, Box 2513B, South Bend, Indiana.

CONVERT any television to sensitive, big-screen oscilloscope. Only minor changes required. No electronic experience necessary. Illustrated plans, $2.00. Relco Industries, Box 10563, Houston 18, Texas.

MILITARY Discount—Name Brands Free Recording Tape and Stereo Handbook. Include Rank and Serial Number. Electronics International Inc. Box 3066, Charlottesville, Virginia.

SUPERSENSITIVE directional microphone picks up faint sounds at 300 feet. Detects sound through ordinary walls. Easily built for $7.00. No electronic Experience necessary. Plans, $2.00. Dee Company, Box 7263-F, Houston 8, Texas.

FREE electronics parts catalog. Lowest prices anywhere. Knapp, 3174E 8th Ave. S.W., Largo, Florida.

10 Distance Crystal set plans—25¢; 20 different—50¢. Includes Transistor experiments, catalog. Laboratories, 1131-L Valota, Redwood City, California.

"LISTEN-in-coil" picks up any telephone conversation in vicinity. No connection to telephone necessary. Easily concealed. $2.98 complete. Consolidated Acoustics, 1302-R Washington St., Hoboken, N. J.

MANY Transistors distance reception no wiring change. Details 50¢. Lindle, Box 1093, Abilene, Texas.

TRANSISTOR-Radios-Recorders—Excellent Quality—60% discount—Write Audio-Tec Mfg., 4305 Zane, Robbinsdale, Minn.

OHM'S law never forgotten with copyrighted tool. $2.00 postpaid. Beck Radio, 6211 S. MacDill Avenue, Tampa 11, Florida.

BUSINESS Cards. Printing. Reasonable. Free Samples. Milver, 1EO, Hazel Crest, Illinois.

TRANSISTOR Ignition described June Popular Electronics. "Operation Pickup." Complete kit quality components quickly assembled. No Drilling. Complete Instructions. Guaranteed. $14.95 Postpaid. Electromart, 1616 S. 81st St., Milwaukee, Wis.

SAVE Money—Free catalog: Photography, Tape Recorders, High Fidelity, Electronics, Tools. Wholesale Radio & Camera Co., Box 3085, Phila. 50, Pa.

TELEPHONE Extension in your car. Answer your home telephone by radio from your car. Complete diagrams and instruction $2.75. C. Carrier Co., 6311 Yucca St., Hollywood 28, Calif.

EAVESDROP with a pack of cigarettes. Miniature transistorized FM Radio Transmitter Complete diagrams and instructions $2.75. C. Carrier Co., 6311 Yucca St., Hollywood 28, Calif.

POLICE Radar Detector plus legal Jammer. Stop before Radar Speed Traps. Build for less than $10.; used with Car Radio. Complete construction details, $3.75. C. Carrier Co., 6311 Yucca St., Hollywood 28, Calif.

BE A Spy. Correspondence course on Wire Tapping, Bugging, Telescopic sound pickup, recording techniques, microphotography, and invisible photography. Lessons in Surveillance, tailing, and use of equipment. Complete course $22.50. C. Carrier Co., 6311 Yucca St., Hollywood 28, Calif.

RECORD TV Programs at home. Easy to construct. Watch your favorite TV Shows whenever you wish. Complete construction details $4.75. DB Enterprises, 8959 Wonderland Ave., Hollywood 46, Calif.

COLOR TV. Convert your black and white TV to color. Completely Electronic. No mechanical gadgets. Costs about $35. Complete construction details $4.75. DB Enterprises, 8959 Wonderland Ave., Hollywood 46, Calif.

ANSAPHONE. Automatic Telephone Answering Machine delivers and takes messages. Build under $40. Plans $4.75. Seaway Electronics, 6311 Yucca St., Hollywood 28, Calif.

TV Camera. Build for less than $50. Construction details $4.75. DB Enterprises, 8959 Wonderland Ave., Hollywood 46, Calif.

TAIL Transmitter. Tiny Transistorized Transmitter for the Private Eye. Signals its location for miles. Construction Details $4.75. DB Enterprises, 8959 Wonderland Ave., Hollywood 46, Calif.

CB transmitters $6.00. Other bargains, send 10¢ for list. Vanguard, 190-48 99th Ave., Hollis 23, N. Y.

BATTERIES. 9 volt rechargeable equivalent to Eveready 216 includes charger, $3.95. Importations Distributors, 425 Excelsior Avenue West, Hopkins, Minn.

DIAGRAMS for repairing Radios $1.25, Television $2.50. Diagram Service, Box 1151PE, Manchester, Conn.

GREATEST Buys! Electronic Surplus list 10¢, Western Electric Mercury Wetted Relay SPST 5AMP Contacts, only $2.95 postage paid, 2 for $5. ($15. value) Fertik's, 9th Tioga, Phila. 40, Pennsylvania.

BARGAINS! Used CB, Ham, Test Equipment! Interesting lists 10¢. Brands, Sycamore, Illinois.

TRANSISTORIZED 6 Meter Receiver $10.00. Williams 33141 Pierce, Garden City, Michigan.

RADCON short wave converter for home radio, no wiring changes, no outside power. Guaranteed $6.50 postpaid. Radcon, P. O. Box 3289 PE, San Antonio, Texas.

VIDICON TV Camera Kit. $189.95, Easily assembled with any TV set. Free literature. Seacol Electronics, 507 E. Olive, Fresno 4, California.

ORGAN-Magic—A fantastic new invention that creates a thrilling new sound sensation. Complete device contained in beautiful bracelet. Adds repeat to Hammond organs. Many other uses. Simple application. $19.95 Check or MO. Free details. Lektro-Price Inc., Div. E, Box 1201, Clearwater, Florida 33517.

TELEVISION Camera low cost transistorized. Write Video Systems, 300 W. Peachtree NW, Atlanta 8, Georgia.

HIGH quality transformers at wholesale prices. Write for free catalogue & specifications, Calemco, Box 585, San Fernando, California.

ALL QSL'S $2.50/100 Free catalogue. Longbrook, Box 393-C Quakertown, New Jersey.

CBers—The sincerest form of flattery. Often copied but never duplicated. Our easy-do Dual Conversation adapter kit for: HE-15, A, B; 800; 910, A, B; HE-20, A, B, C; 770, 1, 2; Mark VII; Messenger; Gw-10 etc. $15.50, with tubes $17.50. Also Speech clipper-kit complete $17.85 or $5.00 plus C.O.D. Results, not promises. Free literature Dept. #9E, Bainbridge Radio Electronics, 2839 Briggs Ave., New York 58, N. Y.

CB QSL Cards. New, kute, klever, komical designs. Reasonable prices. Samples free. R. Hellwig, Box 425, Lake Wales, Florida.

CB-QSL Cards—45 designs, free catalog. Woody, 2611 Shenandoah, St. Louis 4, Missouri.

DECALS; WPE-SWL-CB-HAM, your call letters in gold 2" high—$1.00, Ramco, Box 356, No. Hollywood, Calif.

HAM EQUIPMENT

CBER'S, Hams: Compact AAA-1 Clipper-Filter kit triples talk-power, fits any CB transceiver, improves selectivity; $10.99. Double reception with SK-3 Preselector for GW-10, GW-11, SK-4 Preselector fits GW-12 internally! Kit, $8.99; wired, $11.99. SK-20 Preselector, tunable 3.5-30 megacycles, kit $18.98. Noisejector, NJ-7, $4.49. Prices Postpaid! (Free kit, antenna list.) Holstrom Associates, P.O. Box 8640-E, Sacramento 22, California.

TAPE AND RECORDERS

TAPE Recorders, Hi-Fi, components, Sleep Learning Equipment, tapes. Unusual Values Free Catalog. Dressner, 1523PE, Jericho Turnpike, New Hyde Park 11, N. Y.

SELF-Hypnosis may help you many ways. New Tape or LP-record teaches you quickly, easily! Free literature. McKinley Company, Box 3038, San Bernardino, California.

SAVE 30% Stereo music on tape. Free bargain catalog/blank tape/recorders/Norelco speakers. Saxitone, 1776 Columbia Road, Washington, D. C.

RENT Stereo Tapes—over 2,500 different—all major labels—free brochure. Stereo—Parti, 1616-PE Terrace Way, Santa Rosa, California.

RECORDING tape, top quality by major U. S. manufacturer. 1800 feet, 1 mil, 7 inch reel, $1.95 each, 10 for $17.70 postpaid. Moneyback guarantee. Western Magnetics, Box 3722, Portland 8, Oregon.

RECORDING Tapes. Free sample. Mail 25¢ (handling). Towers, Lafayette Hill, Penn.

TAPE Recorder Sale. Latest models, $10.00 above cost. Arkay Sales, 22-31 Riverside Ave., Medford 55, Mass.

RECORDING Tape highest quality 1800' Mylar 7" reel 10 for $18.50 postpaid. Moneyback guarantee. Lowest quotes: all components, recorders. Pofeh Electronics, Box 217, Muncie, Indiana, 47305.

MYLAR Recording Tape. Lowest price ever. Exceptional quality. 7 inch reel, 2400 feet, ½ mil, $2.40. Postpaid. Ten for $21.50. Moneyback guarantee. J. J. Hayes, Box 337, Rockville Centre, New York.

HIGH-FIDELITY

DISGUSTED with "Hi" Hi-Fi Prices? Unusual discounts on your High Fidelity Requirements. Write Key Electronics, 120 Liberty St., New York 6, N. Y. DI 6-4191.

HI-FI Components, Tape Recorders at guaranteed "We Will Not Be Undersold" prices. All brands in stock. 15-day money back guarantee. 2 year warranty. Write your requirements for quotation. No Catalog. Hi-Fidelity Center, 1797-P 1st Ave., New York 28, N.Y.

"LOW, Low quotes: all components and recorders. HiFi, Roslyn 9, Penna."

RECORDERS, Components. Free wholesale catalogue. Carston, 125-P East 88, N. Y. C. 28.

WRITE for lowest quotations, components, recorders. No Catalogs. Hi-Fidelity Supply, 2817-QC Third, New York City 55.

"FM/Q" Metropolitan Broadband Antenna, the finest compact yagi made, completely rustproof, only $14.95 prepaid. FM Book with station directory 30¢. FM/Q, Wethersfield, Connecticut.

CONDENSER microphone kit, AU-7. Save 60-70% by assembling this professional quality microphone in just a few hours. Complete with factory tested capsule, cables, cases and power supply. Details: Syncron Audio Laboratories, 50 Parker Farms Road, Wallingford, Conn.

WANTED

CASH Paid! Unused tubes, electronic equipment. Barry, 512 Broadway. N.Y.C. 12.

QUICKSILVER, Platinum, Silver, Gold. Ores Analyzed. Free Circular. Mercury Terminal, Norwood, Mass.

TUBES

"FREE Catalog—name brand tubes 65% discount, phono needles 80% or more discount, phono cartridges, picture tubes 75¢ inch parts, parts kits, silicon and selenium rectifiers, transmitting tubes, 7" T.V. test tube $6.99, improved batteries, tube testers, etc. Want to swap or sell tube inventory? Send us your offering. Arcturus Electronics Corp., Dept. Z.D., 502—22nd St., Union City, N. J.

BEFORE You Buy Receiving Tubes, Test Equipment, Hifi Components, Kits, Parts, etc. . . . send for your Giant Free Zalytron Current Catalog, featuring Standard Brand Tubes: RCA, GE, etc.—all Brand new Premium Quality Individually Boxed, One Year Guarantee—all at Biggest Discounts in America! We serve professional servicemen, hobbyists, experimenters, engineers, technicians. Why Pay More? Zalytron Tube Corp., 461 Jericho Turnpike, Mineola, N. Y.

TUBE Headquarters of The World! Free Catalog (tubes, electronic equipment) write! Barry, 512 Broadway, N.Y.C. 12.

TV-Radio Tubes—Lowest prices—100% guaranteed. Send for free listing. Tube Mart, 840 Main St., Paterson 3, N. J.

T.V. and Radio Tubes 70% Discount on first line, name brands, individually boxed. Send for free price list. Starlit Electronics Center, 7124 Fenkell, Detroit 38, Mich.

RADIO & T.V. Tubes—35¢ each. Send for quantity discounts & free list. Cornell, 4213 University, San Diego, California.

TOOLS

CUT Holes Fast With Greenlee Chassis Punches—Make accurate, finished holes in one and one-half minutes or less in metal, hard rubber, and plastics. No tedious sawing or filing—a few turns of a wrench does the job. All standard sizes . . . round, square, key, or "D" shapes for sockets, switches, meters, etc. Available at your electronic parts dealer. Write for free literature. Greenlee Tool Co., 2028C Columbia Avenue, Rockford, Illinois.

TEST EQUIPMENT

SIGNAL Tracer-Injector. New easy, safe method for using your radio (2 connections) to pinpoint trouble in radios and amplifiers. Terrific educational and service tool. Comprehensive instructions, Tested Isoprobe, All parts. Satisfaction guaranteed. Order AM #115 $5.95—AM/FM # 215 $7.95. Waltronics, 1814 N. 84th, Milwaukee Wis. 53226.

REPAIRS AND SERVICING

TV Tuners rebuilt and aligned to Specifications. Guaranteed all makes, One Price. $9.50 Complete. Plus Shipping. Valley Tuners, 5641-D Cahuenga, North Hollywood, Calif.

TV Tuners rebuilt and aligned per manufacturers specification. Only $9.50. Any make UHF or VHF. We ship COD. Ninety day written guarantee. Ship complete with tubes or write for free mailing kit and dealer brochure. JW Electronics, Box 51C, Bloomington, Indiana.

METERS—Multimeters Repaired and calibrated. Free estimates—catalog. Bigelow Electronics, Box 71-E, Bluffton, Ohio.

DIAGRAMS: Radio, Television, HiFi Stereo; $1.00. State make, model. Schematic Collector, 618 4th St., Newark 7, New Jersey.

TRANSISTOR Radio Repair—Bring or mail to: 375 Tweedwood Dr., New Haven, Indiana. PH. 749-4790

PATENTS

PATENT Searches, $6.00! Free "Invention Record"/Information.—Miss Hayward, 1029 Vermont, Washington 5, D. C.

INVENTIONS WANTED

INVENTIONS wanted. Patented; unpatented. Global Marketing Service, 2420-P 77th, Oakland 5, Calif.

INVENTORS. We will develop, help sell your idea or invention, patented or unpatented. Our national manufacturer clients are urgently seeking new items for outright cash sale or royalties. Financial assistance available. 10 years proven performance. For free information, write Dept. 41, Wall Street Invention Brokerage, 79 Wall Street, New York 5, N. Y.

BOOKS

HORROR books—Buy direct from publishers! Bargains! Free details. Trans-International, P.O. Box 2942, Paterson, N. J.

AUTHORS! Learn how to have your book published, promoted, distributed. FREE booklet "ZD," Vantage, 120 West 31 St., New York 1.

BOOKS 15¢, all subjects, catalog free. Cosmic, Clayton R2-1, Ga. 30525.

WANTED: Short stories, books, articles, plays of all descriptions for sale to publishers, producers. Free Literature! Literary Agent Mead, Dept. 39A, 915 Broadway, N.Y.C. 10.

BOOKS New Out-of-Print. Order from Wallace Hill, Books, Popular Dept. Malvern, Arkansas.

1,000,000 Books! Bargains! Catalog—dime. TreasureSite, 6990 Aberdeen, Upper Darby, Penna.

GOVERNMENT SURPLUS

GOVERNMENT Surplus direct from Government. Jeeps $264.00, Radios $2.53. Typical prices. Guns, Typewriters, Cameras, Tools, thousands more Amazing low prices. How, where to purchase, Merchandise available, etc., Only $1.00 to: Surplus, P.O. Box 50512, Dept. R, New Orleans 50, Louisiana.

GOVERNMENT Surplus Sales Bulletin—"Directory-Procedure"—50¢—Industrial, Box 770(A), Hoboken, N. J.

JEEPS $178, Airplanes $159, Boats $7.88, generators, $2.68, typewriters $8.79, are typical government surplus sale prices. Buy 10,001 items wholesale direct. Full details, 607 locations, procedure only $1.00. Surplus, Box 177-C1, Abbottstown, Penna.

JEEPS—$111.68, Typewriters—$4.15, Receivers—$5.65, Televisions, Recorders, Oscilloscopes, Multimeters. Typical Government Surplus Prices. Exciting Details Free. Enterprises, Box 402-B5, Jamaica 30, New York.

SAVE 95% and more. Jeeps, Airplanes, Parachutes, Sporting goods, Electronic Equipment. Everything Imaginable. Complete information only $1.00. Surplus, Dept. 18, Box 5741, Washington 14, D. C.

FREE, "How to Buy Government Surplus Information," with 20 lbs. of New Surplus Electronic Equipment. Guaranteed $1000.00 Value. Tubes, Transistors, Meters, Transceivers, Motors. Etc. $4.95. Send $1.00. Shipped C. O. D. Evergreen Electronics, Box 2233, Everett, Washington.

"GOVERNMENT Surplus buy direct from government; transmitters, receivers, test equipment. How and where booklet—$1.00—Ramco, Box 356, No. Hollywood, California.

JEEPS $111.68, Boats $6.18, Airplanes, Electronic Equipment, Typewriters, thousands more, typically at up to 98% savings. Complete information $1.00. Surplus Service, Box 820, Holland 10, Michigan.

IF you have something to sell, let the readers of Popular Electronics know about it through the classified advertising columns. It costs very little—only 60¢ a word, including your name and address. Your ad will be seen by more than 400,000 active buyers of electronic gear and components. Act now! Write your classified ad today, enclose payment and mail to: Martin Lincoln, Popular Electronics, One Park Avenue, New York 16, New York. November issue closes September 5th.

INSTRUCTION

LEARN While Asleep, hypnotize with your recorder, phonograph. Astonishing details, sensational catalog free! Sleep-Learning Association, Box 24-ZD, Olympia, Washington.

FCC License in 6 Weeks, First Class Radio telephone. Results Guaranteed. Elkins Radio School, 2603B Inwood, Dallas, Texas.

HIGHLY-Effective home study review for FCC commercial phone exams. Free literature! Wallace Cook, Box 10634, Jackson 9, Miss.

LEARN While Asleep. Remarkable, Scientific, 92% Effective. Details Free. ASR Foundation, Box 7021, Dept. e.g., Lexington, Kentucky.

OVER 50 television service training demonstrations—any make-model. Complete manual $1.98. Schek, 11808 Pittson Road, Wheaton, Maryland.

LOOK, listen and learn electronics. New system brings the classroom into your home. No reading, send for free LP record today. Ceetronics, Alger, Mich.

TROUBLE getting homemade equipment to work? Read "Introduction to Electronic Servicing" (Sams BSJ-1) $2.95 at parts distributors or send dollar to Electronic Books, Box 8433-E, University Park, Denver 10, Colorado. Pay postman $1.95 plus COD postage.

COMPUTERS and programming made simple, $2. Adem, 5412 East Washington, Indianapolis, Indiana.

DRAFTING Home Course $15.00 Blueprint Reading, Electronic, Mechanical, Architectural, Art). Prior Inc., 23-09 169 Street, Whitestone 57, New York.

IGNITION interference? Increase your range! Ham and CB mobile operators get complete instructions with detailed schematic to eliminate ignition interference. Send now only one dollar to: Erie Instrument Co., Dept. E, P. O. Box 1047, Sandusky, Ohio.

PLASTICS

NEW Liquid Casting Plastic, clear, colors. Embed real flowers, butterflies, photos, coins. Send 25¢ for two handbooks, "How to Cast Liquid Plastics" and "How to Make Extra Money at Home". Castolite, Dept. L-108, Woodstock, Illinois.

LEATHERCRAFT

FREE "Do-It-Yourself" Leathercraft Catalog. Tandy Leather Company, Box 791-Q49, Fort Worth, Texas.

STAMPS AND COINS

SMASHING Collection Free—Includes Triangles, Early United States, Rockets, Sports, British Colonies, High Value Pictorials, etc. Complete Collection plus big illustrated Magazines, all free. Send 10¢ for postage. Gray Stamp Co., Dept. Z2, Toronto, Canada.

CURIOUS coins and odd paper money from seven countries! Yours for only 10¢. $100,000 Confederate "money" facsimile bonus for promptness. Other interesting offers on approval. Littleton Coin Co., Littleton M12, N. H.

20 Different Commemoratives 1893 up 10¢. U.S. Approvals, K & B, Box 70, Brooklyn 23, N. Y.

YOUR Station on photostamps. 100—$1.50. Samples 10¢. Morgan, 443 Euclid, Akron, Ohio.

SPACEOPHOBIA? 10¢ brings premium, 2¢ approval cure. BKJ, Boston 23, Massachusetts.

PHOTOGRAPHY-FILM, EQUIPMENT, SERVICES

MEDICAL Film—Adults Only—"Childbirth"—1 reel 8mm. $7.50—16mm $14.95. International, Greenvale, L. I., New York.

SCIENCE Bargains—Request Free Giant Catalog "CJ" —144 pages—Astronomical Telescopes, Microscopes, Lenses, Binoculars, Kits, Parts. War surplus bargains. Edmund Scientific Co., Barrington, New Jersey.

SATISFACTION Guaranteed aircraft transparencies, literature 10¢ deductible. Aeroslides, Richelieu, Quebec, Canada.

EDUCATIONAL OPPORTUNITIES

DETECTIVE Profession. Home Study. Lapel pin, Certificate. Future. Box 41197-AG, Los Angeles 41, Calif.

EMPLOYMENT INFORMATION

FOREIGN Employment. Construction, other work projects. Good paying overseas jobs with extras, travel expenses. Write only: Foreign Service Bureau, Dept. D, Bradenton Beach, Florida.

EMPLOYMENT Resumes. Earn more by presenting yourself to prospective employers effectively. Send only $2.00 for Resume Writing Instructions. Or send complete job, educational and personal facts plus $20.00 (cash or money order) for your own complete, personal resume, $30.00 for 200 copies printed on white bond paper. J. Ross, 63-61 Yellowstone Blvd., Forest Hills 75, New York, Dept. 6J—PE.

BUSINESS OPPORTUNITIES

INVESTIGATE Accidents—Earn $750 to $1,000 monthly. Men urgently needed. Car furnished. Business expenses paid. No selling. No college education necessary. Pick own job location. Investigate full time. Or earn $6.44 hour spare time. Write for Free Literature. No obligation. Universal, CZ-10, 6801 Hillcrest, Dallas 5, Texas.

BUY Direct from factories. Appliances, cameras, watches! Free details! Cam Co., 436 PE Bloomfield Ave., Verona, N. J.

VENDING Machines—No Selling. Operate a route of coin machines and earn amazing profits. 32-page catalog free. Parkway Machine Corporation, 715PE Ensor Street, Baltimore 2, Md.

ELECTROPLATING equipment and supplies. All types for home work shops. Free Catalog. HBS Equipment Division, 3445 Union Pacific, Los Angeles 23, Calif.

$100 Weekly possible. Compile Mailing lists and address envelopes for advertisers. Home—spare time. Particulars free. National Service, 81 Knickerbocker Station, New York City.

I MADE $40,000.00 Year by Mailorder! Helped others make money! Start with $10.00—Free Proof. Torrey, Box 3566-N, Oklahoma City 6, Oklahoma.

PIANO Tuning learned quickly at home. Tremendous field! Musical knowledge unnecessary. Information Free. Empire School of Piano Tuning—PE, Champaign, Ill. (Founded 1935).

MAKE $25-$50 week clipping newspaper items for publishers. Some clippings worth $5.00 each. Particulars free. National, 81 Knickerbocker Station, New York City.

BIG Money—Operate own fix-it shop. Service household appliances, motors, mowers, saws, skates, etc. Free book. Christy Trades School, A1214, 3214 W. Lawrence, Chicago 25.

BUY Imports at a fraction of retail. Make big profits. For sample listing and details send $1.00, GPCO, Dept. 1A, Box 18453, Kearns, Utah.

JAPAN Mail Orders available catalog or information 30¢. Japan Merchandise, CPO Box 480, Tokyo.

EARN Money at home sewing or assembling our products. No charge for material to fill store orders. Write: Jiffy Company, Hot Springs 22, Arkansas.

SONGS into $$$$$—New, unknown Songwriters, Songpoets, Composers share $33 millions yearly. Any subject, we collaborate, publish, promote. Largest firm, information, appraisals Free. Send Nordyke Publishers, 6000 Sunset, Hollywood, California 3-90028.

FREE "Franchise Profit Letter" tells how unique NFR service is helping thousands seeking profitable businesses. Write today. National Franchise Reports, PE-528, 333 North Michigan, Chicago 1.

MAKE Durable Building Plastic Easily. Waterproof, fireproof, economical. Bays Laboratory, Cedaredge 10, Colorado.

WORK at home packaging merchandise. Very profitable. No selling. Everything supplied. Details free. HBE, 1043-PE, West Grand, Chicago 60622.

$300 Month possible mailing catalogs. Send $1.00 for sample copy and instructions to: Reddick Enterprises, Box 1082, Washington 20013, D. C.

MISCELLANEOUS

INVESTIGATORS, free brochure, latest subminiature electronic listening devices. Ace Electronics, 11500—K NW 7th Ave., Miami 50, Fla.

NEW Vortex theory with a unique structural explanation for elementary particles and forces. Nuclear theory challenged. New 1963 edition, 25 cents postpaid. C. F. Krafft, 4809 Columbia Road, Annandale, Va.

HYPNOTIZE Unnoticed, quickly, effortlessly, or refund! Thousands delighted! $2.00. Minter, Box 244-D, Cedarburg, Wisconsin.

INDEPENDENT Thinkers—investigate Humanism, the scientific personal philosophy! Free literature. American Humanist Association, Dept. PE2, Yellow Springs, Ohio.

DO-It-Yourself—Bath Massage! Automatic and fingertip controls. Attaches to your vacuum cleaner. Complete kit and instructions $16.69. Butch Bath Co., 435 N. Roxbuary Drive, Suite 105-B, Beverly Hills, Calif.

"HYPNOTIZE . . One Word . . One fingersnap," on stage. Satisfaction—or refund. $2. Hypnomaster, Box 9309-E8, Chicago 90.

PLASTIC wall display holder frames 20 QSL's. Used by Hams and CB'ers universally to modernize shack. 3 holders $1.00 or 10 for $3.00, prepaid. Dealers wanted. TEPABCO, Dept. PE10, Box 198, Gallatin, Tenn., 37066.

HYPNOTIZE Unnoticed! Patented new hand device makes you a Hypnotist first day or refund! Hypnotist's Handbook included! $2.00. Hypnosis Foundation, Box 487, La Mesa 9, California.

DO you know how prayer works? Send 20¢ for issue 162 The Prayers Of Men . . . Who Hears . . . Who Answers? Write: Lemurian Viewpoint, Ramona 15, California.

FAMILY Wine Formulas! Elderberry, Concord, Dandelion, many others! Hydrometers, Supplies Headquarters! Manual $2.00. Brugenheimer Company, Box 201-3, Lexington, Massachusetts.

"HOME Brew Recipes"—Beer, Ale, Liquors, Wines! Recipes, $2.00 Postpaid. Supplies, Hydrometers list included! Research Enterprises, 29thWF Samoset Road, Woburn, Massachusetts.

WILD Labels, bumper strips! Strange, startling, unconventional! Krazy Labels, Box 15-H, Olympia, Washington.

SONG Sheet—82 favorite old-time songs for party occasions. 35¢ copy. Edward Alexander, 2242 Strauss Street, Brooklyn, New York 11212.

STAMMER—Stutter—No More. (Dr. Young.) Write: Gaucho, Box 9309-E, Chicago 90.

EMPLOYMENT Resumes. Earn more by presenting yourself to prospective employers effectively. Send only $2.00 for Resume Writing Instructions. Or send complete job, educational and personal facts plus $20.00 (cash or money order) for your own complete, personal resume, $30.00 for 200 copies printed on white bond paper. J. Ross, 63-61 Yellowstone Blvd., Forest Hills 75, New York, Dept. 6J—PE.

IF you have something to sell, let the readers of Popular Electronics know about it through the classified advertising columns. It costs very little—only 60¢ a word, including your name and address. Your ad will be seen by more than 400,000 active buyers of electronic gear and components. Act now! Write your classified ad today, enclose payment and mail to: Martin Lincoln, Popular Electronics, One Park Avenue, New York 16, New York. November issue closes September 5th.

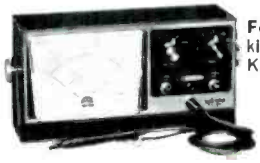
PRINTED IN U.S.A.

For Stereo/Hi-Fi—Heathkit 40-Watt All-Transistor Stereo Amplifier, Kit AA-22, $99.95

For Sports—Heathkit 1-Watt Walkie Talkie, Kit GW-52, $74.95

For Ham Radio—Heathkit 80 Meter SSB Transceiver, Kit HW-12, $119.95

Here are a few Heathkit values....



For Test Equipment—Heathkit "Service Bench" VTVM, Kit IM-13, $32.95

For Your Car—Heathkit Ignition Analyzer, Kit IO-20, $89.95

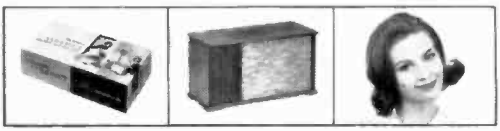
there are 245 more where these came from!

For Your Home—Heathkit Electronic Organ, Kit GD-232, $549.95

For Your Boat—Heathkit 25-Watt Radiotelephone, Kit MW-13, $164.95

A pre-finished compact speaker system kit anyone can assemble in less than 20 minutes without tools. No sanding, no finishing, no special manual skills.

NEW E-V CORONET KIT SPEAKER SYSTEM ONLY $39.00*



Comes like this . . . looks like this . . . sounds great!

Here's a kit that goes together virtually by the power of your suggestion alone!

And ins.de is an authentic component-quality speaker—the MC8 full-range, 8-inch made by Electro-Voice—with a heavy die-cast frame, Radax dual-cone construction and a modern ceramic magnet. Top quality performance is assured by the acoustic phase inverter cabinet design. And its ¾-inch Acoustiply panels are completely finished in oiled walnut veneers.

But the best news of all about the Coronet is the price*; just $39.00, net, for the basic Cororet I (with MC8 loudspeaker, 50-13,000 cps); $43.50, net, for the Coronet II (with LS8 loudspeaker, 45-14,000 cps); and $54.00, net, for the Coronet III (with SP8B loudspeaker, 40-15,000 cps).

See the Electro-Voice Coronet Kit Speaker System on display at your hi-fi dealer's now! Or write direct for complete specifications!

*Slightly Higher West of the Rockies

ELECTRO-VOICE, INC., Dept. 1034P, Buchanan, Michigan

Electro-Voice®
SETTING NEW STANDARDS IN SOUND