

COMPACT SPEAKERS—TRUE HI-FI/LOW-COST

POPULAR ELECTRONICS

MAY
1965

35
CENTS

ANTENNA BUYING TIPS:

Color TV—CB Base—Rotators

CB Mobile—Fringe Area—UHF

BUILD:

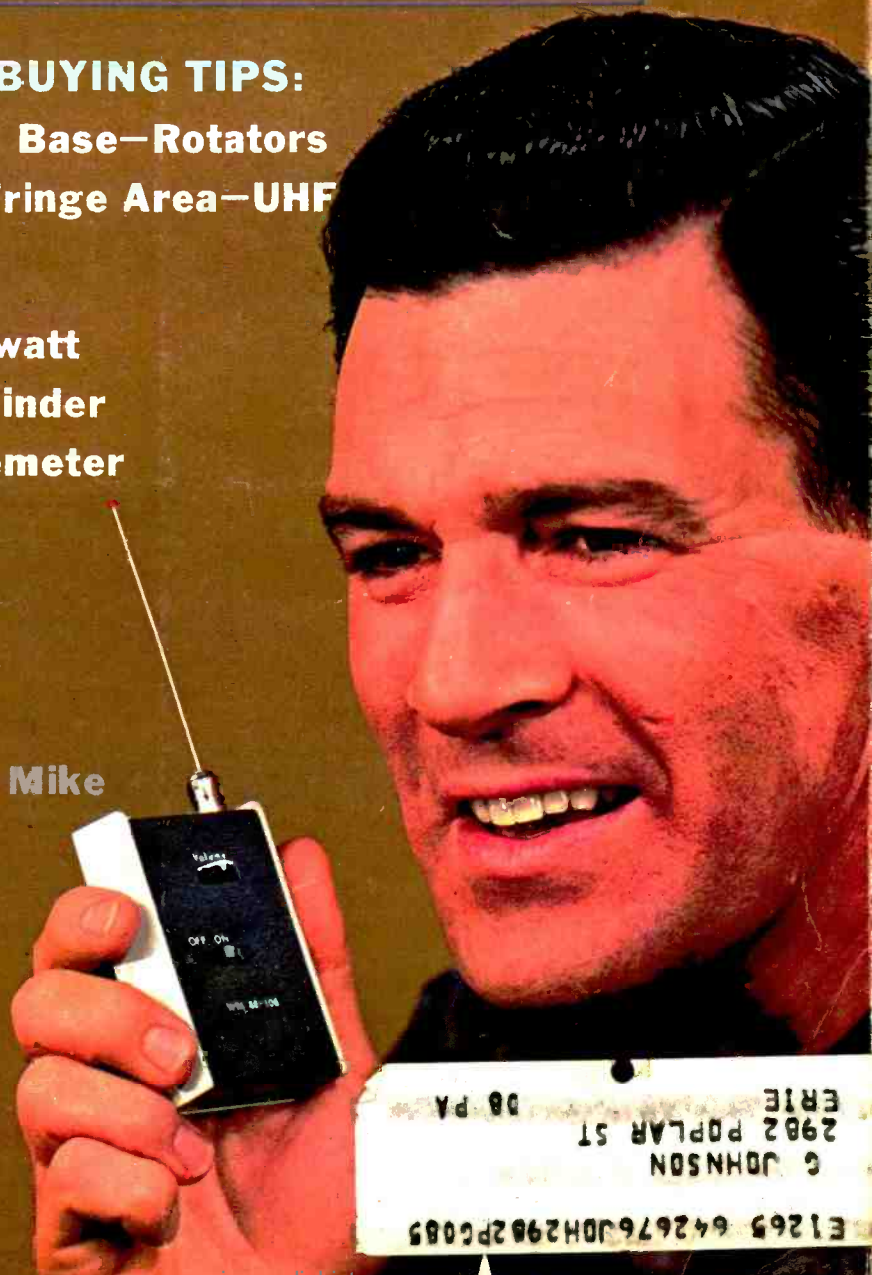
Plug-In Dymwatt

Auto Light Minder

Marine Wavemeter

FM Wireless Mike

(page 35)



E1265 642676JDH2982PC085
G JOHNSON
2982 POPLAR ST
ERIE PA 16508

Thousands Who Gained Through NRI

► TRAINING KITS ► EXCITING, FAST

Thousands of NRI graduates, Industrial Electrician, Television and Radio Repair, and other futures and careers. Training men in electronics has been a priority. NRI pioneered home instruction, providing equipment for a time-proved way to learn. With NRI in a better position with you, we go on to greater heights. No matter how much you have, you can have more. Plans



Make \$3 to \$5 An Hour in Spare Time

You don't have to wait until you get an NRI diploma to start earning. As many others have done, you can be making \$3 to \$5 an hour in your spare-time as you train, fixing radios and TV sets for friends and neighbors. You learn how to install, maintain and service stereo hi-fi, radios, TV sets (including color), even how to charge for service and how to set up your own spare-time or full-time business. Many students pay for their NRI training out of spare-time earnings long before they graduate.

Skilled Technicians Are in Demand

There has never been a time when ambitious men with specialized Electronics knowledge were as much in demand as they are today. From television service shops to launching pads, there's a profitable place for you as a skilled technician to help service, operate, install and supervise Electronically-controlled equipment. The NRI diploma is respected and recognized in business and industry. It can be your key to success in America's "glamor" industry.

Achievement Kit Gets You Started Fast

As soon as you enroll with NRI we deliver to your door everything you need to make a fast start in the Electronics training of your choice. This new Achievement Kit is an unparalleled example of the value of NRI home-study training. No other school has anything like it. Find out about the NRI Achievement Kit, about NRI training equipment, about NRI courses, about opportunities for success in Electronics. Send for the NRI catalog. There's no obligation. No salesman will call. NATIONAL RADIO INSTITUTE, Electronics Division, Washington, D. C. 20016.

PICK YOUR FIELD FROM NRI'S SPECIALIZED INSTRUCTION PLANS

- 1 TELEVISION-RADIO SERVICING**
Complete training from basic fundamentals of electricity to home entertainment equipment. You learn to fix radios, hi-fi and stereo sets, black-and-white and color TV, etc. A profitable field full or part time.
- 2 INDUSTRIAL-MILITARY ELECTRONICS**
From basic principles to computers. A comprehensive training plan that teaches you the fundamentals, then takes you into such modern-day miracles as servos, telemetry, multiplexing, pulse circuitry, data processing, other important subjects.
- 3 COMPLETE COMMUNICATIONS***
Designed to teach and provide you with actual practice in operation, service and maintenance of AM, FM and TV broadcasting stations. Also covers marine, aviation, mobile radio, facsimile, microwave, radar.
- 4 FCC LICENSE***
Specifically designed short course to prepare you for your First Class FCC Radiotelephone License examinations. You begin with a thorough background in fundamental Electronic principles, advance to required subjects covering equipment and procedures.
- 5 MATH FOR ELECTRONICS**
A brief course for engineers and technicians who need a quick review of the essential mathematics used in industry, communications, in government jobs. Basic arithmetic review, shortcut formulas, modern digital number system, much, much more.
- 6 BASIC ELECTRONICS**
A concise course to teach modern Electronics terminology and components. A wealth of practical, useful information to help you better understand the field, to give you some technical knowledge. For anyone who wants basic understanding of Radio-TV Electronics.
- 7 ELECTRONICS FOR AUTOMATION**
This course is not for beginners. Offered for men with some fundamental knowledge of Electronics who want better understanding of Automation in present day use. Covers process control, ultrasonics, telemetering, and remote control, electromechanical measurements, other subjects.
- 8 AVIATION COMMUNICATIONS***
This course prepares you to install, maintain, service aircraft communications equipment. Covers direction finders, ranges, markers, Loran, Shoran, Radar, landing systems. Earn your First Class FCC License with Radar Endorsement.
- 9 MARINE COMMUNICATIONS***
Covers transmitters, direction finders, depth indicators, radar, sonar, other equipment used on commercial ships and thousands of pleasure boats. Prepares you for a First Class FCC License with Radar Endorsement.
- 10 MOBILE COMMUNICATIONS***
Learn to install and maintain mobile equipment and associated base stations. Covers transmitters and receivers used by police and fire departments, public utilities, construction projects, taxis, etc. Prepares you for a First Class FCC License.

*NOTE: You must pass your FCC License exam (any Communications course) or NRI refunds in full the tuition you have paid.

MAIL POSTAGE-FREE CARD NOW

www.nri.com/radiohistory.com



**A MUST
FOR
COLOR TV**

NEW JERROLD **COLORAXIAL**TM Antenna System

The old familiar twin-lead antenna line, that worked pretty well for black-and-white TV, is hopelessly inadequate for color reception. When your pictures smear, ghost, or change color, it's usually because the signal is being garbled between the antenna and your TV set.

What's the answer? Jerrold, pioneer and leader in TV reception systems, announces the ColoraxialTM system for converting any outdoor antenna to shielded coaxial-cable operation. The same way signals are protected in cable systems feeding thousands of sets from one antenna. Installs in minutes, can be run through or against metal, needs no insulation, and has up to ten times the life expectancy of twin-lead. The

shielded cable keeps the color signals or black-and-white signals clean and undistorted under all weather conditions . . . no interference can get in.

Jerrold Coloraxial Kits give you everything you need for a fast, low-cost installation: 50 or 75 feet of shielded Coloraxial cable complete with fittings; matching transformers; even a Coloraxial antenna if you don't have an antenna or if it needs replacing.



A subsidiary of The Jerrold Corporation

Jerrold Electronics, Dept. PE-5
15th & Lehigh Ave., Philadelphia 32, Pa.

Send me complete information on the new Jerrold ColoraxialTM Antenna System.

Name

Address

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

CIRCLE NO. 14 ON READER SERVICE PAGE

May, 1965

POPULAR ELECTRONICS



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

This month's cover photo by Dan Rubin

VOLUME 22

MAY, 1965

NUMBER 5

Special Antenna Section

A New Generation of Antennas	Robert Cornell	46
How to Improve Color TV Antenna Installations	Lon Cantor	52
Selecting a UHF Antenna	Abraham E. Schenfeld	55
Are You Ready for UHF?	James Sarayotes	58
Antenna Rotators Pinpoint Signals	Gary Wayne	59
CB Antennas—Then, Now, and Tomorrow	T. R. Merrick	62

Electronic Construction Projects

FM Wireless Microphone	Daniel Meyer	35
Marine Band Wavemeter	E. H. Marriner, W6BLZ	44
Simple Auto Light Minder	R. L. Winklepleck	45
The Dymwatt	Don Lancaster	71

Amateur, CB, and SWL

Short-Wave Report: Notes from Your Short-Wave Editor's Desk	Hank Bennett, W2PNA	69
English-Language Newscasts to North America		70
Predicted Radio Receiving Conditions	Stanley Leinwall	77
Across the Ham Bands: Getting the Most Out of a Simple Communications Receiver	Herb S. Brier, W9EGQ	79
On the Citizens Band: Regional REACT Monitor	Matt P. Spinello, KHC2060	81
New CB Rules Effective April 26, 1965		86
Short-Wave Monitor Certificate Application		103
DX Countries Awards Presented		106

Electronic Features and New Developments

NEWS		39
Bantam Hi-Fi Speaker Systems Ride on Air Cushion	Hans Fantel	40
Antenna Quiz	Robert P. Balin	54
Equipment Report: Knight-Kit Model KG-275 Exposure Meter		68
Transistor Topics	Lou Garner	74

Departments

Letters from Our Readers		6
Reader Service Page		15
New Products		22
Tips and Techniques		26
POP'tronics Bookshelf		30
Operation Assist		87

Copyright © 1965 by ZIFF-DAVIS PUBLISHING COMPANY. All rights reserved.



**50,000 MEN HAVE
FOLLOWED OUR ADVICE..
HOW ABOUT YOU?**

Profit and Grow as a DeVry-Trained Electronics Technician

"FOR REAL MONEY, A SOLID FUTURE AND EXCITING WORK, GET INTO THIS GREAT INDUSTRY!" — that's the kind of advice we've given ever since DeVry Tech started more than three decades ago. And our advice still holds true, for today's electronics industry is a multi-billion-dollar field, growing fast, calling for more and more trained men, offering some of the greatest opportunities in its history.

There is an air of excitement about electronics, whether you are in radio and television, space and missile electronics, communications, computer work, your own service business, or other branch of the field. Thousands of men much like yourself, men with ambition to be somebody — have learned electronics the DeVry way, either at home or in day or evening classes at one of our well-equipped resident schools. You, too, may keep your present job while preparing for a better one; make extra money in spare time while you learn. And . . . you don't need previous technical experience or advanced education to get started.

When you graduate, our efficient Employment Service will help you get started toward a good job, a promotion or a business of your own. Get the full story — no obligation! All you have to do is fill out the coupon and send it in.

MODERN TRAINING AIDS

"Programmed" texts
... visual aid training
movies ... actual
equipment to build.
DeVry's programs are
designed with progress
in mind.

2,200 RESIDENT STUDENTS

DeVry Tech now has
2,200 resident students
attending day and
evening classes.

5,000 FIRMS HAVE EMPLOYED DeVRY GRADUATES

Our men are "wanted"
in many industries.
There must be a reason!

FREE!



Get two valuable
booklets telling about
today's opportunities
in electronics.

MAIL THIS COUPON TODAY!

DEVRY TECHNICAL INSTITUTE

4141 Belmont Ave., Chicago, Ill. 60641, Dept. PE-5-V

Please give me your two free booklets, "Pocket Guide to Real Earnings" and "Electronics in Space Travel"; also include details on how to prepare for a career in Electronics. I am interested in the following opportunity fields (check one or more):

- | | |
|--|---|
| <input type="checkbox"/> Space & Missile Electronics | <input type="checkbox"/> Communications |
| <input type="checkbox"/> Television & Radio | <input type="checkbox"/> Computers |
| <input type="checkbox"/> Microwaves | <input type="checkbox"/> Industrial Electronics |
| <input type="checkbox"/> Automation Electronics | <input type="checkbox"/> Broadcasting |
| <input type="checkbox"/> Radar | <input type="checkbox"/> Electronic Control |

NAME _____ AGE _____

ADDRESS _____ APT _____

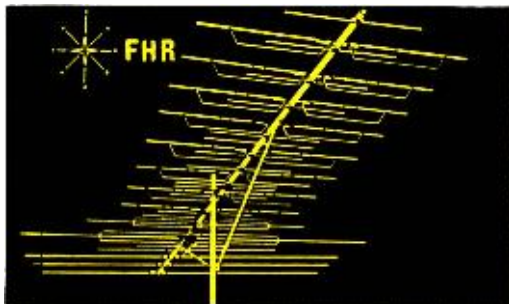
CITY _____ ZONE _____ STATE _____

Check here if you are under 16 years of age.
Canadian residents: Write DeVry Tech of Canada, Ltd.
2097 970 Lawrence Avenue West, Toronto 19, Ontario

DeVry Technical Institute

Chicago • Toronto

THE **MAGIC**
OF
COLORMAGIC
TV ANTENNAS
ADVANCED
ENGINEERING
DESIGN
BEST FOR COLOR AND BLACK AND WHITE



Only Colormagic...

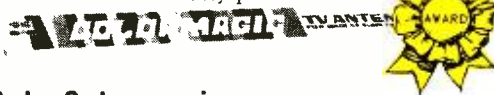
has been top-rated in independent consumer publications for broadband performance, gain, front/back ratio, beam width, impedance match, construction and ease of assembly, etc.

Only Colormagic...

has FHR which is the exclusive development of GC Electronics for process applied to all Colormagic series of antennas, to provide a resonating action within the elements of the fundamental harmonics of both the high and low bands.

Only Colormagic...

has the outstanding Award Winning Carton Design in which all Colormagic series antennas are carefully packed.



Only Colormagic...

has the endorsement from Philco, one of the leading manufacturers of TV receiving equipment. Colormagic antennas are recommended and approved for all Philco TV. Color and black and white installations.



Write For Four Page Color Brochure Today!

Dept.: BMW

GC ELECTRONICS
400 South Wyman Street Rockford, Illinois
CIRCLE NO. 9 ON READER SERVICE PAGE

POPULAR ELECTRONICS

World's Largest-Selling Electronics Magazine

- PHILLIP T. HEFFERNAN** Publisher
OLIVER P. FERRELL Editor
W. STEVE BACON, W2CJR Managing Editor
ROBERT CORNELL, WA2HDQ Technical Editor
WILLIAM GALBREATH Art Editor
MARGARET MAGNA Associate Editor
ANDRE DUZANT Technical Illustrator
NINA CHIRKO Editorial Assistant
PATTI MORGAN Editorial Assistant
H. S. BRIER, W9EGQ Amateur Radio Editor
M. P. SPINELLO, KHC2060 CB Editor
L. E. GARNER, JR. Semiconductor Editor
H. BENNETT, W2PNA Short-Wave Editor
STANLEY LEINWOLL Radio Propagation Editor

LAWRENCE SPORN Advertising Sales Manager
ARDYS C. MORAN Advertising Service Manager

ZIFF-DAVIS PUBLISHING COMPANY

Editorial and Executive Offices (212 ORegon 9-7200)
One Park Avenue, New York, New York 10016

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
Philip Sine, Treasurer
Walter S. Mills, Jr., Circulation Director
Stanley R. Greenfield, Vice President
Phillip T. Heffernan, Vice President

New York Office (212 ORegon 9-7200)
One Park Avenue, New York, New York 10016
Eastern Advertising Manager, RICHARD J. HALPERN

Midwestern Office (312-726-0892)
307 North Michigan Avenue, Chicago, Illinois 60601
Midwestern Advertising Manager, JAMES WEAKLEY

Western Office (213 CRestview 4-0265)
9025 Wilshire Boulevard, Beverly Hills, California 90211
Western Advertising Manager, BUD DEAN



POPULAR ELECTRONICS is published monthly by Ziff-Davis Publishing Company at 307 North Michigan Avenue, Chicago, Illinois 60601. May, 1965, Volume 22, Number 5. (Ziff-Davis also publishes Skiing, Flying, Popular Boating, Car and Driver, Popular Photography, HiFi/Stereo Review, Electronics World, Modern Bride, and Skiing Trade News.) Subscription Rate: One year, \$1.00; additional postage for Canada and Pan American Union countries, \$.50; additional postage for all other foreign countries, \$1.00. 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 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 (25); Swiss francs (23); West German marks (21).

SUBSCRIPTION SERVICE: All subscription correspondence should be addressed to POPULAR ELECTRONICS, Circulation Department, Portland Place, Boulder, Colorado 80301. 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: will 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.

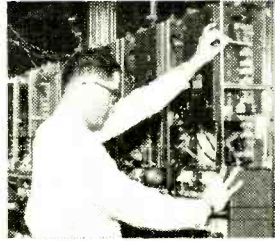
Pick the course for your career...

Electronics Technology



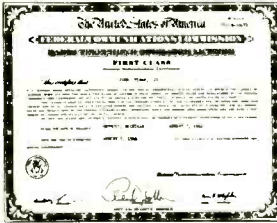
A comprehensive program covering Automation, Communications, Computers, Industrial Controls, Television, Transistors, and preparation for a 1st Class FCC License.

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

Cleveland Institute of Electronics

1776 E. 17th Street, Dept. PE-29
Cleveland, Ohio 44114



Accredited Member

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.

Mail Coupon TODAY For FREE Catalog

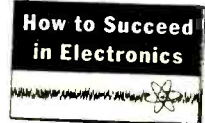
Cleveland Institute of Electronics

1776 E. 17th St., Dept. PE-29
Cleveland, Ohio 44114

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

CHECK AREA OF MOST INTEREST—

- | | |
|---|--|
| <input type="checkbox"/> Electronics Technology | <input type="checkbox"/> First Class FCC License |
| <input type="checkbox"/> Industrial Electronics | <input type="checkbox"/> Electronic Communications |
| <input type="checkbox"/> Broadcast Engineering | <input type="checkbox"/> Advanced Engineering |



Your present occupation _____

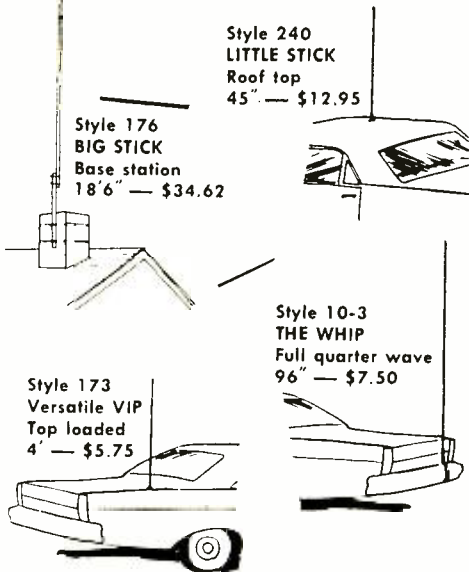
Name _____ (please print) _____ Age _____

Address _____ County _____

City _____ State _____ Zip _____

A leader in electronics training...since 1934.

CHAMPION PERFORMERS



- they're all fiberglass
- they're all WONDERSHAFT

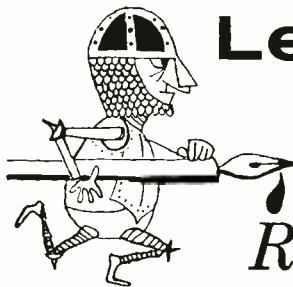
Choose the versatile VIP, the WHIP, or combine the LITTLE STICK with the BIG STICK for a "talking team." You'll pride yourself on the outstanding performance, the rugged good looks and easy installation of a **WONDERSHAFT**.

Look for the **WONDERSHAFT** trademark. It's a mark of distinction for all CB'ers . . . a guarantee of superior quality and performance.



COLUMBIA PRODUCTS COMPANY
SUBSIDIARY OF SHAKESPEARE COMPANY
ROUTE 3, COLUMBIA, SOUTH CAROLINA

CIRCLE NO. 4 ON READER SERVICE PAGE



Letters from our Readers

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

Those Inflated Canadian Prices

■ I thoroughly agree with the reader who wrote in about the high cost of electronic parts in Canada ("Letters from Our Readers," March, 1965). Prices are so high here that by the time you save up enough money for a piece of equipment you no longer need it.

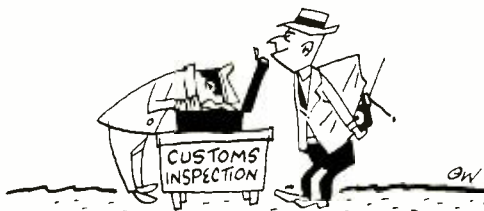
JAMES GOT
Westmount, Quebec, Canada

■ Canadian prices on amateur gear are way out of proportion. Despite the "Buy Canadian" slogan, there is no ham gear being made by a Canadian company, and the prices on U.S.-manufactured equipment are idiotically high. For example, the Hammarlund HX-50 sells here for \$659, \$260 over the U.S. price. The Johnson "Invader" goes for \$1950, \$700 (!) over the U.S. price. Markups range from 40 to 85 percent

is all this "duty"? I, among others, may be tempted to smuggle a few across the border. C U in jail, VE3's, 4's, 5's, 6's, 7's, and what have we.

JOHN BACHMAN
Toronto, Ontario, Canada

■ There are many tricks in buying equipment from the United States which our Canadian customers find helpful. We suggest that remittance for mail orders be in the form of Canadian Postal Money Orders, which cost the customer no exchange as the U.S. Post Office accepts them at full face value. All a customer pays is



the fee for a money order. In the case of bank remittances payable in Canadian funds, the customer has to add about 7 percent to cover exchange; in addition, local U.S. banks may charge extra for processing these checks. If you live near the border, you can save on shipping charges by having your order mailed to General Delivery at the U.S. Post Office nearest your home town. The postage for sending a package weighing just under three pounds from Chicago to Niagara Falls, N.Y., for example, is 55 cents. To Niagara Falls, Ontario, the postage is \$1.10. Picking up packages in the U.S. gives Canadians quicker delivery, and they can take the purchase across the border, paying the tariff themselves.

MELVIN J. BAER, Managing Director
K9TVA Enterprises
Chicago, Ill.

(Continued on page 10)

Choose Your Tailor-Made Course in N.T.S. "PROJECT METHOD" ELECTRONICS!

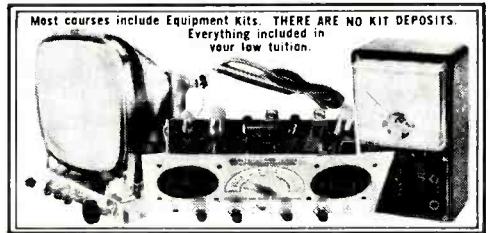
Now! N.T.S. — one of America's oldest leading home-study and resident technical schools — offers you **GREATER CAREER OPPORTUNITIES IN ELECTRONICS**. N.T.S. "Project Method" home training lessons are shop-tested in the Resident School in Los Angeles. You work on practical job projects, learn to use shop manuals and schematics. Your N.T.S. training is individual. You proceed at your own pace. The Schools' practical methods, plus more than 60 years of experience, have helped thousands of students all over the world to successful careers. Prepare now for a secure future in one of 8 N.T.S. Electronics Courses designed to fit your own particular needs.



Work on the electronic "brains" of industry — computers, data processing and other automation equipment. Become a TV-Radio Technician, an electronics field engineer, or succeed in your own business.

CHOOSE YOUR FIELD — INSURE YOUR FUTURE!

- 1 ELECTRONICS-TV-RADIO-SERVICING & COMMUNICATIONS** A basic course thoroughly covering fundamentals of electronics, radio, TV servicing and communications.
- 2 MASTER COURSE IN ELECTRONICS-TV-RADIO, PLUS ADVANCED TV & INDUSTRIAL ELECTRONICS** This course covers everything included in Course No. 1 plus Automation and every phase of the Electronics industry.
- 3 FCC LICENSE** Preparation for this government license essential for interesting jobs in radar, radio, television, communications, guided missiles, many others. Upon completion of this course, if you do not pass the FCC exam for a 1st Class Commercial Radiotelephone License your tuition will be refunded.
- 4 RADIO SERVICING (AM-FM-Transistors)** Train for radio sales and service with dealer or distributor.
- 5 TELEVISION SERVICING (Including Color)** Covers installation, adjustment, repair and servicing of black and white and color television . . . prepares you for your own sales and service business.
- 6 STEREO, HI-FI AND SOUND SYSTEMS** A growing field. Prepares you to build, install and service modern sound equipment for home or industry.
- 7 BASIC ELECTRONICS** Gives you the fundamentals you must know to build on for a future Electronics career. Also offers an excellent background for Salesmen, Purchasing Agents, and others in Electronics.
- 8 ELECTRONICS MATH** Simple, easy-to-follow instructions in the specialized math you need in many electronics jobs.



CLASSROOM TRAINING AT LOS ANGELES

You can take classroom training in our famous Resident School at Los Angeles in Sunny Southern California. N.T.S. is the oldest and largest school of its kind. Associate in Science Degree also offered in our Resident Program. Check Resident School box in coupon for full details.

HIGH SCHOOL AT HOME

Learn easily. New modern method. National also offers accredited high school programs for men and women. Take only subjects you need. Study at your own pace. Latest approved textbooks — yours to keep — everything included at one low tuition. Check High School box in coupon for information.



MAIL COUPON TODAY FOR FREE BOOK AND SAMPLE LESSON

In Field of Your Choice. You enroll by Mail — and Save Money. No Salesmen: This means lower tuition for you. Accredited Member N.H.S.C.



NATIONAL TECHNICAL SCHOOLS
WORLD-WIDE TRAINING SINCE 1905
4000 S. Figueroa St., Los Angeles, California 90037



NATIONAL TECHNICAL SCHOOLS

4000 S. Figueroa St., Los Angeles, California 90037

Please Rush **FREE** Electronics "Opportunity Book" and sample lesson on course checked below:

- Electronics-TV-Radio Servicing & Communications
- Master Course in Electronics-TV-RADIO Advanced TV & Industrial Electronics
- FCC License
- Radio Servicing (AM-FM-Transistors)
- Television Servicing (Including Color)
- Stereo, Hi-Fi and Sound Systems
- Basic Electronics
- Electronics Math

Dept. 205-55

Name _____ Age _____

Address _____

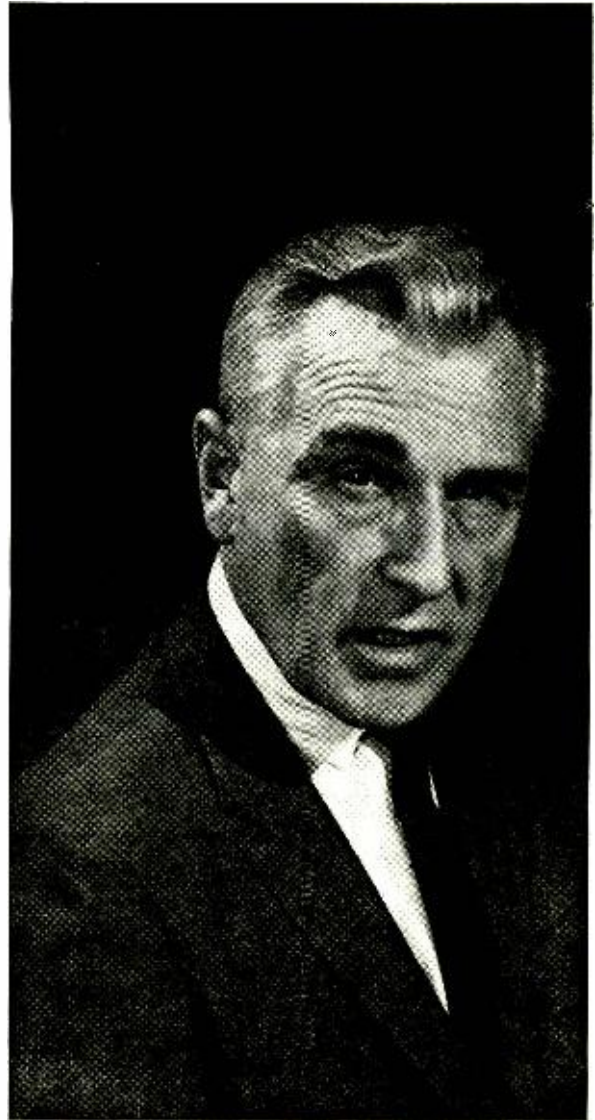
City _____ State _____ Zip _____

- Check here if interested **ONLY** in Classroom Training at L.A.
- Check here for High School Department Catalog only



**“There’s no
sure way to
success in
electronics-**

**but I’ll put my money
on the man who
makes himself
a specialist
in one of these
key areas”**



Take the advice of men who have worked their way up to the top in the electronics industry. Make yourself a specialist in one of the key areas of electronics. Then stop worrying how cutbacks, layoffs and contract terminations will affect you and your family. If you have up-to-date, specialized knowledge, you can look forward to security and excellent earnings while men with ordinary qualifications are made obsolete—and unemployed—by advances in technology or by automation.

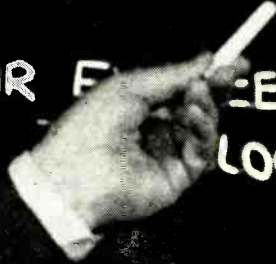
But, to become a specialist, you must supplement your experience in electronics with more technical education. Going back to school isn't easy for a man

who holds a full time job and has family obligations. And few residence schools offer educational programs directly related to current employment requirements in the electronics industry.

CREI Home Study Programs offer you a practical way to get the additional education you need without going back to school. You study at home, at your own pace, on your own schedule. And, because CREI Programs are developed and kept up-to-date with the help of engineers and scientists from every part of the electronics industry, you study with the assurance that what you learn can be applied to the job immediately.

ELECTRONIC ENGINEERING TECHNOLOGY
 COMMUNICATIONS — RADAR & SERVO
 SERVOMECHANISMS & COMPUTERS
 SPACE DATA SYSTEMS — AEROSPACE RADAR
 SPACECRAFT TRACKING & CONTROL
 NUCLEAR INSTRUMENTATION
 AERONAUTICAL & NAVIGATIONAL
 TELEVISION

NUCLEAR ENGINEERING
 TECHNOLOGY



Because CREI Programs cover all the areas of electronics that are important now and will be even more important in the future, you're sure to find a program that fits your particular ambitions and career objectives.

You're eligible for a CREI Program if you work in electronics and have a high school education. Our FREE book gives complete information. For your copy of this book, mail coupon today or write: CREI, Department 1205-C, 3224 Sixteenth St., N.W., Washington, D.C. 20010.



SEND FOR FREE BOOK



The Capitol Radio Engineering Institute,
 Dept. 1205-C, 3224 Sixteenth St., N.W.
 Washington, D.C. 20010

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

Name _____ Age _____

Address _____

City _____ State _____ Zip Code _____

Employed by _____

Type of Present Work _____

Letters

(Continued from page 6)

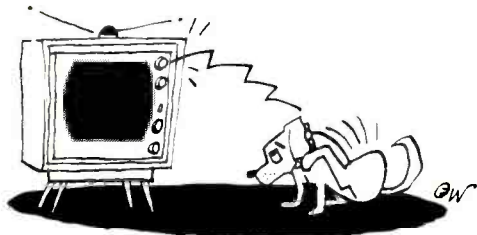
"H.E.L.P." Opposed

■ I'd like to put my two cents worth in on the "H.E.L.P." system proposed by the Automobile Manufacturers Association (see page 64 of the March, 1965, issue). I hope they realize what sort of a problem would result if CB radios are made standard equipment in all new cars. The already over-crowded CB channels would become even more so, what with the 16- and 17-year-olds on the road driving new cars.

RON HANEY, KHC3840
Janesville, Wis.

Dog Disrupts TV Sound

■ We have one of those automatic volume and channel controls on our TV set that operates on receiving a high-frequency audio signal from the remote control unit. Normally, this would not pose a problem, but our dog has a chain collar that gives out the same



signal as the volume control whenever he shakes it. Every time the dog decides to scratch, down goes the volume. What to do?

ROBERT KROHN
Oneonta, N.Y.

Some remote controls are so constructed that you can shift the frequency. Bob. If this is the case, your problem is solved. Otherwise, buy a can of flea powder.

Measuring Cartridge Compliance

■ Your article about stereo cartridges ("Updating Your Stereo System," March, 1965) graphically demonstrates the vast disparities between claimed cartridge specs and actual performance. Unlike amplifier or tuner specs, cartridge compliance figures are sometimes grossly exaggerated. Why do cartridge manufacturers do this?

DICK FEENBERG
St. Louis, Mo.

Stereo cartridge compliance is one of the most amorphous specifications in the hi-fi lexicon, Dick. The basic fault is not so much in advertised claims, but in the fact that manufacturers use different methods to obtain compliance figures. Two concerns will test the same cartridge and come up with two different sets of figures. A standard compliance measurement would be desirable for the hi-fi industry.

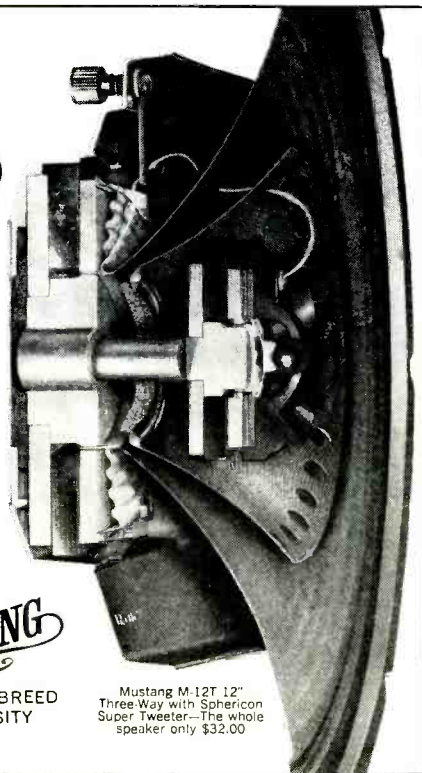
Bi-Coupler Enclosure Boosted

■ I recently completed a "Bi-Coupler" speaker enclosure ("For Better Sound Build the Bi-Coupler," November, 1964) and find it satisfactory beyond my expectations. The cabinet cost me \$8.95 and ten hours of labor; the speakers are two extended-range types

Guts.

It took *guts* to even think of making a low-cost speaker line to University's high quality standards. But we did it! Here's the MUSTANG—an All-American high fidelity speaker, so good it carries the same 5-year warranty that backs all University products! There's a full line of MUSTANGS—prices starting at a low, low \$19.50. Listen to the MUSTANG at your dealer. You'll know why everyone says "University Sounds Better." Get the full MUSTANG story and new Guide to Stereo. Write Dept. PE-55

- Rugged one-piece die-cast basket
- Massive ring magnets
- 2" long-throw voice coil
- Electroplated metal parts to prevent distortion and assure long life
- Shallow depth styling
- Unique 2-step suspension



MUSTANG
A GREAT NEW BREED
BY UNIVERSITY

Mustang M-12T 12"
Three-Way with Sphericon
Super Tweeter—The whole
speaker only \$32.00

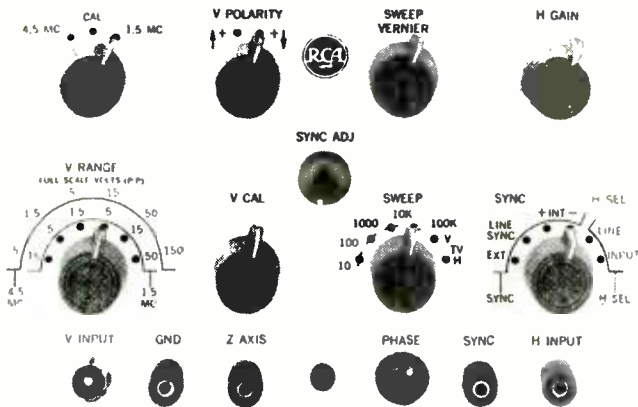
LTV
UNIVERSITY
A DIVISION OF LING TEMCO VOUGHTY, INC.

P.O. Box 1056, Oklahoma City, Oklahoma.

CIRCLE NO. 18 ON READER SERVICE PAGE



WO-91B OSCILLOSCOPE



The famous RCA 5-inch scope NOW WITH MORE FEATURES TO SIMPLIFY YOUR JOB

Here's the latest model of the famous RCA 5-inch scope: the NEW WO-91B

- Provision for connecting signals directly to the vertical deflection plates of the CRT. Permits observation of high frequency RF waveforms, such as trapezoidal and wave-envelope modulation patterns.
- Two-stage sync separator simplifies checking of TV horizontal and vertical sweep synchronization... provides exceptionally solid lock-in action on composite TV signals.
- Choice of wide-band or high-sensitivity, narrow-band display.
- Complete with RCA WG-300B Direct/Low Cap. Probe and Cable.

- Optional at slight extra cost: RCA WG-354A slip-on capacitance-type voltage-divider probe that extends the range of the scope to permit observation of signal pulse amplitudes up to 5000 volts. RCA WG-302A slip-on RF/IF/VF signal tracing probe for RF applications from 100 Kc to 250 Mc.

<input type="checkbox"/> WO-91B Scope:	\$249.50*
<input type="checkbox"/> WG-354A Probe:	\$ 7.50*
<input type="checkbox"/> WG-302A Probe:	\$ 8.20*

Ask to see it at your Authorized RCA Test Equipment Distributor.

*Optional distributor resale price. All prices subject to change without notice. Prices may be slightly higher in Alaska, Hawaii and the West.

RCA Electronic Components and Devices, Harrison, N.J.



The Most Trusted Name in Electronics

CIRCLE NO. 26 ON READER SERVICE PAGE

www.americanradiohistory.com

Letters

(Continued from page 10)

which ran \$19.90 for the pair. I have not added acoustic padding, and corner placement makes a back unnecessary. The response is beautiful, with highs clear and balanced. Bass response is quite easy to obtain with very little boost above flat setting; no booming or muddy tones are present. Although I'm planning to build a second "Bi-Coupler," the single enclosure used for stereo is a fantastic performer. It is very inexpensive, and should give any "bookshelf buyers" many second thoughts.

WILLIAM T. SMITH, USN
Corpus Christi, Texas

"Panic Alarm" Gets Laughs

I've read POPULAR ELECTONICS in the past, but I've never enjoyed it as much as now. I built the "Panic Alarm" (May, 1964) and had a tremendous amount of fun with it. I took it to work with me, and it went from supervisor to foreman, to the head of the section, with laughs all the way.

LEE EWING, K6IUE
Thousand Oaks, Calif.

"Wireless Re-Broadcaster" Applauded

I had the pleasure of building your "Wireless Re-Broadcaster" (January, 1965), and it works very well. I use it to monitor my favorite ham bands without being tied down in the ham shack. Modifications I made in the unit were to compress the size by using a 3" x 4" x 5" aluminum box as a chassis, and to eliminate the three-position switch and bring a shielded

cable out of the unit terminating in a standard phone jack. You omitted the specifications for the rectifier and fuse: I used an KCA 1N1763 diode and a 2-amp fuse.

LEO ROSIK, W9CVM
Rockford, Ill.

Thank you for the letter, Leo. For those missing specifications, see "Out of Tune," March, 1965.

That "Do-Nothing Box" Again

The "Do-Nothing Box" (January, 1964) really bugs me. At first, the neon lamps seem to do just what you say they will do—fire in sequence. Let an hour or two pass, however, and my unit will invariably, at some time or other, change firing sequence. Instead of firing 1-2-3-4-5-6, mine will change to 6-5-4-3-2-1, and some models I have built don't even



have the decency to maintain ANY sequence. Frankly, the more I study the circuit, the bugger I get. Can you help me?

LYOYD E. TOMANY, SR.
New Lenox, Ill.

Some of your readers may be interested in a few tips on the "Do-Nothing Box." After building it, let

YOUR NEW COPY IS WAITING



FREE! For fun and pride in assembly, for long years of pleasure and performance, for new adventures in creative electronics mail the coupon below and get Conar's brand new catalog of quality do-it-yourself and assembled kits and equipment. Read about items from TV set kits to transistor radios . . . from VTVM's to scopes . . . from tube testers to tools. And every item in the Conar catalog is backed by a no-nonsense, no-loopholes, money-back guarantee! See for yourself why Conar, a division of National Radio Institute, is about the fastest growing entry in the quality kit and equipment business.

CONAR

MAIL THIS COUPON NOW

CONAR

EA5C

3939 Wisconsin Ave., Washington 16, D.C.

Please send me your new catalog.

Name _____

Address _____

City _____ State _____ Z-Code _____

CIRCLE NO. 35 ON READER SERVICE PAGE

WOW!

RADIO SHACK HAS CB FOR UNDER \$50

REALISTIC SELECTaCOM

WORLD'S FIRST DUAL-POWER CB TRANSCEIVER & WIRELESS INTERCOM



Desk-Top Size: 8 5/8" x 5 3/8" x 5"

The SELECTaCOM — attractively office-styled in a high-impact beige case, and the only NEW intercom to appear in 15 years!

SELECTaCOM Order No. 21-1160; Ship. wt. 6 lbs.



it's a wireless 100mw intercom!

House electrical wiring is NOT used to transmit! SELECTaCOM transmits the wireless CB way with crystal-controlled stability on Ch. 5. Use it with any number of similar units for an intercom "net"; also receive Ch. 5 signals from mobile or walkie-talkie CB sets! No license, no mike needed.

it's a dual 100mw/3W CB transceiver!

Low power (100 mw) operation with built-in telescoping antenna gives you NO LICENSE communications. Flip to high power, plug in external antenna for full 3-watt operation on quiet Ch. 5. It's a versatile "telephone" for the space-age.

it's sold only by Radio Shack stores!

And the Realistic SELECTaCOM is actually priced below "close outs"! The only desk-top CB on the market — and the world's first CB intercom! Order by mail or buy it at your nearest RADIO SHACK store. External antenna \$9.95, no. 21-901.

49.95

PAIR
99.50

YES... You can buy "ON TIME"

AT ALL 51 RADIO SHACK STORES Coast-to-Coast

Mail to the Radio Shack Nearest You

Introductory Special! We Will Fill Your SELECTaCOM Order for 50c a Unit (Postage & Handling) Anywhere in the U.S.A.

Send Free Radio Shack Bargain Catalog #PE-565

Name _____
Street _____
City _____ State _____ Zip _____

- CALIFORNIA**
BAKERSFIELD — 1308 19th St.
DOWNEY — Stonewood Shop. Ctr.
LA MESA — Grossmont Shop. Ctr.
LONG BEACH — 127 W. 7th St.
LONG BEACH — 3976 Atlantic Ave.
SAN LEANDRO — Bay Fair Shop. Ctr.
- CONNECTICUT**
HAIDEN — Haiden Mart. Shop. Ctr.
MANCHESTER — Manchester Shop. Parkade
NEW HAVEN — 92 York St.
NEW LONDON — New London Shop. Ctr.
STAMFORD — 29 High Ridge Rd.
WEST HARTFORD — 39 So. Main St.
- ILLINOIS**
CHICAGO — Evergreen Plaza at 95th St.
- NEW HAMPSHIRE**
MANCHESTER — 1247 Elm St.
- NEW MEXICO**
ALBUQUERQUE — 6315 Lomas, N. E.
- NEW YORK**
NEW YORK — 1128 Ave. of the Americas
SYRACUSE — 3057 Erie Blvd. East

- MASSACHUSETTS**
BOSTON — 167 Washington St.
BOSTON — 594 Washington St.
BOSTON — 110 Federal St.
BRAintree — South Shore Plaza
BROOKLINE — 730 Commonwealth Ave.
CAMBRIDGE — Fresh Pond Shop. Ctr.
FRAMINGHAM — Shoppers' World
LOWELL — Central Shop. Plaza
SAUGUS — N. E. Shop. Ctr.
SPRINGFIELD — 1182 Main St.
WORCESTER — Lincoln Plaza
- MAINE**
PORTLAND — Pine Tree Shop. Ctr.
- MINNESOTA**
ST. PAUL — 16 E. 6th St.
- OKLAHOMA**
OKLAHOMA CITY — Mayfair Shop. Ctr.
TULSA — 317 South Detroit St.
- OHIO**
CINCINNATI — 852 Swifton Ctr.

- PENNSYLVANIA**
PHILADELPHIA — 2327G Cottman Ave.
PHILADELPHIA — 1128 Walnut St.
- RHODE ISLAND**
CRANSTON — 1301 Reservoir Ave.
EAST PROVIDENCE — Shoppers' Town
- TEXAS**
ARLINGTON — Collins at Park Row
DALLAS — 1601 Main St.
DALLAS — Medallion Center
DALLAS — 125 Wynnewood Village
FORT WORTH — 1515 So. Univ. Dr.
FORT WORTH — 900 East Berry St.
FORT WORTH — 3524 East Denton Highway
HOUSTON — 2315 Travis St.
HOUSTON — 322 Northline Mall
HOUSTON (Bellaire) — 4759 Bissonnet
SAN ANTONIO — Wonderland Ctr.
WACO — 1016 Austin Ave.
- VIRGINIA**
ARLINGTON — Washington-Lee Shop. Ctr.
- WASHINGTON**
SEATTLE — 2028 Third Ave.

CIRCLE NO. 27 ON READER SERVICE PAGE

Letters

(Continued from page 12)

it sit and fire for a few days before wondering why it won't fire in order. The components need time to stabilize. And remember that the NE-2's are sensitive to light and heat. Bright sunlight will cause the lights to flash randomly, and even body heat will affect them. Holding your fingers on any bulb will change its firing rate.

ELLIH MOL, K7VRS
Phoenix, Ariz.

Reader Tomany, meet reader Mor.

QSL'ing: Two Problems

■ What happens when you send a reception report to an Iron Curtain country? Isn't it possible that correspondence of this sort could lead to difficulties in getting a security-sensitive job in the future? Also, how do you go about sending reports to ham stations when all you have is the operator's first name, call-sign, and the city or town?

MICHAEL HATFIELD
Grayling, Mich.

We've never heard of anyone getting into trouble over a purely technical reception report, Michael. However, it is true that you may find yourself on a propaganda mailing list as the result of sending such a report to a station in a communist country. Our advice would be to file all such material in the round file (wastebasket). When it comes to QSL'ing hams, you should buy or borrow a copy of the Radio Amateur Callbook Magazine; it's available in two sections, one covering North America and the other the rest of the world.

P.E. Project Put Reader to Sleep

■ I'd like to compliment you on "The Sleep-O-Mat" (January, 1965). It was an excellent project and worked like a dream (no pun intended).

BRUCE HOT STON, KLH6588
Stark City, Mo.

Wanted: Satellite Receiver

■ Why is it that despite the ever-growing interest in our space program, despite the fact that there are many receivers on the market that receive frequencies near 136 mc., there is not one receiver on the market specifically designed for monitoring satellites broad-



casting in the 108-137 mc. region? I doubt if I have the ability to build "The NASA-136" converter (June, 1962).

ED DEMPSEY
Pasadena, Md.

Probably the lack of consumer-type satellite receivers is due to the excellent sensitivity and stability - not to mention calibration accuracy - required. Ed. Although "The NASA-136" is strictly for experienced builders, hundreds have tackled it with success.

(Continued on page 20)



The Turner 454X

Best Home Base Performer Since Babe Ruth!



Here's the finest base station microphone for its price in the world . . . the Turner Model 454X! Clipped frequency response results in extremely high intelligibility in the voice frequencies. Delivers real home run performance on CB, BB, and mobile radio of any kind including single sideband amateur. Response;

300-3000 cps. Level: -48 db. Comes with convenient push-to-talk switch and lever-lock switch for continuous transmission. Model 454X is wired for standard relay switching . . . or get the Model J454X, wired for electronic switching. Put the 454X in *your* line-up. 454X list price, \$26.50. J454X list price, \$29.50.

In Canada: Tri-Tel Associates, Ltd., 81 Sheppard Ave., West, Willowdale, Ontario
Export: Ad Auriema, Inc., 85 Broad Street, New York 4, N.Y.

THE  MICROPHONE COMPANY
946 17th Street N.E.
Cedar Rapids, Iowa

CIRCLE NO. 31 ON READER SERVICE PAGE

POPULAR ELECTRONICS

PRODUCT SERVICE PAGE

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

1 Circle the number on the coupon below which corresponds to the key number at the bottom of the advertisement or is incorporated in the editorial mention that interests you.

2 Add up your total number of requests and fill in the box in the upper right-hand corner of the coupon.

3 Mail the coupon to the address indicated below.

4 Please use this address only for Product Service requests.

POPULAR ELECTRONICS

P. O. BOX 8391
PHILADELPHIA 1, PA.

NUMBER OF REQUESTS

Please send me additional information about the products whose code numbers I have circled

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

NAME *(Print clearly)* _____

ADDRESS _____

CITY _____ STATE _____ ZIP CODE _____

VOID AFTER JUNE 30, 1965

5

SOMEONE SHOULD DEVELOP AN EASY WAY TO LEARN ELECTRONICS AT HOME



RCA INSTITUTES DID!

Here is a whole new approach to learning electronics at home! RCA Institutes, one of the nations' largest schools devoted to electronics, has developed a faster, easier way for you to gain the skills and the knowledge you need for the career of your choice. Here for the first time, is a student-proved, scientifically designed way to learn. If you have had any doubts in the past about home training in electronics—if you have hesitated because you thought you might not be able to keep up—or that electronics was too complicated to learn—here is your answer! Read how RCA Institutes has revolutionized its entire home training ideas!



NEW CAREER PROGRAMS BEGIN WITH "AUTOTEXT" INSTRUCTION METHOD!

Start to learn the field of your choice immediately!

No previous training or experience in electronics needed!

With this new revolutionized method of home training you pick the career of your choice—and RCA Institutes trains you for it. RCA's Career Programs assure you that everything you learn will help you go directly to the field that you have chosen! No wasted time learning things you'll never use on the job! The Career Program you choose is especially designed to get you into that career in the fastest, easiest possible way!

And each Career Program starts with the amazing "AUTOTEXT" Programmed Instruction Method—the new, faster way to learn that's almost automatic! "AUTOTEXT" helps even those who have had trouble with conventional home training methods in the past. This is the "Space Age" way to learn everything you need to know with the least amount of time and effort.

CHOOSE A CAREER PROGRAM NOW

Your next stop may be the job of your choice. Each one of these RCA Institutes Career Programs is a complete unit. It contains the know-how you need to step into a profitable career. Here are the names of the programs and the kinds of jobs they train you for. Which one is for you?

Television Servicing. Prepares you for a career as a TV Technician/Serviceman; Master Antenna Systems Technician; TV Laboratory Technician; Educational TV Technician.

FCC License Preparation. For those who want to become TV Station Engineers, Communications Laboratory Technicians, or Field Engineers.

Automation Electronics. Gets you ready to be an Automation Electronics Technician; Manufacturer's Representative; Industrial Electronics Technician.

Automatic Controls. Prepares you to be an Automatic Controls Electronics Technician; Industrial Laboratory Technician; Maintenance Technician; Field Engineer.

Digital Techniques. For a career as a Digital Techniques Electronics Technician; Industrial Electronics Technician; Industrial Laboratory Technician.

Telecommunications. For a job as TV Station Engineer, Mobile Communications Technician, Marine Radio Technician.

Industrial Electronics. For jobs as Industrial Electronics Technicians; Field Engineers; Maintenance Technicians; Industrial Laboratory Technicians.

Nuclear Instrumentation. For those who want careers as Nuclear Instrumentation Electronics Technicians; Industrial Laboratory Technicians; Industrial Electronics Technicians.

Solid State Electronics. Become a specialist in the Semiconductor Field.

Electronics Drafting. Junior Draftsman, Junior Technical Illustrator; Parts Inspector; Design Draftsman Trainee Chartist.

SEPARATE COURSES

In addition, in order to meet specific needs, RCA Institutes offers a wide variety of separate courses which may be taken independently of the Career Programs, on all subjects from Electronics Fundamentals to Computer Programming. Complete information will be sent with your other materials.

LIBERAL TUITION PLAN

RCA offers you a unique Liberal Tuition Plan—your most economical way to learn. You pay for lessons only as you order them. No long term contracts. If you wish to stop your training for any reason, you may do so and not owe one cent until you resume the course.

VALUABLE EQUIPMENT

You receive valuable equipment to keep and use on the job—and you never have to take apart one piece to build another. **New—Programmed Electronics Breadboard.** You now will receive a scientifically programmed electronic bread-

board with your study material. This breadboard provides limitless experimentation with basic electrical and electronic circuits involving vacuum tubes and transistors and includes the construction of a working signal generator and superheterodyne AM Receiver.

Bonus From RCA—Multimeter and Oscilloscope Kits. At no additional cost, you will receive with every RCA Institutes Career Program the instruments and kit material you need to build a multimeter and oscilloscope. The inclusion of both these kits is an RCA extra.

CLASSROOM TRAINING ALSO AVAILABLE

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

FREE PLACEMENT SERVICE

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

SEND ATTACHED POSTAGE PAID CARD FOR COMPLETE INFORMATION, NO OBLIGATION. NO SALESMAN WILL CALL. FREE BOOK INCLUDED. CHECK HOME STUDY OR CLASSROOM TRAINING.

RCA INSTITUTES, Inc., Dept. PE-55
A Service of Radio Corporation of America
350 West 4th St., New York, N.Y. 10014



The Most Trusted Name in Electronics

Letters

(Continued from page 14)

Tubing for the "Sound Snooper"

■ Your readers may be interested to learn of another source of tubing for the long-range tubular mike ("Build the Shotgun Sound Snooper," June, 1964). I bought a used zigzag-type TV antenna made with 3/8"-o.d. aluminum tubing without a track. Such an antenna can be acquired for about \$2, and contains 10 feet more tubing than is needed for the project.

DAVID R. WILSON
Doran, Minn.

SSB Signals Throw SWL

■ I enjoy listening on the ham bands, but when the stations are working single sideband I can't get a clear signal despite the fact that the BFO is on. Why do hams operate SSB in the first place? It just garbles up the air waves for the listeners. Secondly, what can be done to my receiver—a Command set—to make it receive SSB?

JIM BELL
Frankfurt, Germany

Well, first off, Jim, SSB might garble up the air waves for the listener, but it sure makes it possible for a lot more amateur stations to get on the air without interfering with one another. The process of tuning in an SSB signal was described in our "Monthly Short-Wave Report," November, 1964. Tune the receiver until the SSB signal is as strong as possible, then slowly vary the BFO frequency until the speech becomes intelligible. (On Command sets BFO frequency can be changed by resetting a screwdriver-adjust ca-

pacitor through a hole in one side of the chassis.) After you've done this once, you should be able to tune in most SSB stations with the tuning control only.

Ham Band Booster?

■ Why not substitute 52-ohm balun coils for the 300-ohm coils used in the FM-TV Booster ("An Easily Built FM-TV Booster," November, 1964) and use it as a preamp for both the 6- and 2-meter ham bands? The 2-meter band falls between the VHF TV bands and the 6-meter band is just below channel 2, so I don't see why it wouldn't work.

BARRON BROWNSTEIN, WB2GXC
Riverdale, N.Y.

We don't see why it wouldn't work either, Barron, although we haven't tried it. One thing to keep in mind, though, is that the Booster is a broadband amplifier. For ham use, more selectivity would be highly desirable. For comparison, see "The 6-Meter 7 and 2 Pre-amp" in the August, 1964, issue.

-30-

Cores for Hi-Fi Color Organ

The manufacturer of the toroid coil core specified in the Parts List for the "Low-Cost Hi-Fi Color Organ" (March, 1965) advises that individual orders cannot be filled. For the convenience of our readers, P.E. will supply the cores (two are required) at 50 cents each, which includes postage and shipping. Write to Coil Cores, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016.

ALL NEW! Hy-Gain's ECONO-LINE

High Performance CB Antennas at Budget Prices!

Now, Hy-Gain superior electrical performance built into value-packed base station and mobile antennas for Citizens Band that are rated to survive winds of 80 mph or more! Optimum performance 3 and 5 element beams...a 1/2 wave omni-directional gain antenna...a Beta Matched 1/4 wave ground plane...an optimum performance top loaded roof or deck mount mobile whip...all constructed of quality materials and embracing many of the unique electrical and mechanical features found only in Hy-Gain's world famous, extra rugged standard line CB antennas. New Hy-Gain Econo-Line antennas...expressly designed to deliver uncompromising electrical performance for the CBER whose mechanical requirements can be adequately satisfied with 80 mph wind survival.



MODEL CB5 5-Element Beam

- Delivers 11.9db Forward Gain - 20db F/B Ratio
- Beta Matched
- Taper-Swaged Seamless Aluminum Construction
- Iridite Treated Hardware

\$39.95 Net



MODEL CB3 3-Element Beam

- Delivers 8db Forward Gain - 20db F/B Ratio
- Taper-Swaged Seamless Aluminum Construction
- Iridite Treated Hardware
- Rotates with Standard TV Rotator

\$19.95 Net



MODEL CBV 1/2 Wave Omni-Directional Gain Antenna

- Delivers up to 6db Omni-Directional Gain
- Entire Antenna at DC Ground for Low Noise Level
- Taper-Swaged Seamless Aluminum Construction
- Iridite Treated Hardware

\$19.95 Net

MODEL CBW Top Loaded Roof/Deck Mount Whip

- Unique Solid State Top Loading Coil
- 17-7 Stainless Steel Radiator
- Lifetime Adjustable Tuning Rod
- Weather-tight Mount

\$6.95
Net *

MODEL CBGP 1/4 Wave Ground Plane (Not Pictured)

- Beta Matched for Optimum Energy Transfer
- Taper-Swaged Seamless Aluminum Construction
- Iridite Treated Hardware

\$9.95 Net

Available now from your Hy-Gain Distributor
HY-GAIN ELECTRONICS CORPORATION

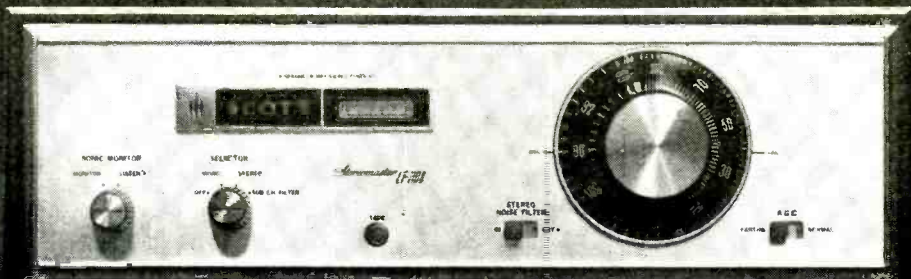
8497 N.E. Highway 6 - Lincoln, Nebraska 68501

CIRCLE NO. 12 ON READER SERVICE PAGE

SCOTT'S TOP RATED LT-110 FM STEREO TUNER KIT NOW AT A NEW LOW PRICE... \$139.95

"... 1.88 uv sensitivity by a home alignment procedure without instruments... an exceptional feat..."

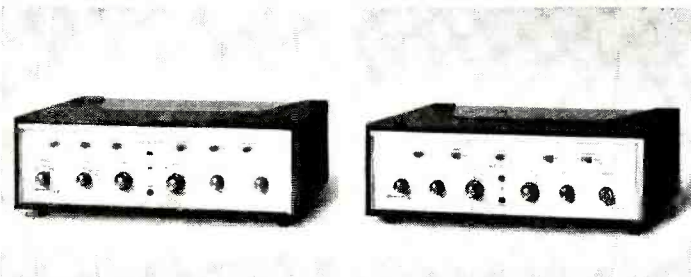
Electronics Illustrated



Here's terrific news for you kit builders! Now, the famous Scott LT-110 tuner kit... top rated by every audio expert... built by thousands of hi fi enthusiasts... is available in handsome styling at a truly modest price.

Look at the outstanding features of this superbly engineered tuner. It includes a heavily silver plated front end... prewired and tested in Scott's engineering laboratories. The critical multiplex section is also pre-wired and tested with the most advanced multiplex equipment available. Among the LT-110B's many extras: Stereo Separation in excess of 30 db, Sonic Monitor stereo indicator, 60 db Signal-to-Noise ratio, sensitive tuning meter.

Here's what the technical editor of *Electronics Illustrated* said about the LT-110: "If you have hesitated to go into stereo FM because of imagined complexities and highly technical skills... a knowledge that might be required, fear no more. The LT-110 shows you how to enjoy stereo the easy way."



LK-72B 80-Watt Stereo Amplifier Kit. This popular amplifier kit delivers enough power to drive any speaker system, and at an outstanding price. Complete range of control features includes switched front panel headphone output, complete recording facilities, and provision for driving a third or center channel loud-speaker system without additional amplification. Only \$149.95.

LK-48B 48-Watt Complete Stereo Amplifier Kit. Here's more than enough power for most music systems, and two great new features: Switched front panel headphone output for private listening, and powered center channel output to drive extension speakers. 13 front panel controls. Complete tape facilities. Includes all-aluminum chassis and DC-operated heaters for lowest hum. Only \$129.95.

IMPORTANT FREE OFFER FROM SCOTT



Please send me your new 20-page full-color 1965 Stereo Guide and complete catalog. Include complete information on new consoles by Scott... component quality in beautiful, hand-finished cabinets.

Name
Address
City Zone State



H. H. SCOTT, INC. 520-05
111 Powdermill Road, Maynard, Mass.

Export: Scott International, 111 Powdermill Road, Maynard, Mass. Canada: Atlas Radio Corp., 50 Wingold Ave., Toronto, Canada
Price slightly higher West of Rockies. Subject to change without notice.

CIRCLE NO. 29 ON READER SERVICE PAGE

May, 1965

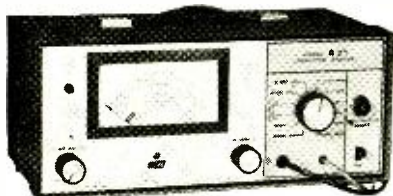


New Products

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

IN-CIRCUIT CAPACITOR TESTER

All capacitor defects that affect the performance of TV, radio, hi-fi, and other electronic equipment can be picked up by the Model 801 in-circuit "Capacitor Analyst," according to the *B & K Manufacturing Co.* The 801 tests electrolytic capacitors up to 2000 μ f.; it detects marginal electrolytics that should be replaced, and predicts the life ex-



pectancy of any electrolytic rated at 3 volts or more. Capacitor value can be measured accurately within a range of 25 pf. to 100 μ f., and a unique in-circuit leakage test can be made on low-voltage circuits, such as transistor radios, or on higher voltage circuits.

Circle No. 75 on Reader Service Page 15

PORTABLE COMPONENT MUSIC SYSTEM

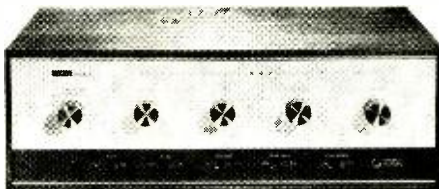
What looks like a set of airplane luggage but is really a portable stereo music system? The "Entertainer I," recently introduced by *Electro-Voice, Inc.*, was designed to provide all the advantages of component high-fidelity stereo in compact, handle-equipped cases. "Entertainer I" features two true component speaker systems; each module incorporates an 8-inch, wide-range, coaxial driver housed in a molded acoustical enclosure. The unit's amplifier, entirely solid-state, provides 30 watts of very low distortion power, 15 watts per channel, IHF. The completely automatic turntable will play all four standard speeds and will intermix 7", 10", and 12" records. In addition, the high-compliance, ultralinear,

ceramic stereo cartridge provided includes a diamond turnover stylus which is guaranteed for the life of the system.

Circle No. 76 on Reader Service Page 15

INTEGRATED STEREO AMPLIFIER

Harman-Kardon's Model SA-2000 solid-state integrated stereo amplifier provides 36 watts IHF music power output (18 watts per channel). Because the SA-2000 utilizes no output transformer, according to the manufacturer, it is able to reproduce all frequencies from



8 to 25,000 cycles, with a flat response within ± 1 db at normal listening levels (1 watt). At full rated power, the unit reproduces 10 to 23,000 cycles with a flatness of ± 1 db. The damping factor is 25:1. Square-wave rise time is only 5 microseconds; harmonic distortion, less than 1%; hum and noise suppression, at least 90 db.

Circle No. 77 on Reader Service Page 15

LOW-COST "VOICE-MATIC" RECORDER DEVICE

"Hands-free" voice-actuated tape recording is now possible at low cost. With the new *Kinematic KX-5000* "Voice-matic," your tape recorder will automatically start recording



when you speak and stop when you stop. The sensitive self-contained microphone will pick up voice or other triggering sounds from a distance. Sensitivity is adjustable to compensate for different noise level conditions, and a "pause" control prevents the unit from turning on unnecessarily. There are many other applications for the "Voice-matic" as indicated by

the accessories available: a.c. accessory cord, audio adapter, contact pickup, magnetic phone pickup, phone-actuated switch, remote start-stop cable, and high-current relay. It will also enable you to find out if you talk in your sleep!

Circle No. 78 on Reader Service Page 15

VHF/FM CAR RADIO CONVERTER

You can listen to VHF/FM mobile communications on your car radio at the flick of a switch if you install the Model RCH-1 r.f. converter under your dashboard. Announced by the *Hartman Marine Electronics Corpora-*

What most people don't know about hi-fi kits could fill a book.

This one. (And it's free!)



FREE! \$1.50 VALUE! 32 PAGES! *The New Kit Builder's Manual* is a completely new version of the authoritative Fisher guide to high-fidelity kit construction. It is new in format, twice as long in content, and contains detailed specifications of all Fisher StrataKits. Here is an introduction to kit building presented in a manner so nontechnical and lucid, even your wife will understand it. Included are comprehensive, illustrated articles on every phase of assembly, wiring and soldering. *The New Kit Builder's Manual* is the handiest tool a do-it-yourself audiophile can have; the first thing you need before investing in stereo amplifier, tuner or loudspeaker kits.

Mail this coupon today for your *free* copy of *The New Kit Builder's Manual!*

Fisher Radio Corporation 105
21-40 44th Drive, Long Island City, N.Y. 11101

Please send me *The New Kit Builder's Manual* without charge or obligation.

Name _____

Address _____

City _____

State _____

OVERSEAS RESIDENTS PLEASE WRITE TO FISHER RADIO INTERNATIONAL, INC., LONG ISLAND CITY, N. Y. 11101.
CANADIAN RESIDENTS WRITE TO TRI-TEL ASSOCIATES, LTD., WILLOWDALE, ONT.

The Fisher

CIRCLE NO. 8 ON READER SERVICE PAGE

New Products

(Continued from page 22)

tion, the RCH-1 converts any standard tube, hybrid, or transistor radio into a sensitive dual-conversion superheterodyne receiver. It enables you to monitor both AM and FM signals, and listen to any single frequency in the 108-174 mc. band, or tune through any 1-mc. portion of this VHF band. The transistorized RCH-1 has a self-contained battery, and can be installed in minutes.

Circle No. 79 on Reader Service Page 15

DRAFTING SYMBOL SET

The latest thing in dry transfer marking sets is *Datapak's* "Electronic Drafting Symbol Set," which features a special heatproof adhesive and includes all common schematic symbols, letters, and numerals according to MIL-STD-15-1A. Schematics made with this set are said to be so crisp that they appear to have been inked and then photographically reduced. The set contains 40 5" x 7" sheets, and refills assorted to order are available.

Circle No. 80 on Reader Service Page 15

R/C GARAGE DOOR OPENER

Are you tired of bending down to open that balky garage door, and getting out of the car to close it? The *EICO* 4000 "Doormatic" garage door opener system will do it for you—and more. The system consists of a



door opener mechanism, radio control receiver, manual push-button wall switch, mounting hardware and a small transistorized portable R/C transmitter. The door can be opened or

closed from inside the garage by operating the wall-mounted push button. It can also be opened or closed from outside the garage or inside a nearby vehicle by pushing the button on the tiny, battery-operated transmitter. As an added attraction, whenever the control mechanism starts to open the garage door, a lamp is lighted inside the garage.

Circle No. 81 on Reader Service Page 15

ELECTRONIC "BUILDING BLOCKS"

Only a simple screwdriver is needed to assemble a line of electronic "building blocks" being manufactured by the *International Rectifier Corporation*; no soldering or technical ability is involved. This new concept in do-it-yourself electronics is called "IRlectronics." Every component part is a com-

pletely preassembled module, called an "IRect-o-pak," which has many uses. You can begin with one of the less expensive projects (they start at \$4.95), and develop other projects by acquiring additional modules. Up to 20 different systems for home, boating, outdoor and automotive use can be put together—such as an electronic babysitter, loud hailer, photoflash slave, walkie-talkie, guitar amplifier . . . and a transistorized ignition system!

Circle No. 82 on Reader Service Page 15

MINIATURE CERAMIC CARTRIDGES

From end to end, a "Micro-Ceramic" cartridge measures exactly one inch; it weighs just one gram. The "Micro-Ceramic" series is a new line of miniature stereo cartridges



designed by *Sonotone Corporation* for low-mass, lightweight tone arms, and for updating standard two-hole,

boss-mounting type arms. Four different models are available in a variety of mounting assemblies. The delicate yet rugged units are said to offer good response over the entire audio range, high compliance, light tracking force, and sharp separation.

Circle No. 83 on Reader Service Page 15

MINIATURE D.C.-TO-D.C. CONVERTER

Need a 12-25 watt, 117-volt d.c. supply for your electric shaver or other a.c./d.c. devices which can operate from a 12-volt d.c. supply? Try a *Sydmur* "Whirlaway" plugged into your cigarette lighter. A miniature transistorized d.c.-to-d.c. converter, the "Whirlaway" is short-circuit-proof. Fully encapsulated, it can be mounted under the dashboard in your car so that the output socket faces to the front.

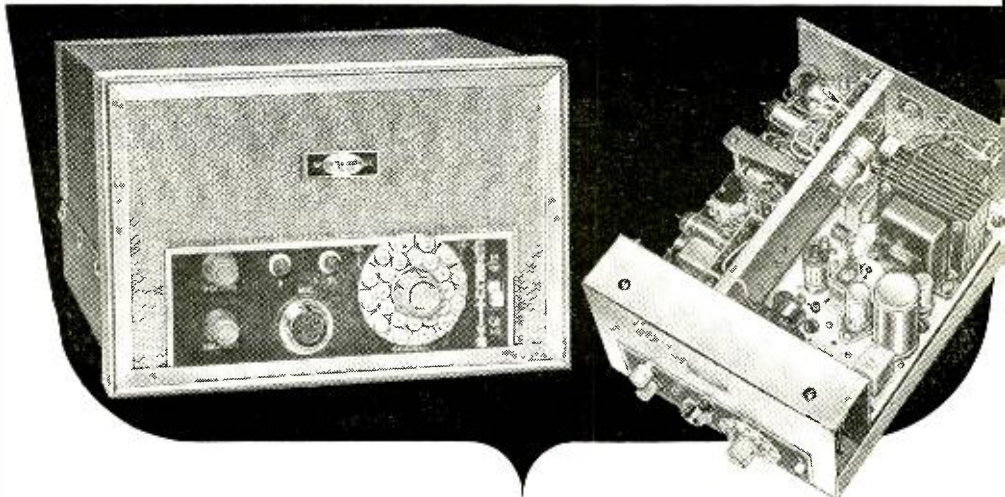
Circle No. 84 on Reader Service Page 15

ALL-TRANSISTOR HI-FI AMPLIFIER

Available both assembled and as a kit, the *Schober Organ* TR-2 power amplifier can be used with hi-fi and stereo systems, with organs and other electronic musical instruments, and with p.a. systems. Although two TR-2's are necessary for stereo applications, their performance is said to be superior to a single "stereo amplifier." Advantages of the TR-2 over tube-type amplifiers include better sound quality, greater reliability, instant turn-on, practically no heat generation, and high sensitivity. The TR-2 contains no selector switches or preamplifiers for phono pickups, etc., and serves solely as a power amplifier. If you want to build the kit, it can be done in 5 to 10 hours; printed-circuit construction and step-by-step instructions make it easy.

Circle No. 85 on Reader Service Page 15

NEW FOR '65

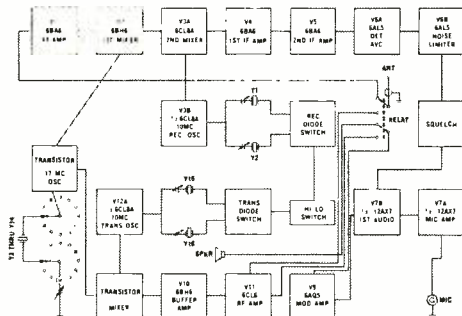


INTERNATIONAL MODEL 440 CITIZENS RADIO TRANSCEIVER

The Model 440 introduces a distinctive new panel and engineering concept to the line of International Citizens Radio transceivers. Designed for base or mobile use, the Model 440 is packed with outstanding performance features. The most discriminating CB operator will acclaim its dependable day after day operation. Silicon transistors and tubes are combined in a new hybrid circuit for optimum performance. The International Model 440 operates from 6/12 and 115 vac power sources. Complete with crystals, dynamic microphone with coil cord.

- New Hybrid Circuits Combining Silicon Transistors And Tubes
- New Zener Speech Limiter
- Distinctive New Panel Design
- Frequency Synthesized Crystal Controlled 23 Channel Operation
- Transistor Power Supply
- Dual Conversion Receiver
- Illuminated Channel Selector Dial
- Ideal For Mobile Or Base Installations
- Ten Tubes
- Five Silicon Transistors
- Two Power Transistors
- Eleven Silicon Diodes

WRITE TODAY FOR THE NAME OF YOUR NEAREST INTERNATIONAL DEALER.



FCC Citizens Radio license required. All use must conform with Part 95, FCC Rules and Regulations.

CIRCLE NO. 13 ON READER SERVICE PAGE

NOW SHOWING

ADMISSION FREE
in

1965 EICO CATALOG

FEATURING

WORLD'S ONE AND ONLY

SSB/AM/CW Tri-Band Transceiver
in Kit and Wired Form -less than
\$180.00

THE ULTIMATE IN SOLID STATE RELIABILITY

All Transistor FM/MPX/Stereo
Tuner/Amplifier Combination—
performance equal to \$470 units—
for less than \$230

A UNIQUE COMBINATION OF TWO TESTERS

Farad0hm 965 Bridge/Analyzer
equals \$400 of equipment for only
\$129.95

MASTER OF COMPACTNESS

435 D-C (DC - 4.5 mc) 3" Scope
outperforming bulkier 5" Scopes

ALSO STARRING

779 'Sentinel-23' CB transceiver — 342
Multiplex Generator — 380 Solid State
Color Dot/Bar Generator and a cast
of over two hundred items.

Produced by the award winning company:



EICO ELECTRONIC INSTRUMENT CO., INC.

SEND COUPON FOR YOUR FREE CATALOG TODAY



EICO Electronic Instrument Co., Inc.
131-01 39th Ave Flushing, New York 11352

Name

Address

City

State Zip



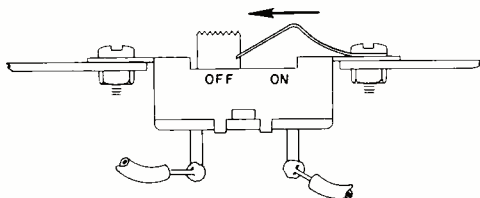
CIRCLE NO. 33 ON READER SERVICE PAGE



Tips and Techniques

ERSATZ PRESS-TO- DO-SOMETHING SWITCH

The next time you are stuck for a press-to-do-something/release-to-do-something-else type of switch, and all you have is a slide switch, fashion a small piece of springy metal into a "V" shape, drill a hole in it to accommodate the machine screw on the



appropriate side of the slide switch, and mount it as shown. Cut or file a small notch in the slide handle to keep the spring in place. A normally open or normally closed switch can be improvised as required.

—A. Rosenblum

DRILL BIT SERVES AS COUNTERSINK AND DEBURRING TOOL

Screw heads that are properly seated stay put longer and look better. Flat-head screws should be countersunk and round-head screws should not have to ride on burrs. A 3/8" or 1/2" drill bit can be hand-driven to dress most materials such as wood, plastic, aluminum, and soft iron. To get lots of leverage, use a king-size knob equipped with one or two setscrews. A protective length of spaghetti slipped over the bit will prevent you from being nicked.

—Donald E. Lancaster



PLASTIC DRAIN TRAYS IDEAL FOR PROJECT BREADBOARDING

Plastic cutlery drainage trays stolen from the kitchen make breadboarding experi-

BUILD YOUR OWN RADIO

CIRCUITS AT HOME \$6.95 only

PROGRESSIVE RADIO "EDU-KIT"® A Practical Home Radio Course



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 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 low price you pay. The Signal Tracer alone is worth more than the price of the kit.

THE KIT FOR EVERYONE

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

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

PROGRESSIVE TEACHING METHOD

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

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

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

THE "EDU-KIT" IS COMPLETE

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

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

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 FROM AD—RECEIVE FREE BONUS RADIO & TV PARTS JACKPOT WORTH \$15

- 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.

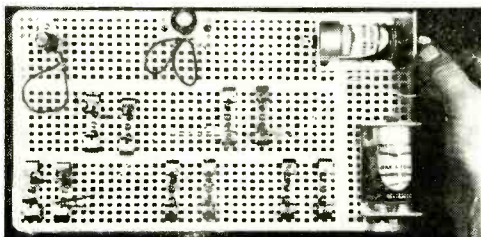
ATTN: S. GOODMAN, M.S. in ED., PRES. J.
1186 Broadway, Dept. 640D, Hewlett, N. Y.

CIRCLE NO. 25 ON READER SERVICE PAGE

Tips

(Continued from page 26)

mental circuits easier and quicker. The holes will accommodate all the nuts and bolts and other hardware you need. Hook-up wire can be conveniently threaded through the holes and run on both sides of the tray. You can easily cut larger holes for controls and tube sockets with a pocket

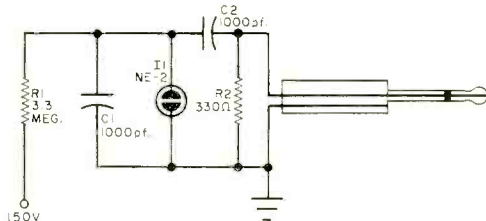


knife. The sides of the tray are deep enough to provide sufficient clearance for many components. —Margie V. Erickson

SIMPLE GDO MODULATOR FITS INTO PHONE PLUG

Do you need a modulator for your grid dipper? The circuit below is that of a simple

neon lamp oscillator with an output from 200 to 1000 cycles. Resistor $R1$ can be increased or decreased to compensate for any variation in B-plus. Coupling is accomplished through $C2$, whose reactance is negligible at these frequencies. Resistor $R2$



controls the amount of modulation, and can be adjusted to give a pleasant sound. (A 1000-ohm potentiometer could be used instead of a fixed resistor.) The entire circuit can be built into a PL-55 phone plug. A suitable socket should be mounted on the front or rear of the GDO case and connected to a convenient B-plus point on the GDO power supply. The B-plus lead from the modulator can then be conveniently connected. If the PL-55 won't fit into your GDO, mount a suitable plug on any small container—such as a 35-mm. film container—that will hold the modulator parts.

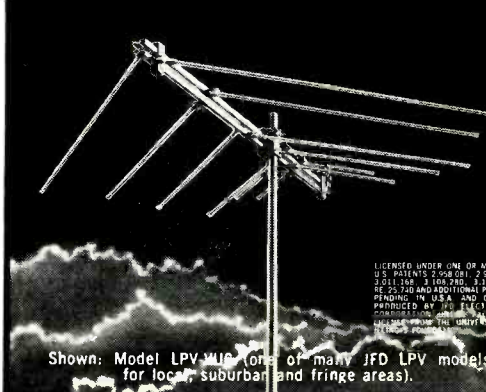
—David W. Beatty, K7MNC

Don't be 1/2 set

BE ALL SET!

Enjoy All Channels 2 to 83 (FM, Too)

JFD LPV[®] LOG-PERIODIC TV/FM ANTENNA



Shown: Model LPV-VHF (one of many JFD LPV models for local, suburban and fringe areas).

The JFD LPV Log Periodic Helps Your TV Get Sharp, Brilliant Pictures—COLOR & Black/White

$$\frac{L(n+1)}{L_n} = \tau$$



The LPV follows the new log periodic formula developed for space telemetry by the famous Antenna Research Laboratories of the University of Illinois. The LPV also features new capacitor-coupled dipoles that work electronically for full picture power on all 82 VHF & UHF channels. No other antenna employs this revolutionary new patented TV antenna design.

Own a new UHF/VHF 82-channel TV receiver? Converting your present TV for 82-channel performance? Don't be 1/2 set—be all set to receive all channels 2 to 83, in brilliant COLOR, and black and white plus FM stereo. Install the new TV antenna discovery, the JFD LPV Log Periodic and watch your picture come alive with crisp detail, rich contrast—not on some channels but all channels—near and far. The reason? All antenna elements (not just some as in other antennas) respond for maximum picture on every channel—because of the JFD LPV's space-age log periodic design. SEE YOUR LOCAL JFD LPV DEALER TODAY!

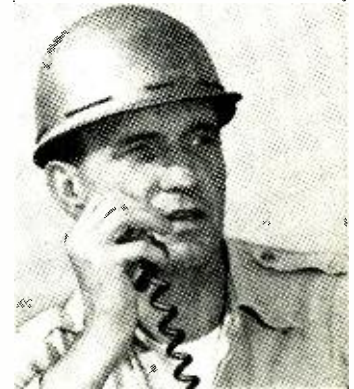
World's largest manufacturer of TV & FM antennas
JFD ELECTRONICS CORPORATION
1462A - 62 Street, Brooklyn, N. Y. 11219

CIRCLE NO. 40 ON READER SERVICE PAGE

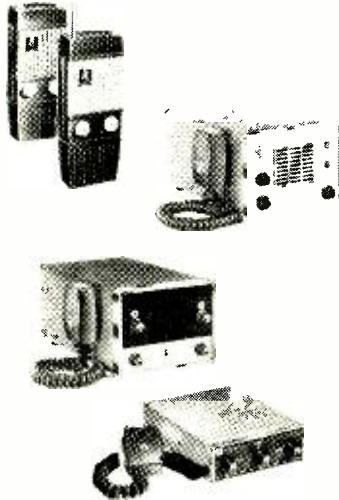
any*

Yes, in any CB application...you'll outperform 'em all with a

MESSENGER®



Your own 2-way radio for Business or Personal use!



"PERSONAL MESSENGERS"—Compact, hand-held 100 milliwatt or 1½ watt units! Rugged and reliable—11 transistors, 4 diodes. Twice the sensitivity and 40% more range than similar units with conventional circuitry—more output than similar units with same rated inputs!

Cat. No. 242-101..... 100 Milliwatts..... **\$109.50 Net**
 Cat. No. 242-102..... 1½ Watts..... **\$129.50 Net**

"MESSENGER" AND "MESSENGER TWO"—For mobile or base stations. High efficiency design makes full use of maximum allowable legal power. Excellent receiver sensitivity and selectivity. Automatic "squelch" control. 5 crystal controlled channels on the "Messenger" and 10 crystal controlled channels plus tunable receiver on the "Messenger Two".

"MESSENGER"		"MESSENGER TWO"	
Cat. No. 242-127	Cat. No. 242-162	Cat. No. 242-162	Cat. No. 242-163
115 VAC/6 VDC..... \$114.95 Net	115 VAC/6 VDC..... \$169.95 Net	115 VAC/6 VDC..... \$169.95 Net	115 VAC/12 VDC..... \$169.95 Net
Cat. No. 242-128	Cat. No. 242-163		
115 VAC/12 VDC..... \$114.95 Net	115 VAC/12 VDC..... \$169.95 Net		

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

Cat. No. 242-150..... 12 Volts DC Messenger III..... **\$189.95 Net**
 Cat. No. 250-823..... 117 Volt AC Power Supply..... **\$ 29.95 Net**

The nation's most popular
 Citizens Radio equipment line!

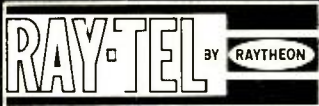
*Rated BEST by Distributor
 Salesmen in National Survey!



E. F. JOHNSON COMPANY
 2425 TENTH AVE. S.W. • WASECA, MINNESOTA

WRITE TODAY for full color brochure, or see your Dealer/Distributor and ask for a demonstration!

CIRCLE NO. 15 ON READER SERVICE PAGE



TWR-7

GREAT NEW CITIZENS BAND RADIO



Advanced solid-state technology... all planar silicon transistors... slim-line styling permits easy mounting in any car. TWR-7 is the economical answer to highway emergency radio for every motorist.

\$129⁹⁵

HIGHLIGHTS: 5-channels • 5-watts power input • Usable for Public Address • Zener diode regulated • RF output and modulation indicator light • Two-stage noise limiter • Exceptionally low standby current drain • Size: 1½" high, 6¼" wide, 7½" deep.

RAY-TEL 213 E. Grand Ave., So. San Francisco, Calif.

Please send full information on TWR-7. C-B radio.

Name _____			
Number _____		Street _____	
City _____		State _____	Zip code _____

CIRCLE NO. 38 ON READER SERVICE PAGE



POP'tronics Bookshelf

2-WAY MOBILE RADIO HANDBOOK

by Jack Helmi

The use of two-way mobile radio by utilities, police and fire departments, doctors, private individuals, and businesses of all sorts has enjoyed a phenomenal growth in the twenty years since W.W. II. As a corollary to this growth, there has been a steadily increasing demand for individuals qualified to sell and service two-way equipment. To keep the record straight, this is *not* a book about Citizens Band radio. It is a text for those interested in selling, servicing, or setting up "professional" two-way systems in the 30-50 mc. band, the 152-174 mc. VHF band, or the 450-470 mc. UHF band. While the units of different manufacturers vary considerably in detail, attention to the typical circuits illustrated and described in the book will give the newcomer to the mobile radio field a good idea of the current state of the art. Chapter subjects include basic systems, receivers, transmitters, control systems, antennas, power supplies, servicing, setting up a shop, and common carrier service.

Published by Howard W. Sams & Co., Inc., 4300 West 62 St., Indianapolis 6, Ind. Soft cover. 223 pages. \$3.95.



FUNDAMENTALS OF TELEVISION

by Walter H. Buchsbaum

Walter H. Buchsbaum, the author of scores of feature articles for our sister publication, *ELECTRONICS WORLD*, has written an appealing book on TV servicing. He obviously believes that it is desirable to know how a circuit works and what part it plays in a TV set before any servicing is attempted. With this thought in mind, he has assembled a book devoid of mathematics, overly complex diagrams, and many of the "trick" circuits that confuse the

POPULAR ELECTRONICS

The price tag went on last



KLH Model Seventeen

The quality went in first. The kind of quality you can hear. Quality in the Seventeen's smooth, flawless response. Quality that gives the Seventeen the lowest harmonic distortion in the bass of any speaker in its price range. KLH quality in a handsome new oiled walnut enclosure. In the ingenious grillecloth that can be changed in a snap.

And while the quality was going in, the waste was coming out. All the waste that inflates the cost of speakers. The waste of rejects and varying quality in stock components from outside suppliers. (KLH builds, tests, and rigidly controls the quality of every component that affects the musical performance of a speaker.) The waste of obsolete design and engineering. Of inefficient and outdated manufacturing techniques. Of gingerbread 'features' that add nothing to musical performance.

When we finally had a speaker that was all quality and no waste, we put the price tag on. And you won't find a trace of puff in the price.

This is the Model Seventeen. A speaker that brings a whole new level of sound quality — a new distinction to speakers costing under \$100.

But no description can tell you how the Seventeen sounds. You've got to hear it. Only then will you be able to understand what an unusual achievement the Seventeen is in high performance at low cost. See the Seventeen at your KLH dealer now. Listen to it. Then look at the price tag. We think you'll agree that nothing touches the Seventeen for honest sound at an honest price.

**Suggested retail for eastern U.S. Slightly higher in the West.*



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

CIRCLE NO. 16 ON READER SERVICE PAGE

Thinking of college and a space age career in electronics?



Send for this booklet on ENGINEERING TECHNOLOGY AND ENGINEERING

Learn how you can prepare for a dynamic career as an electrical or mechanical engineering technician or engineer in such exciting, growing fields as **avionics, missiles, reliability control, fluid mechanics, data processing, metallurgy, microelectronics, and advanced aerospace research.**

MSOE offers residence study programs leading to these degrees in engineering technology and engineering:

- 2 years — Associate in Applied Science
- 4 years — Bachelor of Science

Also get facts about scholarships and financial aids, job placement and other student services, plus photographs of MSOE technical laboratories and student activities. For your copy, just mail the coupon — no obligation.

MSOE

Milwaukee School of Engineering

Milwaukee School of Engineering
Dept. PE-565 1025 N. Milwaukee Street
Milwaukee, Wisconsin 53201

Please send the "Your Career" booklet. I'm interested in

- Electrical fields Mechanical fields

Name Age.....

Address.....

City..... State..... ZIP.....

MS-227

CIRCLE NO. 20 ON READER SERVICE PAGE

Bookshelf

(Continued from page 30)

newcomer. The term "fundamentals" in the title is used in its true-blue sense. Step by step, Buchsbaum takes the reader through typical TV receivers, pointing out why the circuit is there, what it does, and what might possibly go wrong.

Published by John F. Rider Publisher, Inc., 116 West 17 St., New York, N.Y. 10011, 292 pages, Hard cover, \$9.95.



TV RECEIVER TUBE USAGE GUIDE

This little book should prove to be a real time-saver for the TV serviceman—nothing can be quite as aggravating when making a house call as discovering that one or more critical tubes needed to make a repair is missing from the caddy. Divided into three sections, the volume includes a complete index of all TV models and chassis covered in the text; complete information regarding the types of tubes, semiconductor devices and fuses used in each individual set; and a tube-usage section listing each tube type employed in the receivers.

Published by Howard W. Sams & Co., Inc., 4300 West 62 St., Indianapolis 6, Ind. Soft cover, 96 pages, \$1.95.

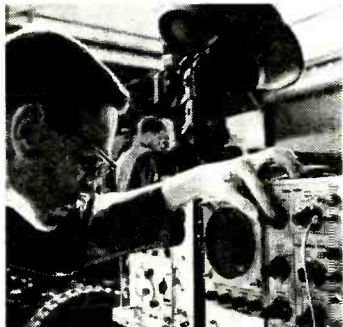
New Literature

Over 100 new products are featured in Edmund Scientific Company's latest catalog, No. 651, in addition to their regular line of more than 4000 low-cost scientific, educational, optical, surplus, and hobby items. A special feature is the introduction of Moiré Patterns, the new science which can be used to speed mathematical training and solve complex problems by making complex computations visual. Write to Edmund Scientific Co., Dept. AV, 104 E. Gloucester Pike, Barrington, N.J. 08007 for your free copy. . . . A new 16-page, 4-color catalog is also available for the asking from the Turner Microphone Company, 909 17th St., N.E., Cedar Rapids, Iowa 52402. Their complete line of microphones for CB, broadcasting, professional and home recording, etc., is covered . . . The problems of sound reinforcement resulting from recent changes made in the Catholic church liturgy—and their solutions—are discussed in a booklet entitled "Sound Reinforcement and the New Liturgy" which has been published by Electro-Voice, Inc., Buchanan, Mich. —50—

Share great moments with other great guys



Get a new set of wheels in the Army. Ten feet across or scooter size, there are more wheels in the Army than in any other organization in the Free World. Some are an adventure to drive, others take you to adventure—and, if you want, you can learn what makes each one roll.



Experts are made, not born. And the Army makes the best. Army schools teach hundreds of different specialties. If you qualify, you can sign up for the one you want before you enlist.

It's different from your home town. And who wouldn't expect it to be? After all, one of the reasons you join the Army is to see the world of differences.



You're not alone in today's action Army.

Every experience you have is shared with other great guys. Regular guys who are learning, earning, growing, going, serving our Country, developing themselves. Just as you are.

But the wonder of these experiences is yours alone. No one can tell you how great it feels to master a difficult specialty like computer programming, missile repair, electronics, or construction. No one can live the excitement of landing in a foreign country for you. No one can know what *your* great moments in the Army will be. But you can be sure your life in today's Army will be full of great moments. Enough to add up to a great life.

Talk to your local Army recruiter. Let him tell you what the Army can do for you... and what you can do for the Army. Let him help you to that great moment, the moment you realize that...if you're good enough to get in, a proud future can be yours in today's *action*

Army

CIRCLE NO. 46 ON READER SERVICE PAGE

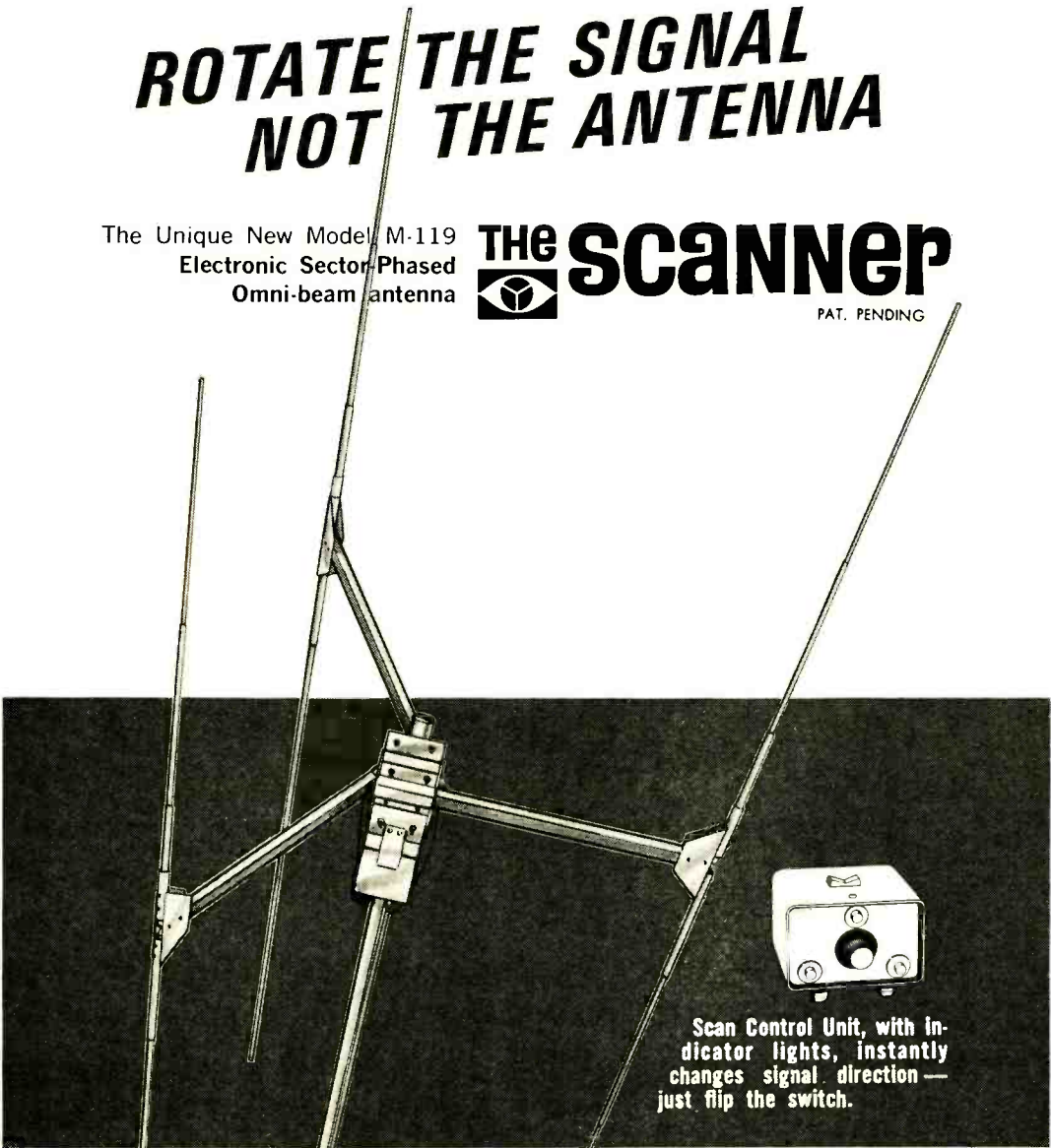
REVOLUTION IN CB BASE ANTENNAS

ROTATE THE SIGNAL NOT THE ANTENNA

The Unique New Model M-119
Electronic Sector Phased
Omni-beam antenna

THE Scanner

PAT. PENDING



Scan Control Unit, with indicator lights, instantly changes signal direction — just flip the switch.

Write for complete data, including radiation patterns.



the antenna specialists co.

12435 Euclid Ave., Cleveland, Ohio 44106
64-14 Woodside Ave. Woodside 77, N.Y.

Export Div.:

Stripes of Quality



CIRCLE NO. 1 ON READER SERVICE PAGE

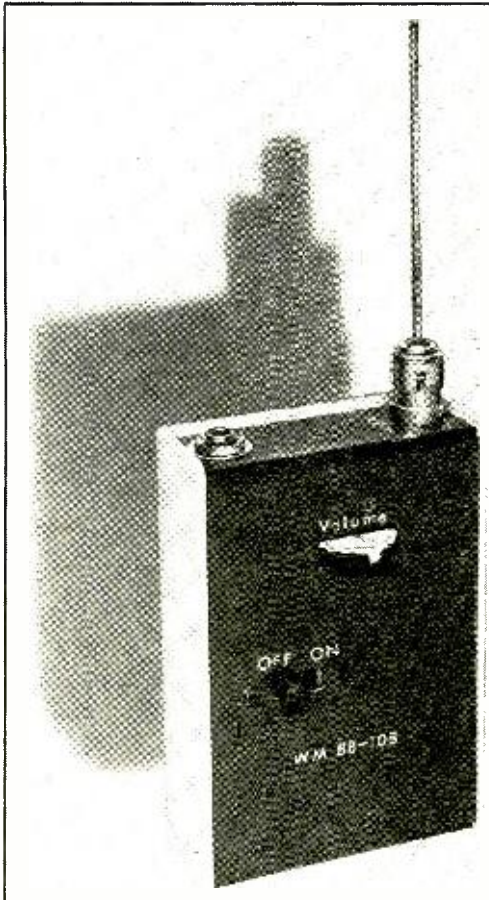
May P. Elec.—No. 2

COVER STORY

FM WIRELESS MICROPHONE

**You can broadcast
voice or music
with this pocket-size
combination microphone and
transistor transmitter**

By DANIEL MEYER

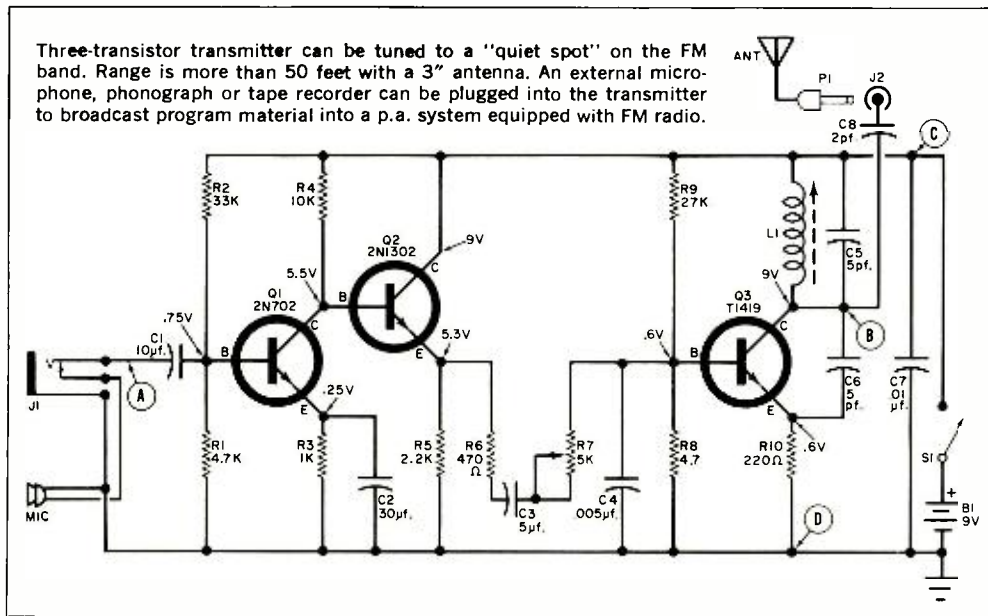


HAVE you ever gotten tangled up in your microphone cord while using a public address system, or needed a portable listening system for baby-sitting or telephone monitoring? If you have, you can readily appreciate the usefulness of a wireless microphone system. Here's one that will work with your FM tuner or radio. With the FM Wireless Microphone, you can convert your p.a. system to enable you to walk about freely as you use it—just add an FM tuner to your p.a. system if it doesn't already have one.

The FM Wireless Microphone is actually a small FM transmitter that can be tuned to a vacant spot on your FM radio. In the FM frequency range, only a small antenna is needed to radiate a usable signal throughout a building. FCC regulations permit the use of such devices as long as their output does not cause harmful interference to licensed services. The entire unit including battery is no larger than a pack of king-size cigarettes. Its range is 50 to 100 feet with a 3" antenna. (The range can be increased by using a longer antenna.)

A printed circuit board and prefabricated case are available to enable you to build a unit identical to the model shown here. An external microphone jack permits use of program material from a remotely located AM radio, record player, tape recorder, etc.

Three-transistor transmitter can be tuned to a "quiet spot" on the FM band. Range is more than 50 feet with a 3" antenna. An external microphone, phonograph or tape recorder can be plugged into the transmitter to broadcast program material into a p.a. system equipped with FM radio.



How It Works. Transistor *Q1* is used as a common emitter amplifier to amplify the output of the microphone. Transistor *Q2* is used as an emitter follower and serves to match the rather high impedance of *Q1*'s collector circuit to the low impedance of *Q3*'s base. Potentiometer *R7* controls the amount of signal fed to the base of *Q3*, and capacitor *C4* bypasses to ground any r.f. present at *Q3*'s base. Transistor *Q3* oscillates at the signal frequency which is determined by tuned circuit *L1*, *C5*, *C6* and the inter-electrode capacitance of the transistor. Capacitor *C6* provides the needed positive feedback from the collector to the emitter for the circuit to oscillate.

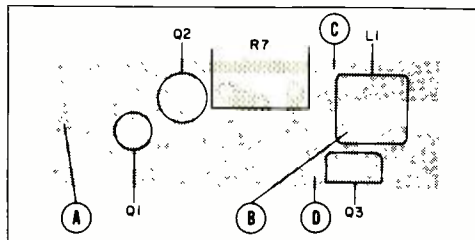
The audio signals applied to the base of *Q3* cause the collector current to vary at an audio rate and modulate the oscillator output. This type of modulation produces both AM and FM, but AM is rejected by the discriminator and limiters in the FM receiver and causes no problem. The collector current variations in turn vary the transistor's output capacitance. This capacitance is part of the tuned circuit and varies the frequency of the output signal which is coupled to the antenna by *C8*.

Construction. First "finish" the aluminum case front in whatever color and with any type of paint you wish in order not to get paint onto the switches and

microphone. Spray-type enamel does a nice job. The case front should be cleaned with a household cleaner. The back of the case is a vinyl plastic extrusion. The cut ends can be smoothed and rounded off with sandpaper.

After the case front has dried, mount the microphone, external microphone jack, antenna jack, switch, and threaded spacer. (The small internal microphone can be omitted if you intend to use only an external microphone or a program source.) The microphone is mounted with epoxy cement. Use a fine grade of sandpaper to rough up the surfaces to be cemented, and avoid getting cement into the case and microphone openings.

The threaded spacer, a ground lug and one side of the switch is held in place with a 4-40 x 1/2" machine screw. There should be enough clearance for a 4-40



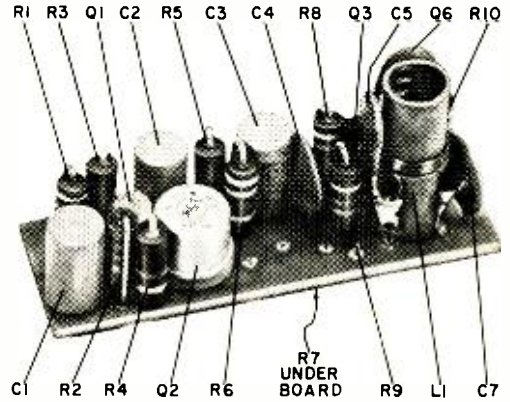
If you want to make your own printed circuit board, copy this actual-size photograph of the foil side.

nut between the spacer and the case back. This 4-40 nut keeps a 4-40 x 1/4" machine screw on the back of the case from getting lost. The screw fastens the back to the threaded spacer when the job is done, and should not be held tightly in place by the nut; it must be allowed to turn freely.

Wire the jacks, the switch and battery clip next; glue a piece of 1/8"-thick foam plastic pad in place to cushion the battery. Then mount the parts on the printed circuit board as shown, making sure to observe polarity of the electrolytic capacitors. Mount C5 and C6 on the lugs of the coil form.

The transistor specified for Q1 was used because it was available at a low price from surplus. Almost any npn transistor mounted in the same size can (TO-18) may be substituted. A 2N706 would work well. The epoxy case transistor units made by GE and TI, such as the TI419 used for Q3, will also work if the leads are bent to fit the proper holes.

After all the other parts are mounted and soldered, install the volume control (R7) on the bottom of the circuit board. To prepare the control for mounting, bend the two outside control leads on the control over the edge of the control's phenolic base; bend the center lead in the same direction, and trim all leads to



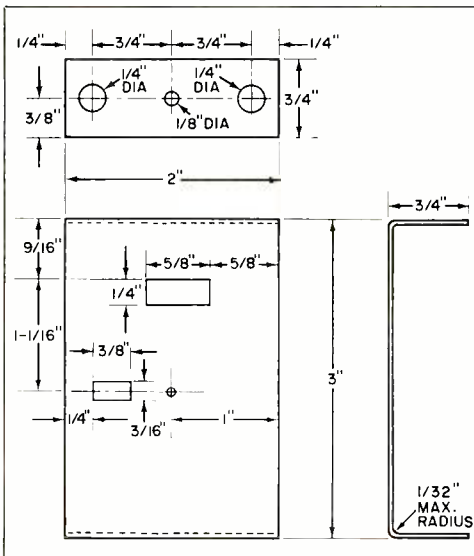
Completed transmitter, with all parts except R7 mounted on blank side of the printed circuit board.

PARTS LIST

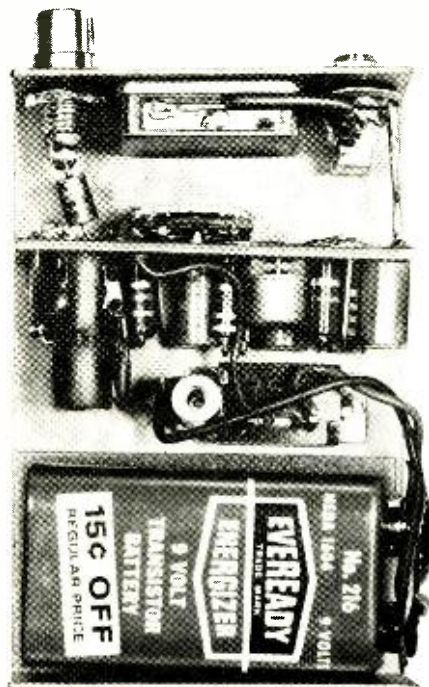
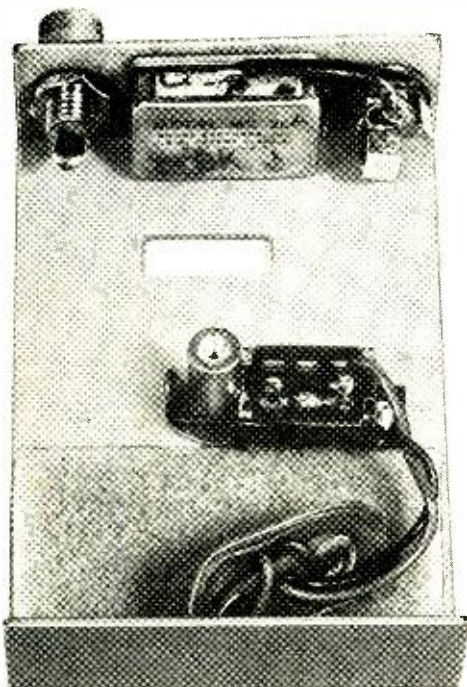
- B1—9-volt battery
- C1—10- μ f., 15-volt electrolytic capacitor
- C2—30- μ f., 15-volt electrolytic capacitor
- C3—5- μ f., 15-volt electrolytic capacitor
- C4—0.005- μ f., 50-volt ceramic capacitor (Centralab CK 502 or equivalent)
- C5, C6—5-pl., 0 temperature coefficient, ceramic disc capacitor
- C7—0.01- μ f., 50-volt ceramic capacitor (Centralab CK 103 or equivalent)
- C8—2-pl., carbon or ceramic capacitor
- J1—Miniature phono jack (Switchcraft 42A or equivalent)
- J2—Single hole mounting phono jack (Switchcraft 3501 FP or equivalent)
- L1—3 1/4 turns of #26 magnet wire on 0.3"-o.d. coil form, 1/4", high-frequency ferrite core*
- P1—Phono plug (Switchcraft 3501M or equivalent)
- Q1—2N702 transistor
- Q2—2N1302 transistor
- Q3—TI419 transistor
- R1, R8—4700 ohms
- R2—33,000 ohms
- R3—1000 ohms
- R4—10,000 ohms
- R5—2200 ohms
- R6—170 ohms
- R7—5000-ohm trimmer potentiometer (CTS 201 or equivalent)
- R9—27,000-ohm, 1/2-watt resistor, $\pm 10\%$
- R10—220-ohm resistor (two 470-ohm resistors in parallel)
- S1—S.p.s.t. miniature slide switch
- 1—Circuit board (Demco—etched and drilled*)
- 1—Miniature microphone (Shure MG-20AJ or equivalent)**
- 1—1/2" x 4-40 threaded spacer (Herman Smith 2372 or equivalent)
- Misc.—Case, battery clip, wire, solder, etc.

*An etched and drilled circuit board plus wound coil L1 (CB-125) is available from Demco, Box 16041, San Antonio, Texas 78216, for \$2 postpaid. A kit of the listed parts, including the special case shown but NOT the microphone (CBC-125) is \$10.00. A kit of all parts including the microphone (CBCM-125) is \$18.00.

**Suitable lavalier type microphones include the Shure 560 and 420, Turner 58, American D 12L or D 11L, Astatic 335L, and Electro-Voice 649B or 624.



An aluminum sheet about 1/32" thick can be cut, bent, and painted to form an attractive housing.



The microphone is cemented to the case. The hole in the back cover should line up with the bushing.

Mount all parts on board before enclosing in case. Use epoxy cement on inside edge to keep in place.

space the control approximately $\frac{1}{16}$ " away from the printed circuit board. Cut off the small pointer projection on the control knob so that the knob clears the opening in the case. The knob can be painted with a contrasting color.

Attach a ground lead from point *D* on the circuit board to the ground lug under the threaded spacer. Capacitor *C8* is connected between *J2* and point *B*. Another lead connects *J1* to point *A*. If the leads are strong enough, they can be relied upon to keep the board in place; otherwise, the board can be cemented in place with a drop of epoxy cement on each end of the board.

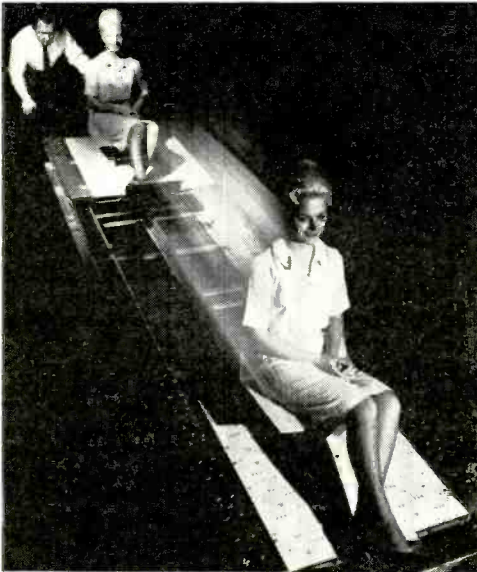
Check all wiring and be sure to observe battery polarity. An RCA type phono plug is used to hold the antenna. If you have difficulty getting a case or any of the parts for this project, try Delaco, Box 16041, San Antonio, Texas 78216. (See Parts List.)

Final Adjustment. Turn on your FM radio and tune it to a clear spot on the dial, near the center of the band. Use a nonmetallic tuning tool and rotate the core of *L1* until quieting or a feedback

howl occurs. It should be possible to adjust the wireless microphone to work almost anywhere on the FM band. The exact tuning range depends upon the type of antenna used and component tolerances.

Adjust the volume control and the receiver volume so that no feedback howl occurs. The amount of volume you can use will depend upon your distance from the loudspeaker, and room acoustics. The FM Wireless Microphone can be carried in your shirt pocket, or placed in a suitable location to pick up the desired sounds. If you use a lavalier type of microphone, all or part of the neck cord can be replaced with a piece of insulated wire, one end of which is plugged into the antenna jack to serve as an antenna, thus increasing the range.

The antenna should not be allowed to move around too freely, because body capacity can cause a change in the frequency of operation. If this is a problem, replace capacitor *C8* with a 1-pf. capacitor. If you cannot get the microphone to work, check the transistor voltages—they should be within 20%. —50—



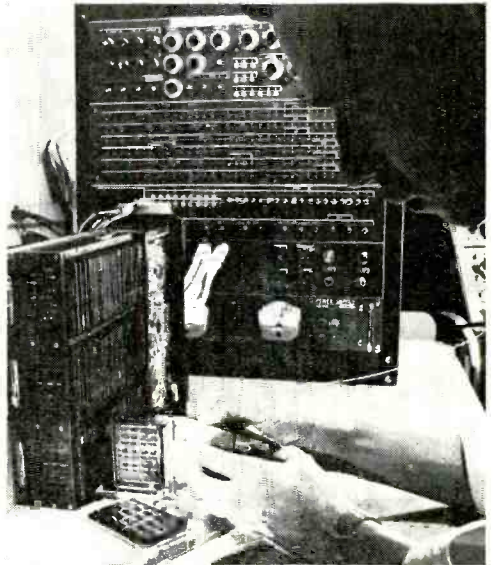
RIDING ON AIR—Principle of magnetically floating transit cars is demonstrated by Westinghouse test vehicle above. In a full-scale system, the frictionless floating cars would be driven at speeds in excess of 150 m.p.h. by a linear electric motor.

MINIATURIZED COMPUTER—A digital computer that can perform 25,000 instructions per second (right), yet weighs just 26 pounds and measures 3.4" x 10.4" x 11.5", has been developed by IBM for the U.S. Navy. The new unit, for use in aircraft to calculate the release point for bombs and missiles, employs thin film circuits made by vacuum deposition.

ANTI-MISSILE RADAR—Experimental radar system developed by Sylvania employs many antenna elements rather than a rotating dish to track enemy missiles. The radar beam is steered electronically by shifting electrical phase of individual elements.

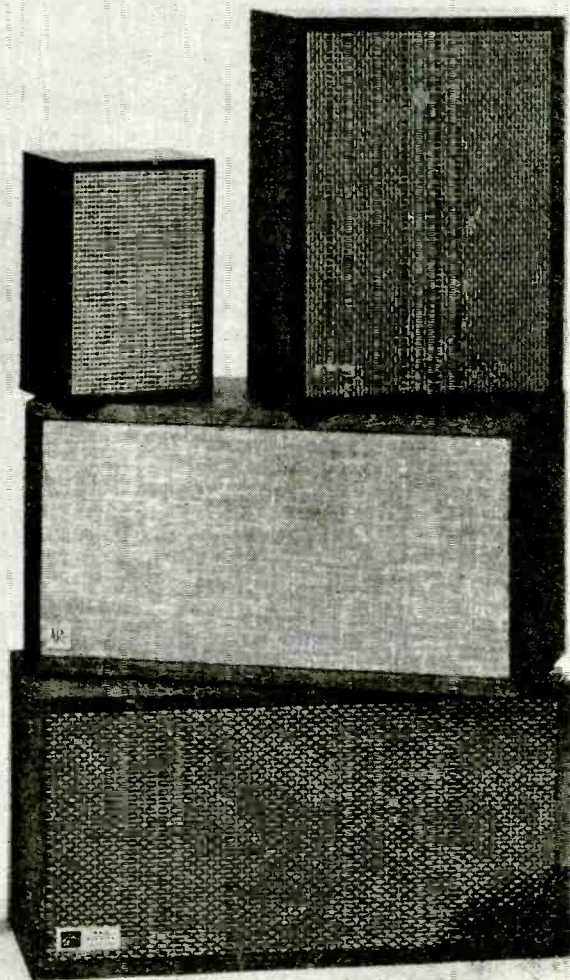


PHASE-LOCKED LASERS—Beams from two lasers have been combined for the first time in a Bell Labs experiment. To obtain interference rings shown above, the beams must be at the same frequency and have a constant phase difference. The technique will greatly increase range of laser communications.





Why build? For \$20 to \$70 you can buy a



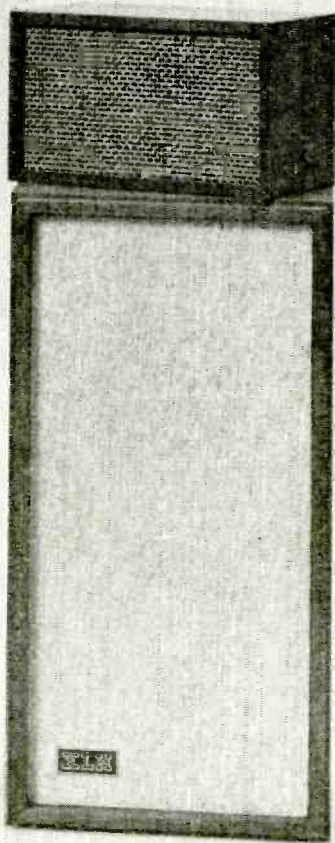
Bantam Hi-Fi

Speaker Systems

Ride on Air Cushion

By HANS FANTEL

carefully designed two-way hi-fi speaker system that sounds just great



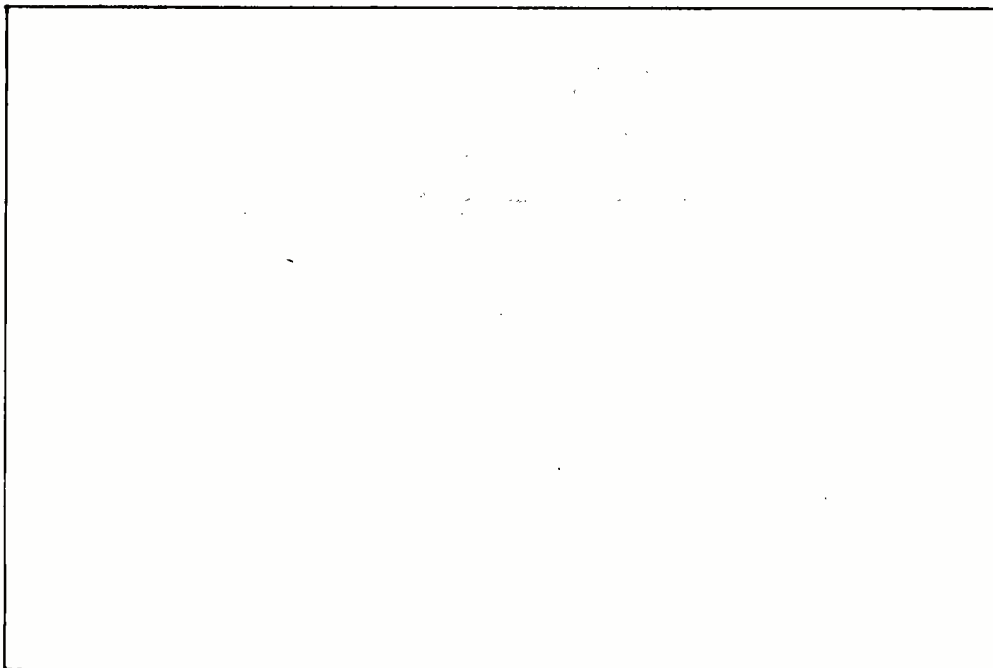
WANT good sound on a tight budget? Then “take a close listen” to the new speaker systems covered in this report. As a group, they offer just about the “soundest” bargains in high fidelity. They’ll not just save you money; they’ll also save you space. For these designs combine low cost with extreme compactness. Some of them are no bigger than a shoebox.

Until this year, you had to fork over nearly \$200 for a pair of stereo speaker systems that could live up to high fidelity standards. Today you can almost match that quality level for half the price.

In the past, budget-bound hi-fiers saved money by building their own speaker enclosures. Now they are discovering that they can buy a speaker system as cheaply as they can build one. What’s more, they no longer have to worry about the right cabinet dimensions for a given loudspeaker. In buying the complete system—woofer, tweeter, crossover network, and enclosure—they can be sure that all parts are correctly matched for optimum performance.

Floating on Air. A key to the success of these new compact designs is the fact that all of them use the air suspension principle, which was formerly used mainly in high-priced speaker systems. Thanks partly to this principle, the new compacts manage to pack bigger and better bass into smaller boxes than was previously considered possible.

The main feature of air suspension speakers is that they are mounted in a sealed box. Unlike the familiar bass reflex baffles, they have no opening or “bass port” through which the back pressure from the moving speaker cone is vented. Instead, the back pressure is allowed to build up at the rear of the speaker cone with



Bantam speakers vary in size from the KLH to the Olson. This illustration matches photo on pages 40-41.

each back stroke of the woofer. The compressed air forms an "air cushion" that supports the cone. In effect, the cone leans on the air enclosed in the box. Thanks to this pneumatic support, the speaker cone can be suspended far more loosely than in other types of enclosures. The loose, floppy suspension, in turn, leaves the cone free to make the long, powerful swings needed to pump out the low bass notes.

The air cushion provides an additional advantage. It acts like an air-filled shock absorber in a car and keeps the cone from swinging along on its own momentum after the original sound impulse has passed. This damping action keeps the cone motion accurately in step with the electrical signal and cuts down distortion and boominess. As a result, the best of the new bantams have a tightly controlled bass, sharp transient response, and an overall clarity of sound that once was heard only from far more expensive speakers.

Nature, however, never gives you anything for nothing. The extra energy needed to build up the air cushion behind the cone has to come from the amplifier. Consequently, air suspension

speakers gobble up more watts to produce a given volume of sound than other types of speaker systems. But since most quality amplifiers nowadays deliver upward of 12 watts per channel, this shouldn't cause any problems for the majority of hi-fi fans.

Listening Tests. A group of POPULAR ELECTRONICS staffers lent their critical ears to various examples of this new breed of budget speakers, which range in price from \$14.98 to \$69.95. They came away surprised. Each of the entries produced far better sound than is normally expected of a speaker in its class. Granted, the lowest reaches of the bass fiddle and the deep pedal notes of the organ did not come through with the same richness as in full-size speaker systems. Some of the compacts had fairly limited power-handling capacity and wouldn't let you shake the walls with Wagnerian orchestrations. But the best of this group had a very natural tonal balance, solid bass, and sweet highs. In fact, for sheer naturalness of sound, several of these low-cost compacts outperformed some larger systems selling at nearly twice the price.

The tonal character of a speaker can't

Manufacturer	Model	Width	Height	Depth	Woofers Diameter	Tweeter Diameter	Tweeter Control	Price
ACOUSTIC RESEARCH	AR-4	19"	10"	9"	8"	3½"	yes	\$57.00 (walnut) 51.00 (unfinished)
AUDIO DYNAMICS (ADC)	325	19	10½	8	6*	3*	yes	49.50
ELECTRO-VOICE	E-V Seven	19	10	9	8	3½	yes	65.00 (list)
FISHER	XP-5	20	10	9	8	2½	no	54.50
GOODMANS	Maximus I	10½	5½	7¼	3¾	2¾	no	59.50
HEATH	*AS-81	10¾	6¾	6¾	6	3	no	19.95 (walnut) 17.50 (unfinished)
JENSEN	PR-50	18	9¾	7¾	5¾	**	yes	69.50
KLH	Model 17	23	11¾	8½	10	**	yes	69.95
OLSON	"X" Air	9	6	5	3½***	—	no	14.98
SCOTT	S-5	16	10	6¾	6	2½	yes	59.95
SONOTONE	RM-1	14½	10½	7¼	6	**	no	42.50

*Separate connections provided if required. **Miniature dome tweeter. ***Full-range response; no separate tweeter.

Comparison table of some of the characteristics of the bantam speakers. All of the enclosures are sealed.

be pinned down accurately by test instruments. Frequency response and other specifications—even if correctly measured and honestly reported—don't really tell what a speaker sounds like. The ear is the only judge. So the judgment is necessarily personal and subjective.

Yet there is one standard by which experienced listeners can gauge the merits of a speaker: How closely does it reproduce the sound of "live" music? If you know just what to listen for when comparing loudspeakers, your own ears make a fairly reliable test instrument. Here are some of the telltale clues to watch for:

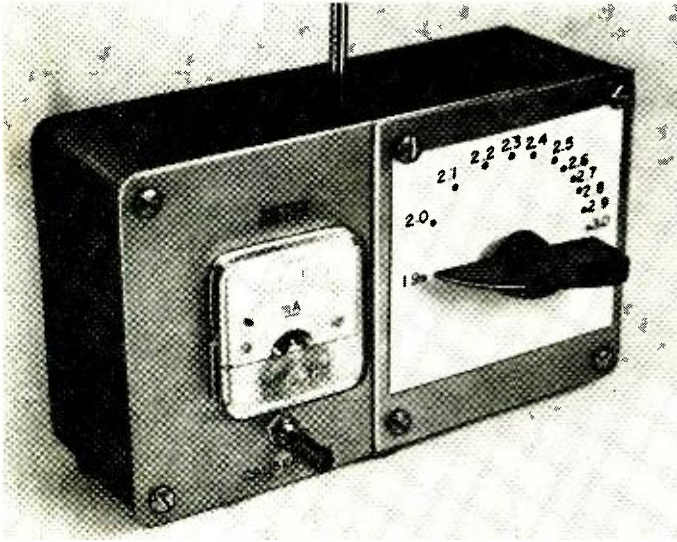
- Do the violins have a silky sheen without sounding harsh?
- Is there solid weight in the sound of cellos and contrabass?
- Do the drums and other percussion instruments sound sharp and crisp? (You should hear the impact of the sticks on the drumskins.)
- Does the brass come through with brilliance but without blaring?
- Does the sound stay clear, even in heavy symphonic orchestrations?

Speaker Ratings. Four models in the current crop of compact speakers come

amazingly close to big-speaker quality. They are, in alphabetical order, the Acoustic Research AR-4 (\$57), the Electro-Voice E-V SEVEN (\$65), the Fisher XP-5 (\$54.50), and the KLH Model 17 (\$69.95). All four sound smooth and natural, with clear highs and no trace of harshness—a sign that their tweeters are free of distortion-causing frequency response peaks.

In fact, these four speakers sound so similar that, with your back turned, you'd have a hard time telling one from another. However, if you concentrate on the bottom end, you'll notice slight differences. The Fisher, which uses an 8-inch woofer, has a full, warm sound, with plenty of lows. But the KLH, whose 10-inch woofer is the biggest of the lot, also puts out the clearest bass in the lowest register. The AR-4 and the E-V SEVEN, which are similar both in size and performance, have an unobtrusive "rounded" sound that doesn't strike you as spectacular on first hearing but proves very satisfying after a long stretch of listening; both units employ 8-inch woofers.

All four of these speakers deliver am-
(Continued on page 92)



MARINE BAND WAVE-METER

By E. H. MARRINER,
W6BLZ

This little unit keeps tabs on your signal

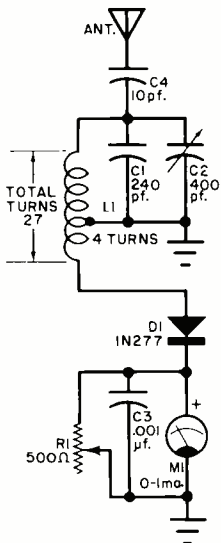
SMALL boat owners, fishermen, technicians, and others who own, use, or service and install marine band radio equipment will want to duplicate this simple wavemeter designed for monitoring and tuning up shipboard transmitters in the 2-3 mc. range. The unit does not use any batteries, and can be left on to monitor transmitter output and insure that it is set to the proper channel.

How It Works. To simplify matters, the wavemeter was constructed inside a small plastic box; in most cases, enough r.f. energy will be picked up by the internal coil to operate the device. If not,

the rod antenna specified in the Parts List can be added to the unit.

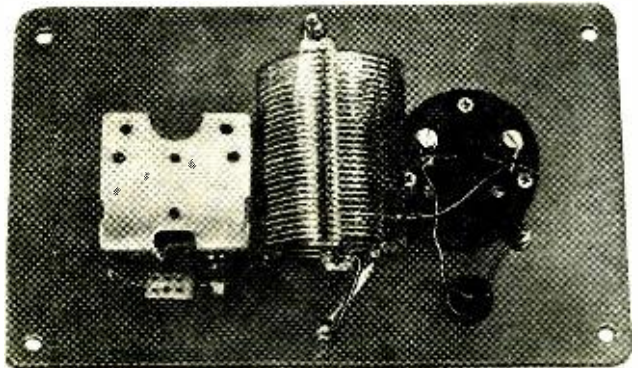
The bottom four turns of coil *L1* act as a coupling between the tuned circuit, consisting of *C1*, *C2*, and *L1*, and diode *D1*. The coupling coil prevents overloading of the tuned circuit so that the main dial (*C2*) tunes sharply and accurately. The r.f. is rectified by *D1*, and the resulting d.c. current indicated by *M1* (the meter can be made more or less sensitive by adjusting *R1*).

Construction. A small plastic instrument case (Lafayette 19G2001 or similar) was used to house the meter; an



Wavemeter is simply tuned circuit coupled to rectifier-meter circuit by bottom four turns of coil. Circuit tunes sharply to indicate frequency of transmitter.

As shown below, all components are mounted on front panel of wavemeter. Connections to the optional external antenna are not shown here; simply add a 10-pf. coupling capacitor and wire the antenna to the stator of *C2*. The top end of the coil must be mounted on an insulator as shown. Calibrate the wavemeter as described in text, using accurate generator.



aluminum cover was made for the box. As shown in the photos, all of the components are mounted on this aluminum cover: *C2* at right; the coil in the center with the above-ground end fastened to an insulator; and the meter at left. Potentiometer *R1* is just below *M1*.

It is necessary that the coil be of the dimensions specified in the Parts List, tapped at four turns, and that a 240-pf. capacitor be placed across the variable and not some other value. This will insure that the wavemeter covers the correct range.

Calibration. After the wavemeter has been assembled, it can be tested and calibrated by placing it near some r.f. source in the 2-3 mc. band. One of the best methods is to use the radiophone set itself, a crystal oscillator, a grid dip oscillator, or other signal generator of known accuracy. If the meter should read backwards, reverse either the diode or the meter.

A rough dial can be made by placing a piece of paper under *C2*'s knob, and marking off frequencies in pencil. You can then ink in a finished dial and install it on the wavemeter; it should look much like that shown in the photo. A piece of clear plastic mounted over the dial will keep it clean and free from smudges.

As mentioned earlier, you can use the unit for peaking your transmitter, as well as for monitoring, if you have a commercial FCC license. For monitoring only, you can bolt the wavemeter to a bulkhead wall to keep an eye on transmitter output. A log of readings from day to day will serve as an indication that your antenna is radiating as it should be.

SIMPLE AUTO LIGHT MINDER



Both *R1* and *D1* can be mounted under buzzer cover.

IT'S EASY to forget that your headlights are still on—easier still to forget the parking lights if you turn them on while driving on a rainy or foggy day.

You can eliminate the whole memory problem entirely by building this simple Auto Light Minder that requires only three components—a 10-ohm, 1-watt resistor, the cheapest silicon diode rectifier you can locate (the author used a 1N2069), and an inexpensive code practice buzzer. The recti-



Light Minder uses three components; *R1* is omitted in 6-volt cars, leads reversed for positive ground.

fier and resistor can be mounted under the buzzer cover for compactness.

Connect one lead of the Light Minder to the light switch, and the other to the ignition switch as shown in the diagram. The correct terminals can be identified by observing which ones show a voltage to ground when the switches are operated (avoid the accessory lead on the ignition switch, however). When the lights and ignition are both off, both sides of the buzzer are at ground potential and there is no sound. Likewise, when both lights and ignition are on, there is no potential difference.

Diode *D1* blocks current flow with the lights off and ignition on, but with the lights on and ignition off, one side of the buzzer is grounded through the low-resistance ignition system. *D1* is forward-biased by the battery, and the buzzer sounds.

Eliminate *R1* for 6-volt cars, and reverse the light and ignition leads for positive ground cars.

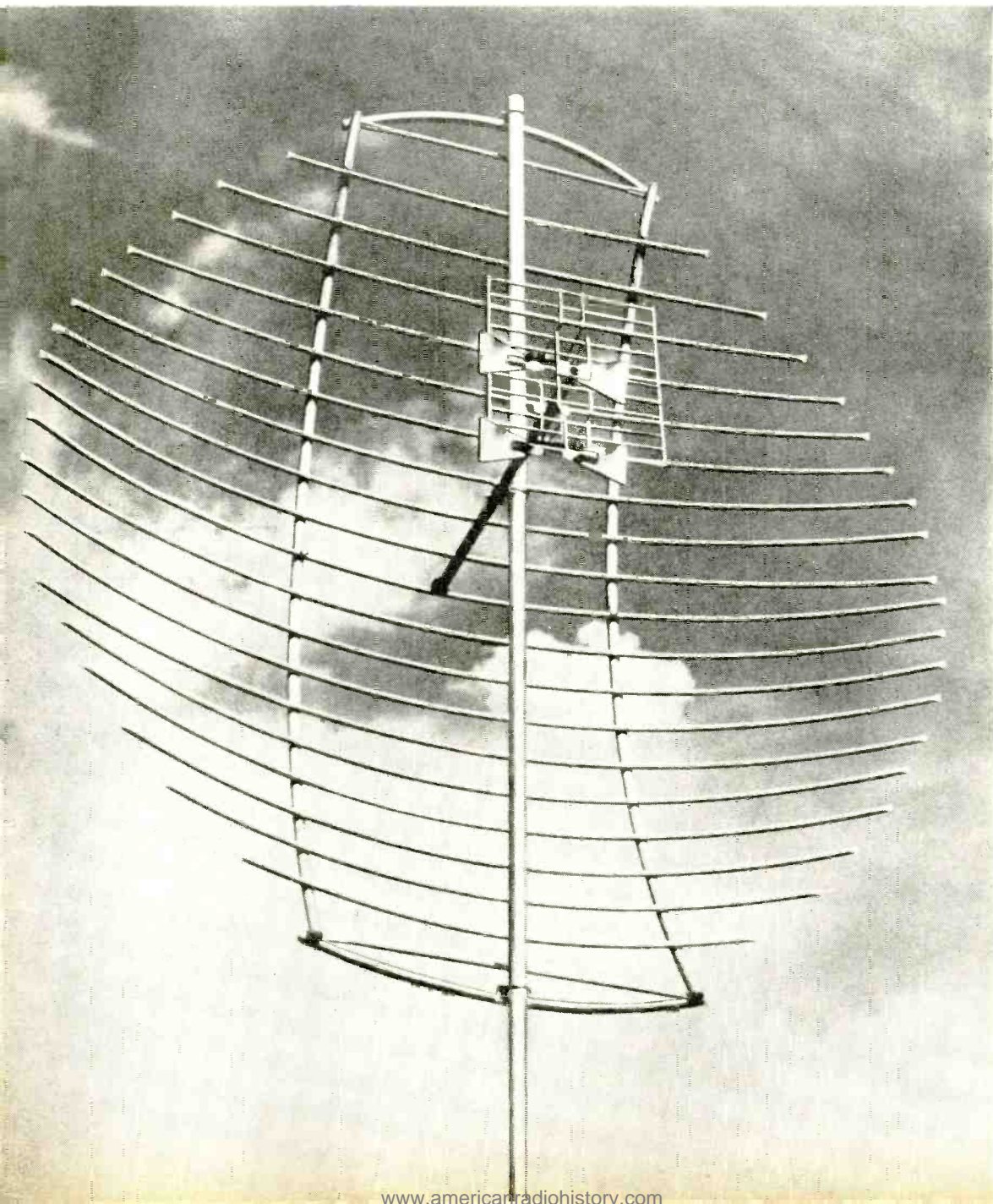
—R. L. Winklepleck

PARTS LIST

- C1* 240-pf. silver mica capacitor
- C2* 400-pf. variable capacitor
- C3* 0.001- μ f. ceramic disc capacitor
- C4* 10-pf. ceramic or mica capacitor
- D1* 1N277 silicon diode
- L1* 27 turns of ≈ 12 to ≈ 18 wire, 1 1/4" diameter form, 16 turns per inch, tapped at 4 turns (B & W Abductor ≈ 3019 or equivalent)
- M1* 0-1 ma. meter
- R1* 500-ohm potentiometer
- 1—2" x 3 3/4" x 6 1/4" plastic box
- 1—Extension antenna optional (Lafayette 99G4001 @ 59 cents or equivalent)
- Misc.—Wire, solder, mounting insulator for coil, aluminum sheet, pointer knob, etc.

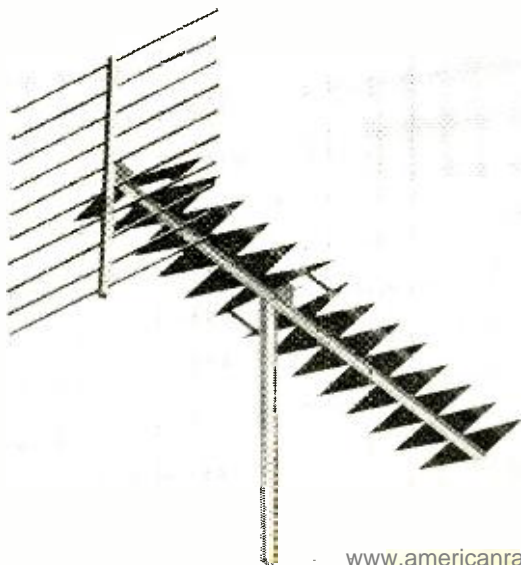
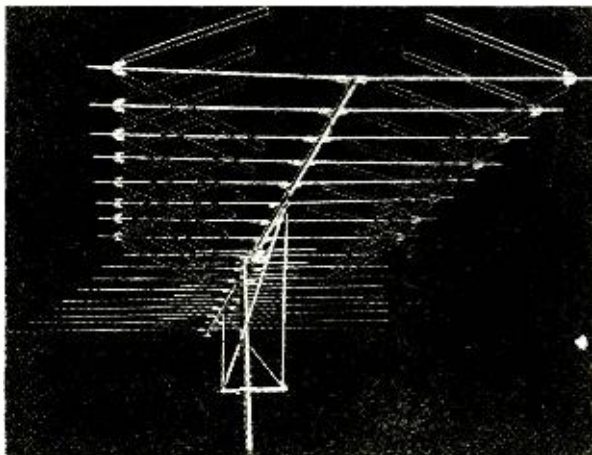
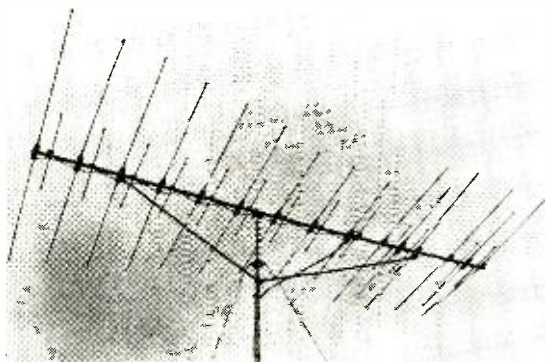
A NEW GENERATION OF

Space-age technology simplifies antenna installations and improves reception



ANTENNAS

By **ROBERT CORNELL**, Technical Editor



AN unprecedented demand for bigger and better antennas brought on by the advent of color TV, UHF TV, FM and stereo FM, plus the actual progress in the state of the art gained from man's race to the moon, has resulted in a whole new generation of antennas. Not that the dipoles, V's, and conicals are no longer any good—they are, and they are still with us. But where an installation requires more gain, more image rejection, flatter frequency response, more uniform impedance match across the band, and greater bandwidth, the new antennas are a "must."

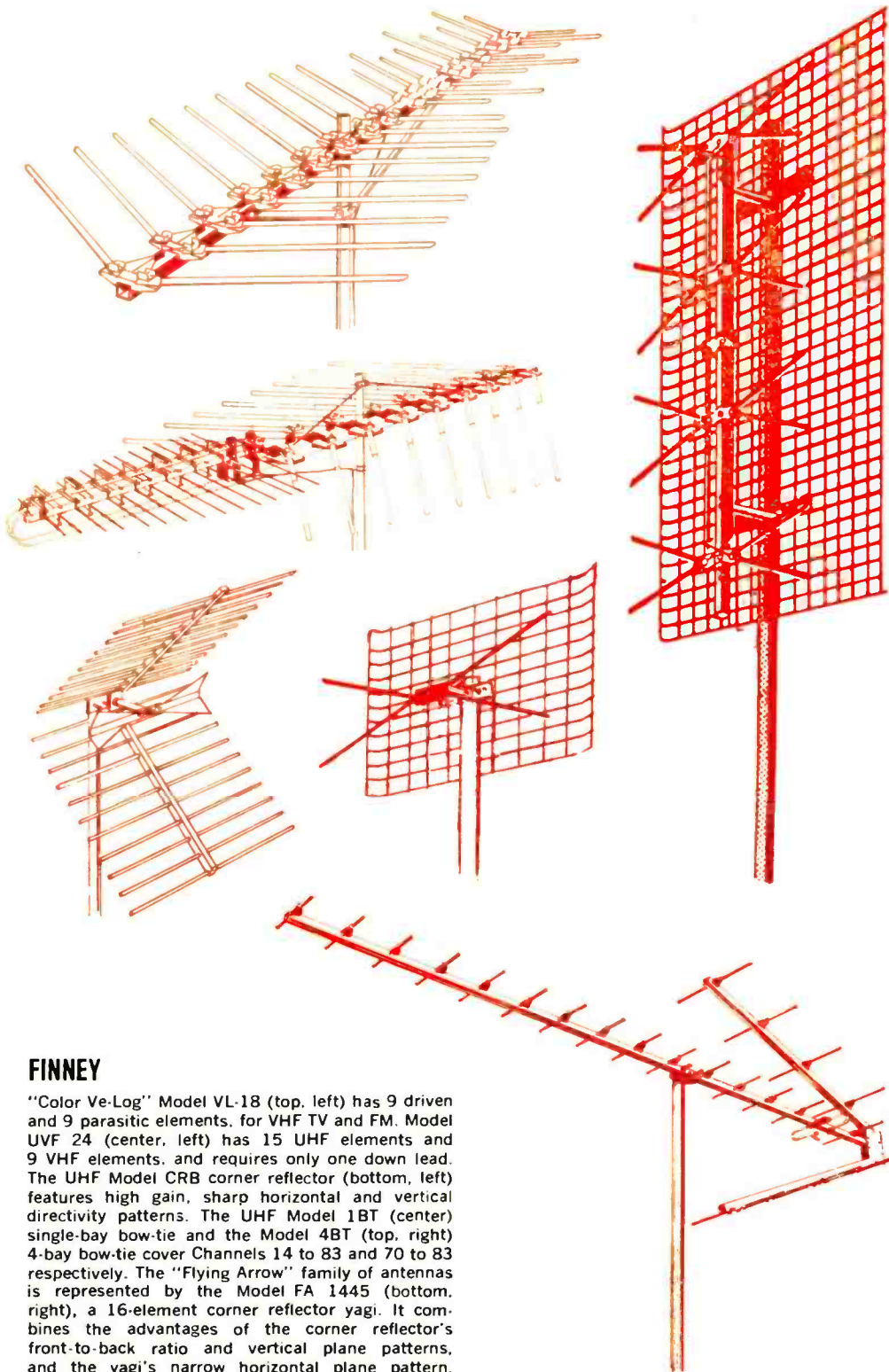
It is not unusual for a home to be receiving a combination of signals, and to have one or more TV sets and radios turned on at the same time. Just as it is possible to couple several sets to one antenna, it is possible to couple several antennas to one or more sets. FM radio frequencies lie in between the high and low VHF band and are not in a position for an ordinary TV antenna to do much good. In the past, if you wanted FM, VHF, and UHF reception at the same time, you were likely to wind up with three antennas on your mast.

But now you can obtain a single combination antenna with a single down lead to satisfy all your requirements. The use of line splitters makes it possible to watch TV in one room and listen to FM radio in another. Actually, while the new trends in antenna design may seem quite complicated, they tend to simplify antenna installation.

The antennas that are illustrated at left and on the following pages are only representative of complete series or families of models made by the manufacturers indicated, in alphabetical order. All of these antennas effectively improve and increase range of reception.

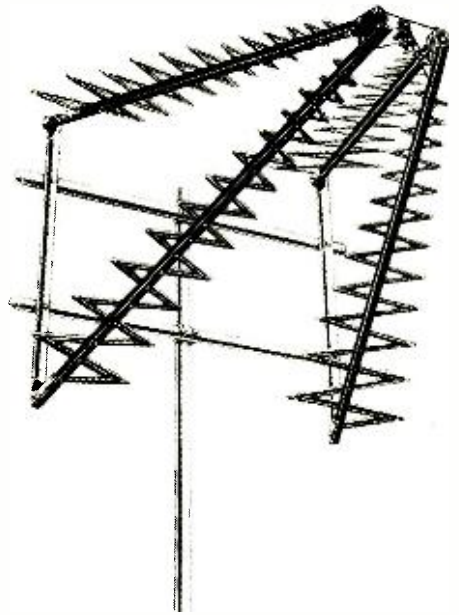
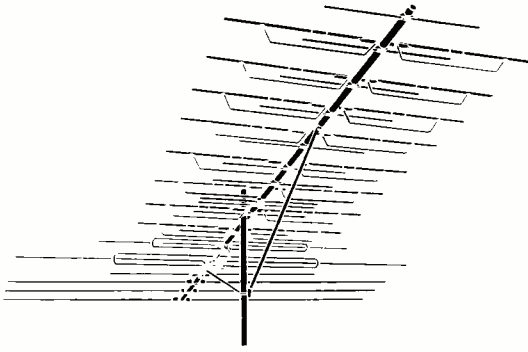
CHANNEL MASTER

"Super Para-Scope" Model 4251G parabolic UHF antenna (facing page) measures 7 feet in diameter and has a 16 to 20 db gain figure; in spite of its massive appearance, it does not take up any more mast space than a stacked VHF antenna. "Crossfire" Model 3600 (top) has 28 elements including two director power groups. "Super-Crossfire" Model 3607 (center) features a folded-whisker phase controller on each end of the eight directors to enable them to build up low- and high-band TV and FM radio signals. The UHF "Bandsaw" Model 4311G (bottom) can be adjusted to limit bandwidth in order to obtain more gain.



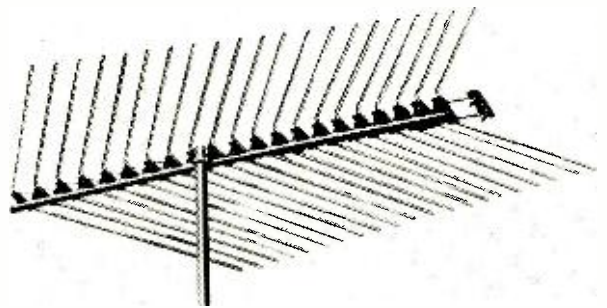
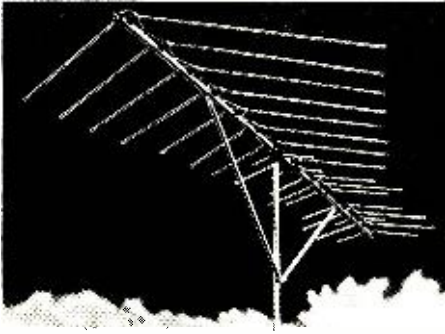
FINNEY

"Color Ve-Log" Model VL-18 (top, left) has 9 driven and 9 parasitic elements, for VHF TV and FM. Model UVF 24 (center, left) has 15 UHF elements and 9 VHF elements, and requires only one down lead. The UHF Model CRB corner reflector (bottom, left) features high gain, sharp horizontal and vertical directivity patterns. The UHF Model 1BT (center) single-bay bow-tie and the Model 4BT (top, right) 4-bay bow-tie cover Channels 14 to 83 and 70 to 83 respectively. The "Flying Arrow" family of antennas is represented by the Model FA 1445 (bottom, right), a 16-element corner reflector yagi. It combines the advantages of the corner reflector's front-to-back ratio and vertical plane patterns, and the yagi's narrow horizontal plane pattern.



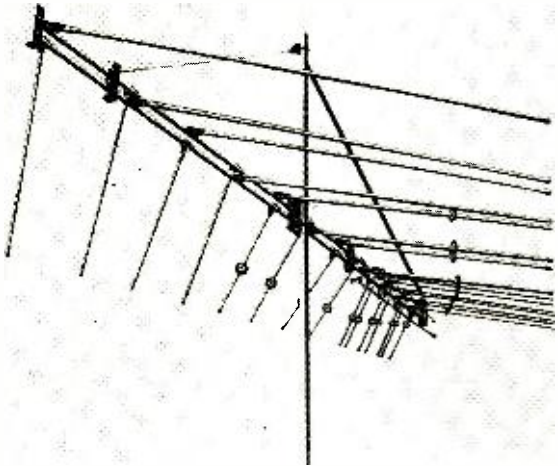
GC

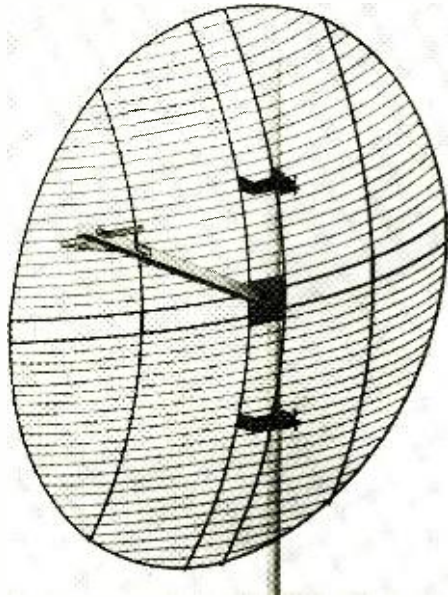
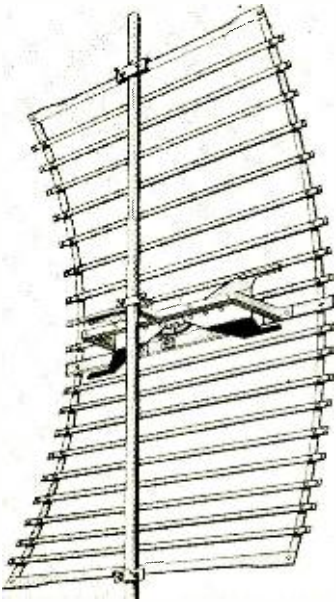
"Colormagic" Model A-2012 (above) is a giant-size (190' x 110') 42-element VHF antenna, and weighs 14 pounds. It is the biggest of a series of six FHR (Fundamental Harmonic Resonance) antennas. There are 40 parasitic and 2 driven elements working into one down lead. The parasitic elements consist of directors and reflectors to obtain a narrow polar pattern, good front-to-back ratio, high gain. The series was specifically designed for color reception.



JFD

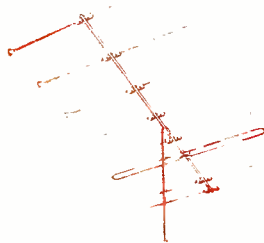
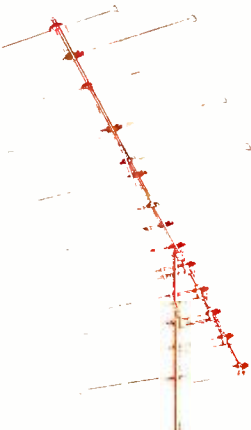
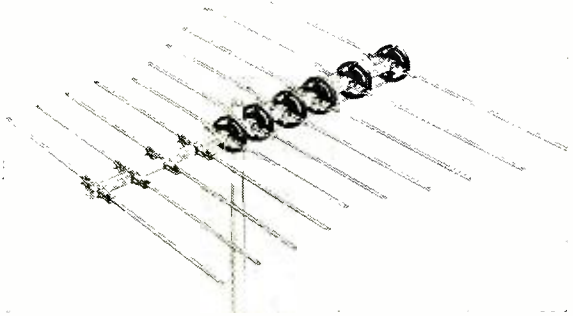
"Log-Periodic" Model LPV-17 antenna (center, left) has an 18 active cell and director system. There are five smaller versions in this series of VHF antennas. Besides wide bandwidth, and high front-to-back ratio, they exhibit a constant impedance across the band and are capable of 1.2:1 VSWR's. "Cap-Electronic" Dipole Log-Periodic Model LPV-VU15 antenna (bottom, left) has 15 active cells. It is a combination VHF, UHF, and FM antenna using a single down lead. Capacitor-coupled dipoles effectively create more driven elements. There are three smaller versions and one larger version of this antenna. "Zig-A-Log" Model LPV-ZU20 (top, right) is known as a Log-Periodic planar-helical-in-axial-mode antenna and is intended for use on the UHF TV band. This is actually a stacked array of two LPV-ZU10 antennas, with a gain of 16 to 17 db. The UHF "Log-Periodic" Model LPV-U21 (bottom, right), one of four in a series, has 21 active cells to give a 15 db gain to 830 mc., and 11 db at 890 mc. It also brings in Channels 7 to 13 with a 4-6 db gain. Impedance is 300 ohms. Range is deep fringe.





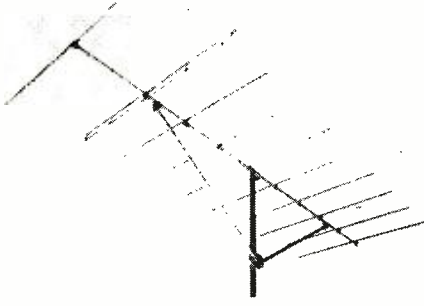
JERROLD

"Paracyl" Model JUP-3 (above) is one of five models having an extended resonance driver designed to cover the entire UHF-TV band. Size of screen is a function of the distance to be covered. Series J3065 is a group of four 75-ohm parabolic dish antennas (one is shown at top, right) that cover the UHF-TV spectrum in segments (Channels 14 to 22, 23 to 51, 52 to 69, and 70 to 83). Gain is 14 to 17 db and front-to-back ratio is better than 20 db. "Paralog" Model FMP-10 (right) is representative of a family of seven TV and three FM antennas. They are broadband log-periodic antennas with added parasitic elements to improve gain.



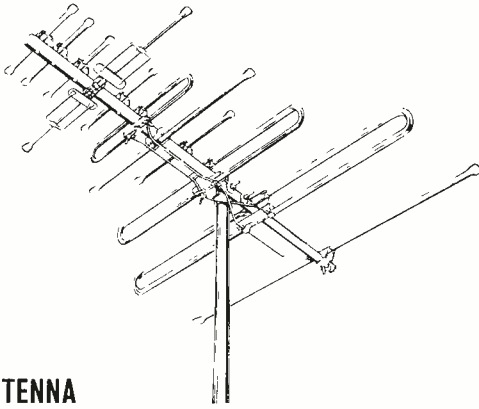
RCA

Color TV Model 400 antenna (left) is the largest of three models for the VHF-TV band, designed to work on color and black and white TV signals. The Model 500 (above) is an 8-element yagi antenna cut to pick up 88 to 108 mc. for FM reception; antenna has high gain, and a high front-to-back ratio.



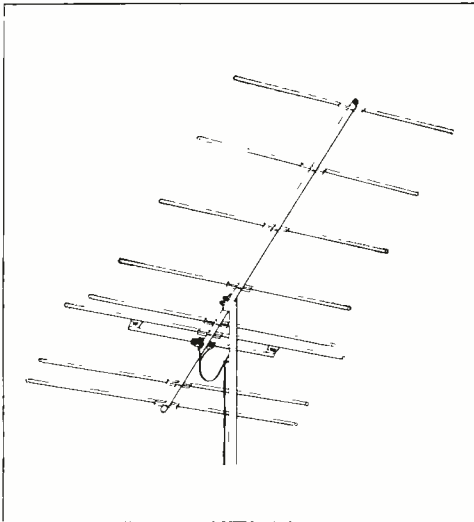
SCALA

Heavy-duty 10-element yagi, 300-ohm model (above), is for CATV and industrial users. Elements are $\frac{3}{4}$ " o.d. heavy-wall tubing. Average VSWR: 1.45 to 1. Also available are 72-ohm models with baluns. Antennas can be stacked to further narrow beamwidth.



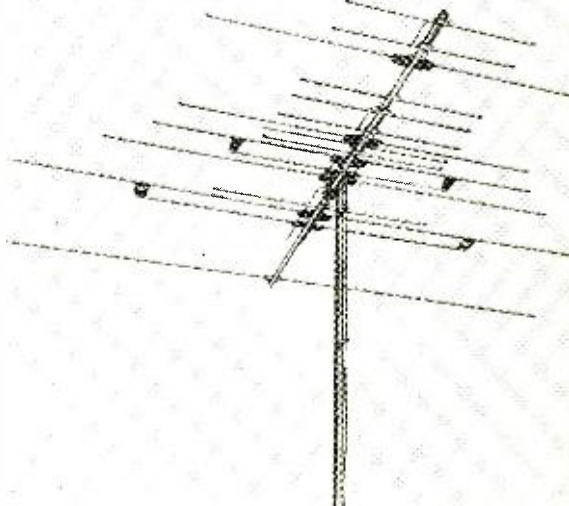
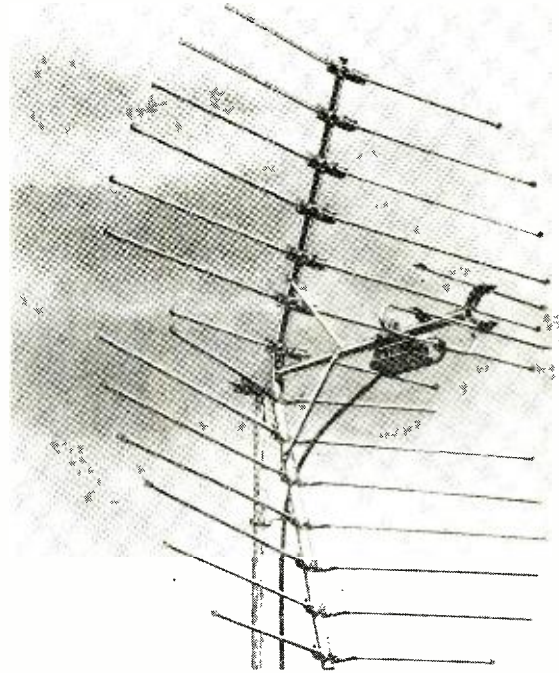
TENNA

Broadband VHF-TV Model TM-70 (above) has 3 driven dipoles and 9 other elements; one of the dipoles is tuned to the high band. There are six antennas in this series, three smaller and two larger. Largest has 4 driven dipoles. Reflector system can be added.



WINEGARD

"Tracker" Model U-540 (below) is a high-gain parabolic type UHF-TV antenna for Channels 14 to 83. It is shown here with a Model UHF-212 preamplifier mounted between the driven dipole and down lead. "Colortron" Model C-42 (bottom, right) is one of a series of four VHF-TV antennas. It has 14 elements. Directivity pattern is broader and gain is less than those of the two larger models in the series. Model C-44 (not shown) has 30 elements and a VSWR of 1.5 to 1 or better; gain across any 6-mc. channel is $\pm\frac{1}{2}$ db. Model SF-8 FM directional antenna (bottom, left) is $67\frac{1}{2}$ " wide, 90" long. Gain is 8.8 db.



HOW TO IMPROVE **COLOR** TV ANTENNA

By **LON CANTOR**

Jerrold Electronics Corp.



THE ONE THING beyond the quality control of the set maker or the TV studio is what happens to a signal between the transmitting antenna and the TV set. It is obvious that there is a lot of difference between color and monochrome receivers, but people often overlook the fact that there is also a tremendous difference in reception problems.

This difference is due mainly to the color carrier, which contains the color modulation. The color carrier is sandwiched in between the picture carrier and the sound carrier, 4.83 mc. away from the lower edge of the channel. For example, Channel 2 covers 54 to 60 mc., with the picture carrier at 55.25 mc., color carrier at 58.83 mc., and sound carrier at 59.75 mc.

Now, why should this cause difficulty? After all, if we can receive the picture carrier and the sound carrier, why not the color carrier? The answer is in the type of modulation. The picture carrier is amplitude-modulated, and the sound carrier is frequency-modulated, but the color carrier is phase-modulated. The color carrier is also suppressed, to prevent interference with the sound carrier.

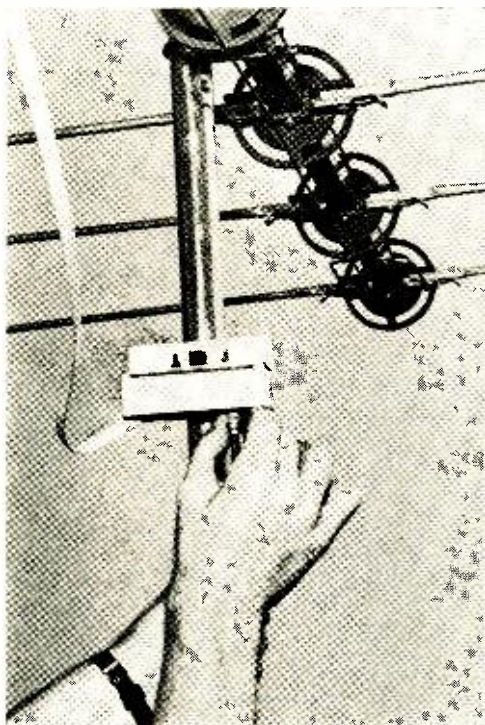
It's a lot harder to get good color pictures than to get black and white ones. An antenna installation that provided quite usable monochrome pictures might easily give you color distortion. Two



After spending \$500 for a color set, don't skimp on the antenna. A high-gain, flat-response, unidirectional antenna is a must for a good installation.

Some reflected signals may not be bad enough to create much of a disturbance on a black and white picture, but can cause intolerable color distortion.

INSTALLATIONS



Mast-mounted impedance-matching transformer is used to match 75-ohm cable to 300-ohm antenna.

important considerations for good color pictures are: (1) the antenna gain must be flat, and (2) the lead-in system must be free from standing waves.

Antenna Gain. Many commonly used antennas are unsuitable for color reception; their gain is not flat, and varies from channel to channel. More important, gain within a single channel may vary by as much as 6 db. Even a modest tilt in the response curve indicates a rapid change from resonance, hence phase shift. Because the color carrier is phase-modulated, any variation in response can cause changes in color—both in intensity and in hue.

In addition, many antennas do not exhibit a flat 300-ohm impedance within the frequency range they are supposed to cover. A poor impedance match can also cause color shifts.

For these reasons, a number of antenna manufacturers have come out with

an antenna specifically designed for color. Some of these antennas sacrifice gain, to an extent, in order to achieve match and flatness. The recently introduced log periodic type of antenna is noted for its flat response, excellent impedance match, and high gain.

Lead-In System. Even if you get perfect color reception at the antenna, you need a good down lead to carry it to the TV set. Ordinary flat-ribbon, 300-ohm twin lead has been used extensively for black and white TV, but it is not recommended for color.

Television engineers have never really liked twin lead. They started out using coaxial cable, and switched to twin lead only for the sake of economy. In theory, twin lead works fine. But the theory only applies when the twin lead is standing in free air. The trouble is that twin lead is very much affected by its surroundings. It can pick up signals almost as well as the antenna itself. It can also pick up auto ignition, appliance, and other types of interference. Most significantly, however, its impedance is changed by proximity to metal.

That's why experienced TV technicians take great pains to use standoff insulators to hold the twin lead away from the mast, metal gutters, heavily painted surfaces, etc. The problem is, though, that standoffs themselves are metal. These metal rings are cut by the magnetic fields set up around the twin lead. They not only absorb part of the signal, but they change the impedance of the twin lead at the points at which they are installed.

Reflected Signals. Here's what happens. The signal starts down the twin lead toward the receiver. But it sees the standoff as a "lump" in the line. Because this lump does not have an impedance of 300 ohms, maximum energy transfer does not occur. Some of the energy is reflected by the lump back up the line toward the antenna. When the reflected signal reaches the antenna, a portion of it goes back down the twin lead to the TV set.

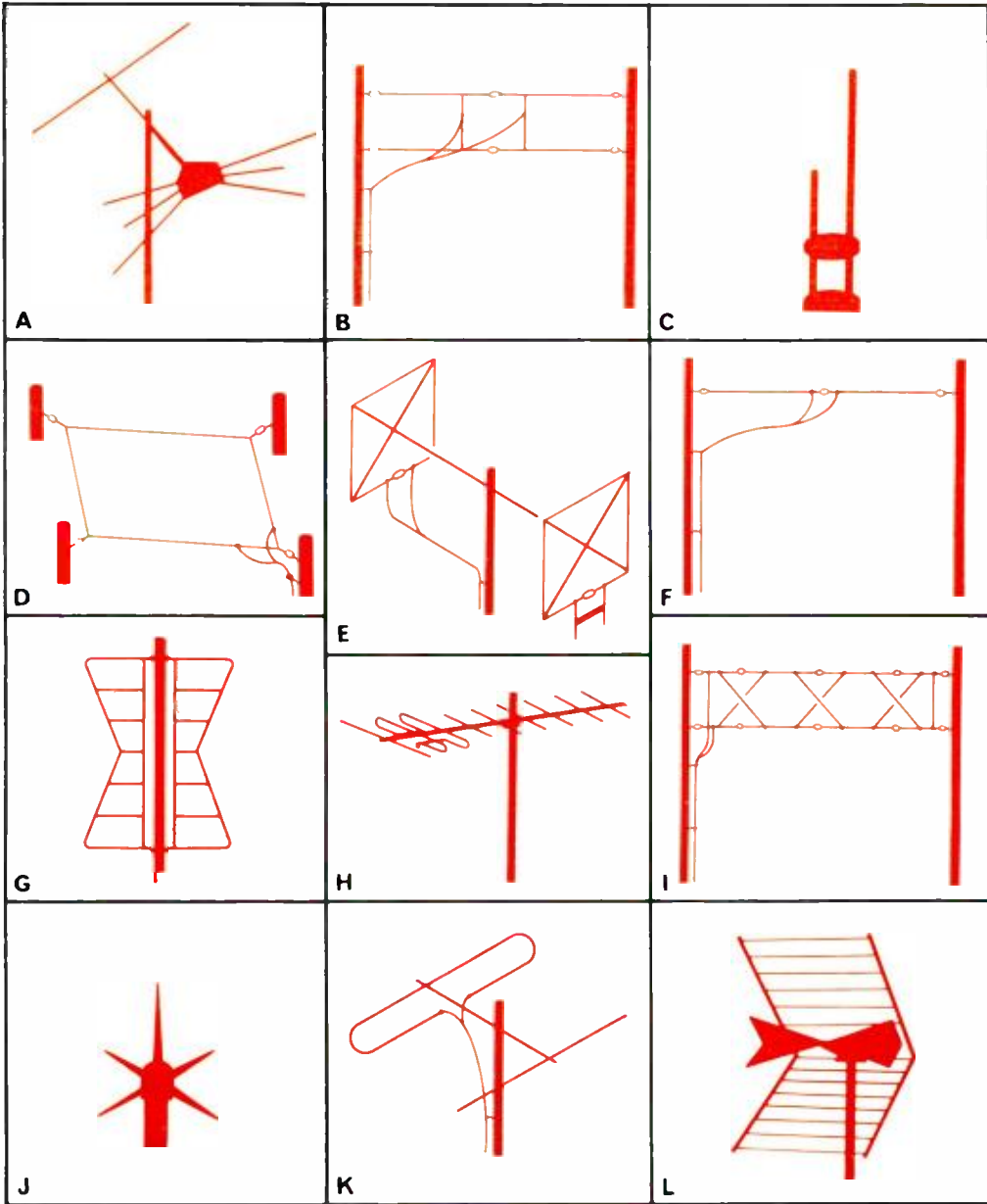
Thus, the same signal actually reaches the TV receiver twice—once directly and once by the roundabout, reflected route. The only difference is a time delay. The reflected signal gets to the set a little

(Continued on page 94)

ANTENNA QUIZ

By **ROBERT P. BALIN**

See how many of these commonly used antenna types you can identify by matching their names (1-12) with the drawings (A-L)



- | | | | | | |
|--------------------|-----|-----------------|-----|-------------------|-----|
| 1 Batwing | ___ | 5 Doublet | ___ | 9 Lazy H | ___ |
| 2 Conical | ___ | 6 Folded Dipole | ___ | 10 Rhombic | ___ |
| 3 Corner Reflector | ___ | 7 Ground Plane | ___ | 11 Sterba Curtain | ___ |
| 4 Cubical Quad | ___ | 8 J | ___ | 12 Yagi | ___ |

(Answers on page 89)

SELECTING A UHF ANTENNA



By **ABRAHAM E. SCHENFELD**

Project Engineer, Consumer Products
Blonder-Tongue Laboratories, Inc.

Higher frequencies
create more critical
antenna problems
for the home TV viewer

PRECISE determination of which antennas should be used at various distances from a transmitter is virtually impossible. There are many variable factors, including: (1) effective radiated power of the transmitter; (2) height of transmitting and receiving antennas; and (3) sensitivity of the TV receiver.

To make matters worse, the problem is complicated by the fact that topography has a very marked effect on UHF. Hills, buildings, and even trees (especially

when full of leaves) can block or absorb UHF signals.

Antenna Characteristics. The antenna characteristic most directly related to reception distance is gain. Gain is an indication of how much more signal a particular antenna will pick up than a theoretical isotropic antenna, which is used as a standard. Some people prefer to compare various antennas to a dipole. The gain of a specific antenna compared to that of a dipole is about 2 db lower than when it is compared to that of an isotropic antenna.

In many areas, the shape of the lobe is even more important than gain. A good, highly directional lobe means that signals will be picked up only from the transmitter—"ghosts" or reflected signals will not be received. Side lobes and back lobes, especially if they are large, can cause a lot more trouble than low gain.

Also, many antennas are not completely uniform across the entire UHF band. Most, in fact, are tuned to a certain UHF frequency. At this frequency, gain may be high and the lobe clean. On other UHF channels, however, gain may be very low and there may be many side lobes. A poor VSWR (voltage-standing-wave ratio) can also cause ghosts.













In fringe areas, antennas can be stacked for higher gain (about 3 db). Where signals are really weak, a mast-mounted preamplifier may be required. Another important consideration is the vertical positioning of the antenna. Generally, the higher the antenna, the greater the signal pickup; but the gain curve is not linear. As the antenna is raised, a series of high and low spots will be observed. The trick is to position the antenna in a high spot. A field strength meter can be a big help in locating the high spots.

The UHF Antenna Characteristics Chart on the next page and the UHF Antenna Chart on page 57 can be used as a guide in selecting the best type of antenna for a given installation.

Recommended Antenna Types. In the circular graph on page 90, the broadcasting station is located in the center and each circle represents an increase of 25 miles in radius up to 100 miles away from the station. The resulting

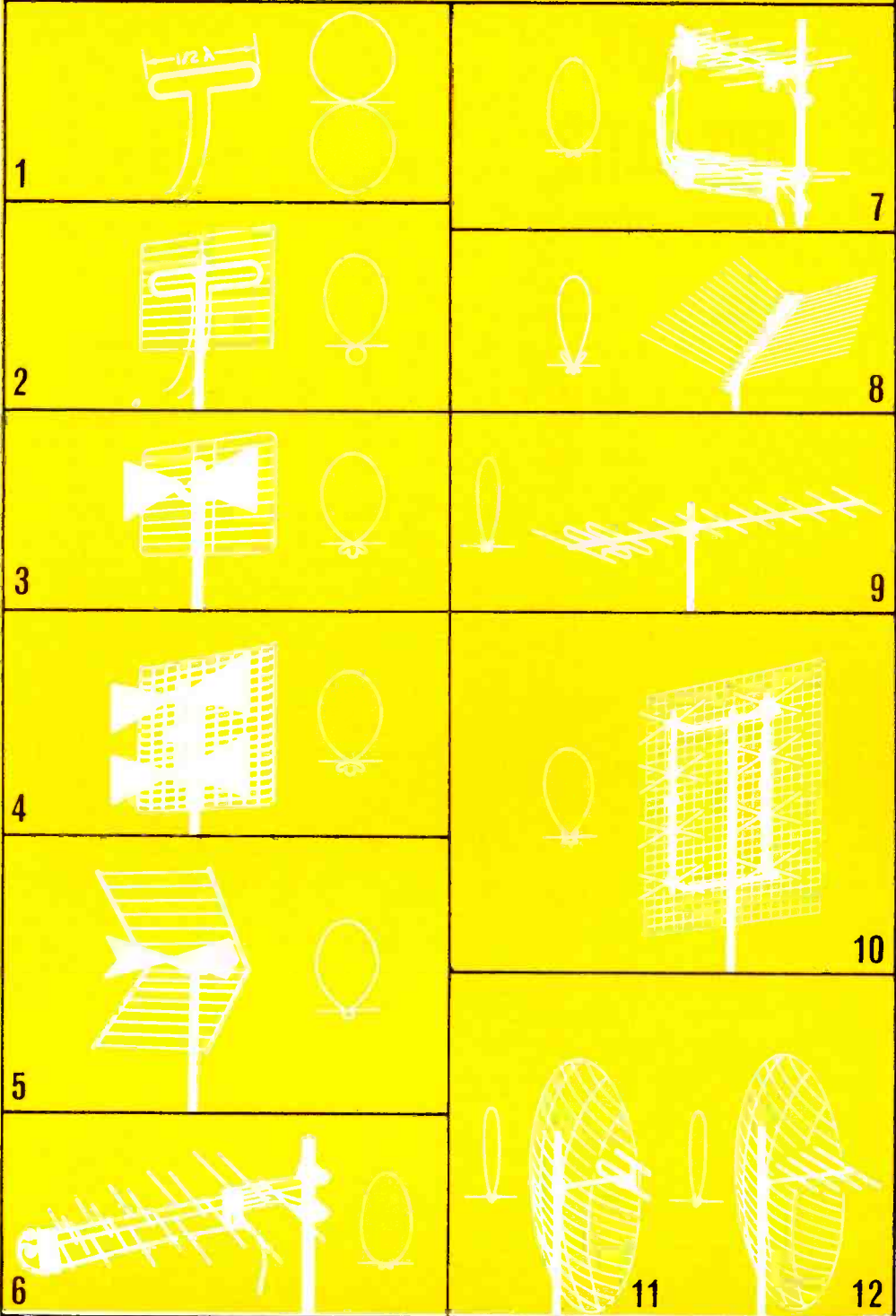
(Continued on page 90)

UHF ANTENNA CHARACTERISTICS

Antenna Number	Antenna Type	Front-to-Back Ratio (average db)	Typical Lobe	Gain Over Isotropic (average db)	Comments
1	Dipole (half-wavelength)	0		2.14	Good for narrow frequency coverage. No front-to-back ratio. No rejection for back path reflections.
2	Dipole with Screen Reflector	under 20		6.24	Good for narrow frequency coverage. Improved front-to-back ratio.
3	Single Bow-Tie with Screen Reflector	under 20		6.24	Slightly greater frequency range than dipole with screen.
4	Two Bow-Ties, Stacked, with Screen Reflector	under 20		9	Better gain than single bow-tie.
5	Corner Reflector	20		11	Limited frequency range.
6	Periodic	over 25		10-11	Uniform gain and VSWR over the entire UHF range. Very good front-to-back ratio.
7	Two Periodics, Stacked	over 25		13-14	Same as single periodic antenna, but there is a 3 db increase in gain.
8	Log Periodic (3/2 wavelength elements)	over 20		10-15	Good uniform gain and VSWR over the entire UHF range.
9	Yagi	over 20		7-17	High gain. Narrow frequency range.
10	Bow-Tie Arrays	20		10-17	High gain. Limited to narrow frequency coverage.
11	Parabolic Dish Reflector Dipole	over 20		16-21	High gain. Narrow frequency coverage. Very narrow beam. Installation is critical.
12	Parabolic Dish Reflector Broad-band Antenna	over 20		16-21	High gain. Broad frequency coverage. Very narrow beam. Installation is critical.

NOTE: The figures given above are average values. Antennas of the same type made by different manufacturers often have a different set of readings.

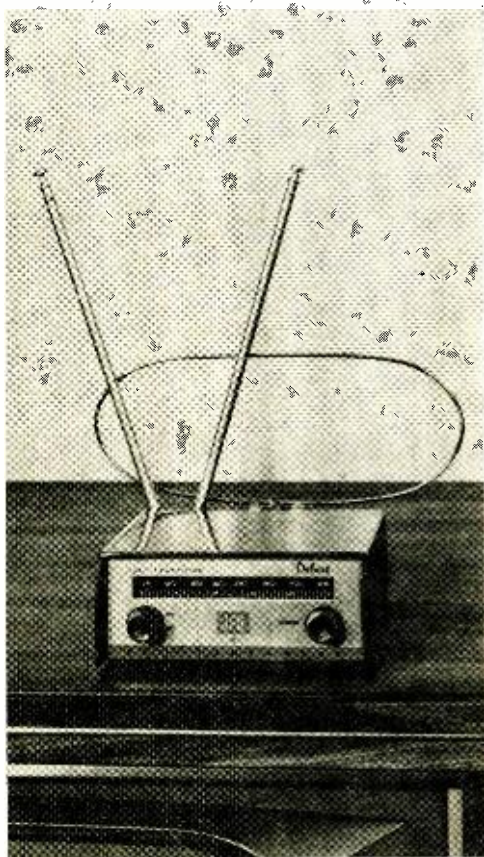
UHF ANTENNAS



ARE YOU READY FOR UHF?

By **JAMES SARAYIOTES**
JFD Electronics Corp.

Expanding interest
in UHF TV creates need for
antennas and converters



All-in-one UHF converter (self-mounted VHF and UHF indoor antennas) is for use in strong signal areas. Made by JFD Electronics, it combines signal pickup and conversion of VHF-only TV sets to UHF.

ON April 30, 1964, commercial ultra-high-frequency (UHF) telecasting became a permanent part of the American home entertainment scene. On that day Federal law decreed that henceforth TV manufacturers would be required to equip all new receivers with 82-channel tuners. In addition, thousands of families have been converting their old VHF TV sets for reception of the new UHF Channels 14 through 83.

These two factors have produced a surge in the growth of UHF TV stations in many parts of the country. Last year approximately 100 new stations began broadcasting on UHF. In 1965, there will be 200 additional UHF stations. Chances are that most TV viewers will be able to watch one or more UHF stations in the near future.

If, like most televiewers, you are currently equipped to receive only standard VHF TV signals (Channels 2 to 13), your problem is how to pick up Channels 14 to 83 when they are broadcast in your area. You have three alternatives:

(1) Have a 70-channel tuner installed in your set. This is most easily done with the later model TV receivers, made in 1962, 1963, or early 1964.

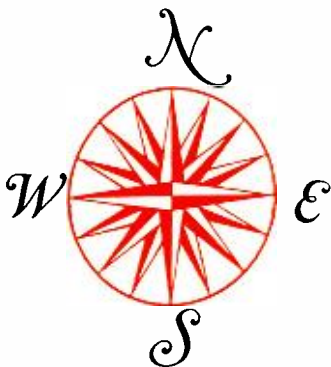
(2) One or more single UHF channel strips can be installed on strip-type tuners inside the set. Unused VHF channel strips are removed and the UHF strip snapped into place. (Wafer-type tuners can't be modified in this manner.)

(3) Place a 70-channel converter on or close to your set, and hook it up to the set's antenna terminals.

You will also need to add a new UHF antenna. Your present VHF antenna is likely to be insensitive to UHF signals, which range from 470 to 890 mc.

Whatever you decide to do about your UHF antenna system, take the necessary time and effort to do it right. You'll find that an investment in a better antenna will provide you with a better and more stable picture.

-30-



ANTENNA ROTATORS PINPOINT SIGNALS

By GARY WAYNE

Rotators resolve
problems of transmitting
and receiving signals
from different directions

WHEN do you need an antenna rotator? There are many situations where a rotator can make the difference between good and bad reception, or the difference between reception and none at all. While many applications of rotators are obvious, there are often rather subtle reasons for using one.

Some reception problems and their solutions are very similar, regardless of the distance of a receiver from the transmitter. For example, many homes are exposed to signals from different directions. One solution to the reception problem in such cases is to put up an individual antenna for each different signal path; another solution is to use an omnidirectional antenna; and still a third is to put up a single antenna with a rotator.

Omnidirectional antennas leave much to be desired. They do not have the gain of other antennas and lack the ability to reject unwanted reflected signals which cause distortion and other signal losses. This type of distortion in a TV receiver usually appears as one or more ghosts; in an FM set, hiss, distortion and loss of stereo can occur; in a color TV set, reflected signals will also prevent the colors from appearing as they really are.

In a fringe or near-fringe area, the antenna should have high gain in addition to being equipped with a rotator. Fortunately, the more directional the antenna, the higher the gain. The ability of the antenna to reject reflected signals is so important that if a choice between high gain and narrow beamwidth has to be made, it is better to sacrifice the gain.

Multi-Antennas. Consider the case for a multi-antenna installation. There are two reasons for putting up more than one antenna: (1) if the range of frequencies is such as to exceed the bandwidth of any single antenna, and (2) if signals are received from more than one direction.

For the signals coming from different directions, use of a rotator is highly desirable. Where both conditions exist

simultaneously, it is possible to mount several antennas on the rotator; the antennas will satisfy the frequency range and the rotator will take care of the directional requirements.

In metropolitan areas, where the signal strength is great and where the reflections are many, highly directional antennas are most important. The high antenna gain, plus the strong signal, is often too much for a TV set, and will cause it to overload and black out. In a way, this is good, because an attenuator can then be used to reduce the strength of the signals applied to the set, and in so doing reduce the reflected signal, which is usually weaker, to a level where it no longer becomes a factor; yet enough of the desired signal is left to drive the receiver properly.

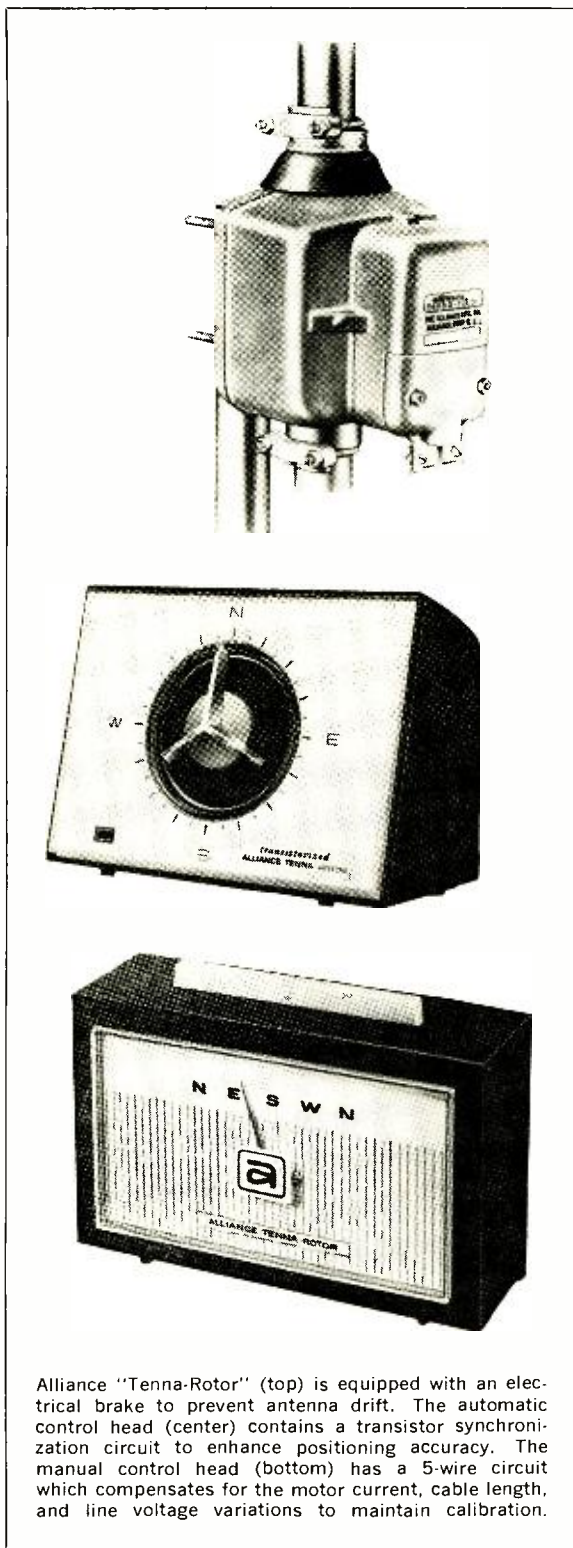
There may be times when one or more tall buildings block the direct signal path; then the solution is to point the antenna to the side or rear, in an effort to catch a reflection. Just as trees grow leaves in the spring and obstruct certain signals (especially at UHF), so do cities sprout new buildings, tanks, and other superstructures.

Rotator Components. Antenna rotators consist mainly of two major assemblies: the control unit near your receiver and the rotator proper which supports and rotates the antenna.

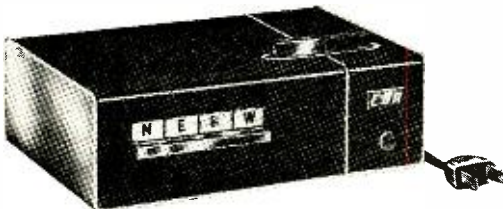
The rotator should be weatherproofed to resist rain, snow, ice and wind. It should not "windmill" but be able to rotate the antenna in a high wind. Different climates impose different minimum requirements for the entire antenna system including the rotator.

The control unit should be easy to use; the markings should be easy to read, and the antenna direction indicator should be fairly accurate. Two basic types of control units are available: manual and automatic. With the manual type, you simply depress a button or bar until the antenna reaches the desired position. With the automatic type, a knob can be rotated to a known position and the antenna will automatically stop at that position.

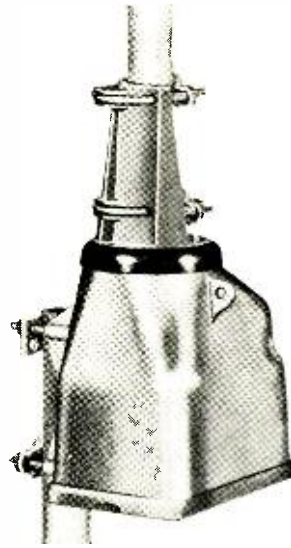
-30-



Alliance "Tenna-Rotor" (top) is equipped with an electrical brake to prevent antenna drift. The automatic control head (center) contains a transistor synchronization circuit to enhance positioning accuracy. The manual control head (bottom) has a 5-wire circuit which compensates for the motor current, cable length, and line voltage variations to maintain calibration.



Cornell Dubilier's distinctive bell-shaped rotator (top) permits top and bottom masts to be mounted in line with each other. A heavy-duty model (not shown) for the heavier amateur antenna beams is also available. Automatic control unit (center) is easy to read. Illuminated compass points on manual unit (bottom) indicate antenna position.



Channel Master's "Tenn-A-Liner" rotator can be aimed in any direction in 1° increments. The automatic control head (center) can be re-synched simply by rotating the knob slightly to the north. A motor in the control head continues rotating the knob until it is again in sync with the antenna. The meter in the manual unit (bottom) indicates antenna position.

CB ANTENNAS THEN NOW AND TOMORROW

By T. R. MERRICK

Inch for inch
the antennas
designed for CB
are the most
efficient radiators
ever developed—
here's how and why



These examples represent two approaches to the problem of shortening mobile antennas. On the left is the Hy-Gain "Topper" with an encapsulated center load. On the right is a Columbia "WonderShaft" with top loading.

AT ONE TIME CB'ers had no problem choosing an antenna—all that was needed was an aluminum rod about 9 feet long. That was seven years ago. Today there's a collection of exotic and business-like antennas that reach up 20 feet or shrink to petunia size. No longer does the drag-strip racer have to buy the same model as the local diaper service. Have CB antennas merely changed in appearance, or have engineers discovered new techniques? The answer is a healthy mixture of both.

The antenna manufacturer is confronted by two rough restrictions. One is FCC law. It keeps overall antenna height down to 20 feet. The other: no shattering breakthrough in antenna theory has occurred since 1888, when Prof. Hertz transmitted sparks to a loop antenna. But in the face of these limitations, the manufacturers have shrewdly introduced a raft of improvements. They whet the CB'ers appetite for hotter performance or for special models to meet individual needs. Now, for example, there's a marine CB antenna that doesn't need a costly ground plate below the waterline. Other models boost a 5-watt signal to 40 watts. One new antenna even changes directivity without rotating! These and other variations prove that the manufacturers haven't been standing still.

Shorter Whips. The best mobile antenna, unfortunately, is a 9-foot whip planted in the center of a station wagon roof. Since that's an impractical mounting point, the big whip usually ends up on the rear bumper. Here it radiates strongest signals an inch or two above the bumper. The resulting signal pattern takes on the shape of a pretzel; energy is blocked in one direction, juiced up in another. Yet, many hard-core CB'ers staunchly abide by the quarter-wave whip, even enjoying the backlash when the car brakes are touched.

There has been some welcome progress, however, in the shortened whip. Once considered inefficient by comparison, the 2-, 3- or 4-footer now enjoys wide acceptance. A key reason is that manufacturers took a second look at the loading coil: the necessary evil that allows the whip to be shortened.

Manufacturers used to place the coil down low so it wouldn't be subject to

damage; neither would it cause antenna sway (which results in fluttering signals). Electrically, however, the base-load was plagued with the same problem as its big 9-foot brother on the bumper. Most of the signal left the antenna from the bottom. If it was positioned on a side cowl or rear deck, much of the signal struck the car roof. So coils began to move up the whip, pulling the radiated signal into the clear.

One technique that made the move practical was the slimmer and trimmer coil. Instead of an outside, heavy winding, the coil became just a thickening in the antenna shaft. An example is Hy-Gain's "Topper." A close look reveals a bulge in the top half which contains the loading coil. The height of the antenna is just 29", which makes it convenient for roof-top mounting.

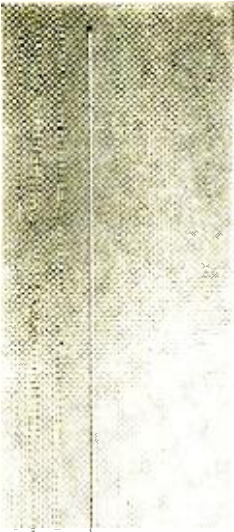
In some shortened whips, you'd be hard-pressed to find the loading coil. Take the Columbia unit, for example. Its narrow shaft rises 4 feet. At first glance it appears to be a continuously loaded whip, that is, a spiral of wire embedded in fiberglass which runs from bottom to top. Not so in this model. A narrow coil is hidden in the top section.

The shrinking coil also appears in Master Mobile's "Range Buster." It's nearly a full-size whip, but the small loading coil permits 3 feet to be lopped off the standard 9-foot length. Note, too, the fold-over feature so the antenna can clear garage doors.

Thus, the trend in mobile whips is marked by shorter length and a migration of the coil from bottom to top. In



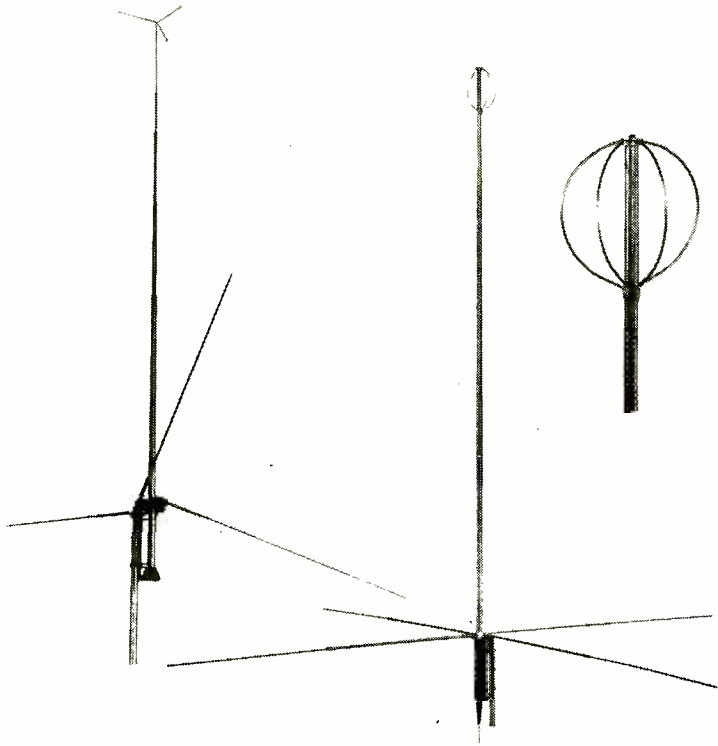
To use a CB antenna for AM broadcast-band radio reception, a coupler must be installed (it takes only two minutes) to keep the signals separate. The coupler shown here is manufactured by B & K/Mark (division of Dynascan Corp.) as model number CBC-1.



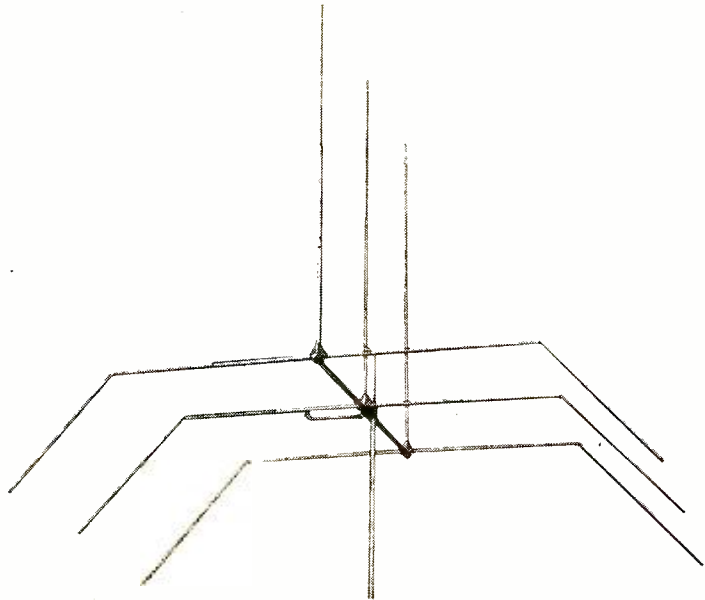
... the antenna is mounted on a base insulator which is attached to the deck or side of a cabin. The antenna is made of a single wire which is supported by a bracket at the base. The antenna is made of a single wire which is supported by a bracket at the base. The antenna is made of a single wire which is supported by a bracket at the base.



A Columbia "Big Stick" CB marine antenna needs no grounding plate. It has brackets for mounting on the deck or side of a cabin. Base insulator has fold-down provision for low bridges.



These antennas provide base stations with signal gain at no loss in omnidirectional coverage. At left is the Hy-Gain CLR2, at right the A/S "Super Magnum."



Either horizontal or vertical polarization can be radiated by the A/S MR-77. Two feedlines to the transceiver are required, as well as a sturdy rotator.

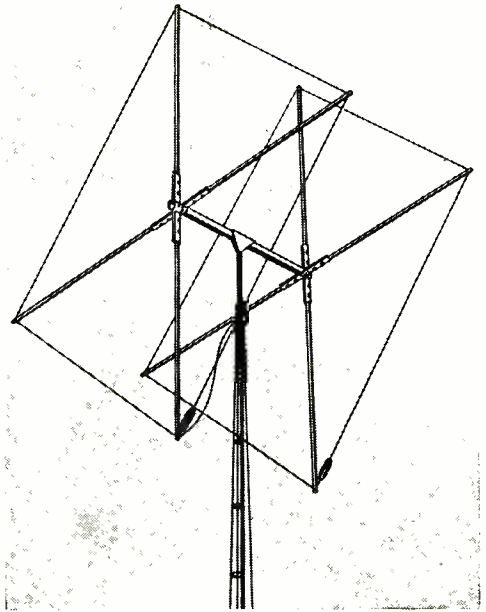
many instances, the short whip high on the car rivals the performance of a 9-footer not so favorably located. And if you want to make that whip do double-duty—work for both CB and a regular AM radio—try a diplexer. A unit like the B & K/Mark coupler neatly splits CB and AM signals with no need for switching. It has a network to keep transmitter power out of the regular car radio. Incoming signals, CB or AM, are channeled to the correct points.

Marine Antennas. The CB-boating enthusiast has finally come into his own. In earlier years, he had to compromise with a standard mobile or base-station antenna. Neither type is suited to marine operation. Mobile whips must work against a ground system (like the metal of a car). To get top efficiency, the boat-owner would need to have an extensive grounding system installed on the bottom of the hull. Base antennas have unwieldy radial elements or inadequate mountings for marine use. Today, there are special marine types designed for the typical small boat.

The Columbia "Big Stick Wonder-Shaft," for example, is an 18½-foot coaxial unit which needs no ground system; it's self-contained. The top half of the antenna is similar to a 9-foot whip. The lower half has an equivalent 9-foot section to provide the ground effect. Also in the lower half is a special matching system for correct coupling into the CB transceiver. Weatherproof construction and a versatile mounting system make the antenna a good bet for the small-boat owner. Signal range over water can be 25 miles or more.

Base Station. While mobile antennas strive to get radiation up and in the clear, base station antennas attempt to get it down. A contradiction? Not if mobile and base operations are compared. Low radiation on a car means obstructed signals. This is usually no problem at the base station since the antenna is generally mounted at a fairly high point—so high, in fact, that a good portion of the signal rides above a distant receiving antenna, or is lost beyond the horizon. A major trend in base antennas, therefore, is to lower the angle of radiation.

Early base station antennas were mainly ground planes: 9-foot verticals



This cubical quad antenna is a CB adaptation of a popular ham radio beam. Sold by Master Mobile, the quad must be rotated for maximum effectiveness.

with drooping radials to provide an electrical ground. They survive today mostly because they're relatively inexpensive. New-type base antennas, however, not only bring down radiation angles but provide a magic ingredient—gain. The precious signal that once shot out at high, useless sky-wave angles is squashed down where it counts—close to the earth.

One of the most popular base types today is the collinear antenna. Extending nearly to maximum 20-foot height, it relies on a fancy coil and matching network to make the antenna perform as if it were 36 feet high. But its value is not so much in length as in the effect on radiation patterns. A signal leaving the collinear is extremely low in angle. Most energy is concentrated under 1 degree—almost flat out. The ground-plane radiates at 5 or more degrees, aiming much of its signal skyward. The collinear offers solid gain in all desired directions. It makes a 5-watt signal sound like 10 watts to the distant sta-

tion. Illegal? Not at all. As long as power multiplication occurs in the antenna, not the transmitter, it can go to any theoretical limit.

The collinear antenna provides just about the highest gain you can get while still remaining in the nondirectional class. The power increase occurs over 360 degrees. Collinears, too, provide a distinct advantage in receiving. Since elements are grounded to the mast (through a coil), static tends to be short-circuited. The 27-mc. signal remains unaffected.

Directional Antennas. With a whopping boost up to about 40 watts, the beam antenna dominates the high-power field. Unless it's used between two fixed points, it requires a rotator to aim the signal in the desired direction. A typical 5-element beam is manufactured by Mosley.

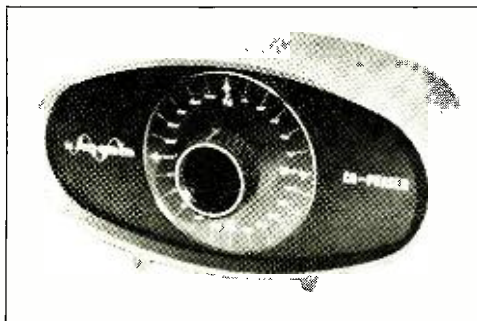
How the big beam antenna can boost a 5-watt signal up to 40 is a matter of juggling signal pattern. All available power is squeezed into a narrow horizontal arc. A 5-element beam consists of a radiator, reflector and 3 directors. The radiator is driven directly by transmitter power. As the signal attempts to travel in the wrong direction, it hits the reflector and is bounced back in the desired direction. The three director elements pick up energy and reradiate it. The net effect is to strengthen and compress the signal in the desired direction.

A novel variation on the directional beam is the combination horizontal-vertical unit made by Antenna Specialists (A/S). It is actually two antennas, each requiring its own feedline. The CB'er has the option of quickly selecting horizontal or vertical polarization. Vertical polarization is standard in CB since the mobile whip lends itself to this type of operation. Two CB stations, each with horizontal antennas, could net certain advantages. For one, the antennas tend to reduce interference from other CB'ers. There's some signal loss due to cross-polarization. Just as important is that noise which radiates vertically—from automobile ignition and other sources—tends to be reduced.

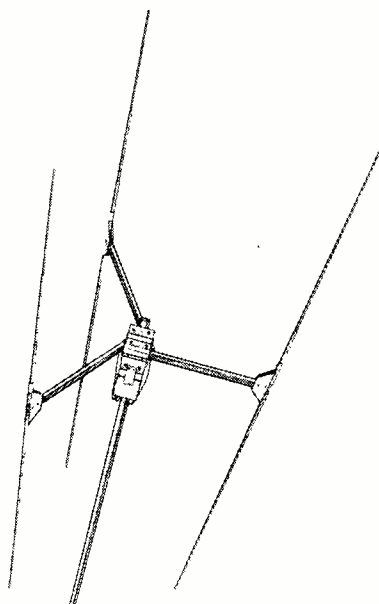
Another highly directional antenna is the cubical quad by Master Mobile. Its gain with 2 elements is comparable to that of a standard 3-element beam.

Like a regular beam, one side acts as the radiator, the other serves as reflector. Polarization of the quad is circular (both horizontal and vertical).

Two major antenna manufacturers have triggered off what could be an important trend in directional antennas. It's the beam that doesn't rotate. Elements remain fixed in place; the signal swings electronically. Hy-Gain's "Co-Phaser" is a small control box that can impart a beam effect to any two identical CB antennas mounted 9 feet apart. Inside the box are lengths of coaxial



Operating control of Hy-Gain "Co-Phaser" is used to beam energy of two CLR antennas spaced 9 feet apart. CB'ers can choose one of three lobe patterns.



With one element acting as a radiator and the other two as directors, the A/S "Scanner" antenna also offers beaming effects from a stationary position.

cable and an elaborate switching system. The cables act as transformers to match up the two antennas. Also, they provide a time delay in the signal going to one antenna. This creates an out-of-step condition between elements, and signals add and cancel in different directions. The operator can choose one of three major patterns by switching the front-panel selector.

Let's say the two antennas are mounted along an east-west line. For one switch position, the signal is more than doubled in power to the east. Another position produces the same effect to the west. In the final position, identical signals are transmitted to the north and south. Depending on the particular installation, the CB'er can select his major areas of maximum power. And pattern switching is fast—there's no waiting for a mechanical rotator to swing around.

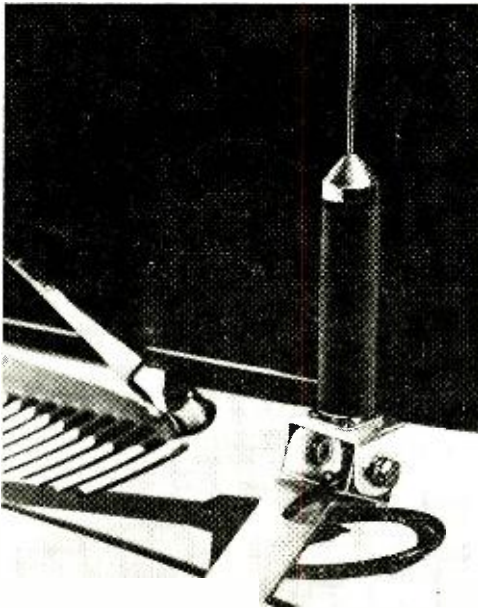
Another entry in the electronic beam field is the "Scanner" by Antenna Specialists. The array consists of three 17½-foot elements. These verticals are connected to relays housed at the top of the mast. As the CB'er switches his control box, the relays activate one of the elements. Now, the two other ele-

ments become reflectors to focus the signal in the desired direction. In this manner, the pattern, not the elements, can be shifted around the compass. It covers 120 degrees at a time. To inform the CB'er of the active direction, three neon indicators are located on the control-box panel. In each of the three directions, the 5-watt signal is multiplied to about 30 watts.

Future Improvements. The antenna manufacturers, despite legal and electrical limits, have managed to develop a remarkable diversity of CB antenna types. It's safe to assume that even greater improvements are in the offing. Intense antenna research in aerospace has led to some practical developments in CB.

The electronic beam, for example, was developed for massive missile tracking antennas too big to rotate conveniently. Fiberglass whips first flew on helicopters and other military vehicles. Solid-state coils, improved metal-treating and use of tough plastics like Cylolac have significantly benefited CB. And if some university lab upsets today's basic antenna principles, chances are that any forthcoming improvements will be snared for CB.

-30-



Webster developed this unusual mounting for lightweight CB antennas. The base bracket fits into groove between car body and trunk or engine hood.

GET LITERATURE BEFORE DECIDING

The manufacturers listed below will gladly send details on the various CB antennas they have for sale. Since this article just discusses a few types that are available, the Editors urge interested readers to write to the manufacturers for more information.

The Antenna Specialists Co.

12435 Euclid Ave., Cleveland, Ohio 44106

B & K/Mark

1801 W. Belle Plaine Ave., Chicago, Ill. 60613

Columbia Products Co.

R.F.D. 3, Columbia, S.C.

Francis Industries

Pataskala, Ohio

GC Electronics

Rockford, Ill.

Hy-Gain Electronics Corp.

8495 N.E. Highway 6, Lincoln, Nebr.

L-Coil Research

Brighton, Mich.

Master Mobile Mounts

4125 W. Jefferson Blvd., Los Angeles, Calif. 90016

Mosley Electronics, Inc.

4610 N. Lindbergh Blvd., Bridgeton, Mo. 63044

New-Tronics Corporation

3455 Vega Ave., Cleveland, Ohio 44113

Telrex Laboratories

Asbury Park, N.J.

Webster Mfg. Co.

317 Roebling Rd., S. San Francisco, Calif.

KNIGHT-KIT MODEL KG-275 EXPOSURE METER

ELECTRONICS conquered yet another realm a few years ago when the first battery-operated exposure meters using cadmium sulphide photocells appeared on the market. These sensitive "electronic" meters were a revelation to photo bugs: At last it was possible to make meaningful light measurements in something other than sunlight.

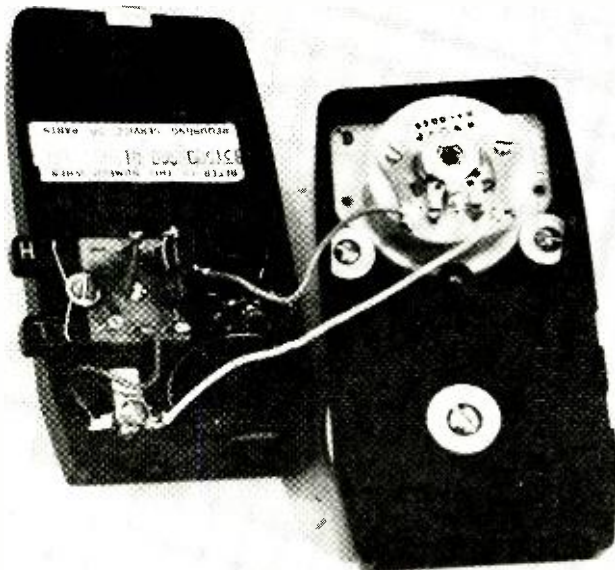
Undoubtedly the CdS exposure meter is destined to become very popular, and one thing which will help make it so is the introduction by Allied Radio of the KG-275 two-range exposure meter kit. Design, price (\$15.88), and styling of the Knight-Kit unit are very attractive, and there appear to be almost no comparable competitive units.

Putting the kit together is a job easily accomplished in a single evening. Parts include the range switches, four precision resistors, a potentiometer, the photocell, batteries and hardware. There are only ten solder joints.



The sensitivity of the KG-275 is 0.014 to 28 footcandles on the low range, 28 to 28,000 footcandles on the high range. ASA film speed settings are provided from 6 to 12,000, *f* stop settings from 0.5 to 64, and shutter speed settings from 1/4000 second to 30 minutes. So sensitive is the meter that you can even take readings in the moonlight!

Circle No. 86 on Reader Service Page 15



Completed exposure meter is shown above; the two push buttons at the right select either low-light or high-light ranges. The large dial contains a wide range of ASA, *f* stop, and shutter speed settings. Also included are windows showing cine and EV settings. Construction of the meter is a simple matter (see photo at left), involving few parts and little soldering. The meter can be instantly calibrated for battery and other changes by adjusting the potentiometer fastened on the back.



Monthly Short-Wave Report

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

NOTES FROM YOUR SHORT-WAVE EDITOR'S DESK

THE RESULTS of the 1964 Station Popularity Poll conducted by the International Short-Wave Club of London have been announced. The winner, with a total of 1131 votes, is *Radio Nederland*. In a very close second place, with 1121 votes, is *Radio Australia*.

Others in the top ten include: BBC London (914); Swiss B/C Corp. (883); *R. Canada* (777); *Voice of America* (533); *R. Japan* (298); *R. New York Worldwide* (291); *R. Sweden* (266); and *Deutsche Welle* (237). Honorable mention may also be given to the following: HCJB (196); Prague (146); Moscow (118); and Portugal (116).

Since 1950, *R. Nederland* has gradually moved up towards the top position in this annual poll. The other stations in the first five places continue to maintain approximately the same positions in the poll from year to year.

The "Local" Broadcasting Problem. In the February issue, we discussed a plan being considered that would pave the way towards abolishing "local" or regional broadcasting on the short-wave bands. Your Short-Wave Editor wrote to the International Frequency Registration Board (Place des Nations, Geneva, Switzerland) about this plan and received a reply from M. N. Mirza, chairman. His letter, in part, reads as follows:

"... I refer to Recommendation #30 of the Panel of Experts established for the purpose of devising ways and means of relieving the pressure on the radio spectrum between 4 and 27.5 megacycles. The recommendation reads:

"(1) Those broadcasting services in the bands between 5950 and 26,100 kc., which, by reason of their service ranges, can be accommodated in other parts of the radio spectrum, shall be removed from the bands between 5950 and 26,100 kilocycles by 1 January 1970.

"(2) No new broadcasting services which,

by reason of their service ranges, can be accommodated in other parts of the radio spectrum, shall be permitted in the bands after 1 January 1967."

Since the 60-, 90-, and 120-meter tropical bands are evidently not affected by this recommendation, there would seem to be a simple solution to the congestion problem: the regional stations could move into the tropical bands. However, there are stations within the affected range of frequencies lo-



The Hallicrafters S-20R "Sky Champion" receiver and DB-20 preselector in the shack of WPE6AKA, Serge Neumann, II, Culver City, Calif., have pulled in 108 countries for him, 90 of them verified.

Two receivers—a Hallicrafters SX-99 and Hammarlund HQ-100—are used by Richard Bender, WPE2MAJ, Hoboken, N.J., plus a crystal calibrator and Q-multiplier. His shack wall speaks for itself.



ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

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

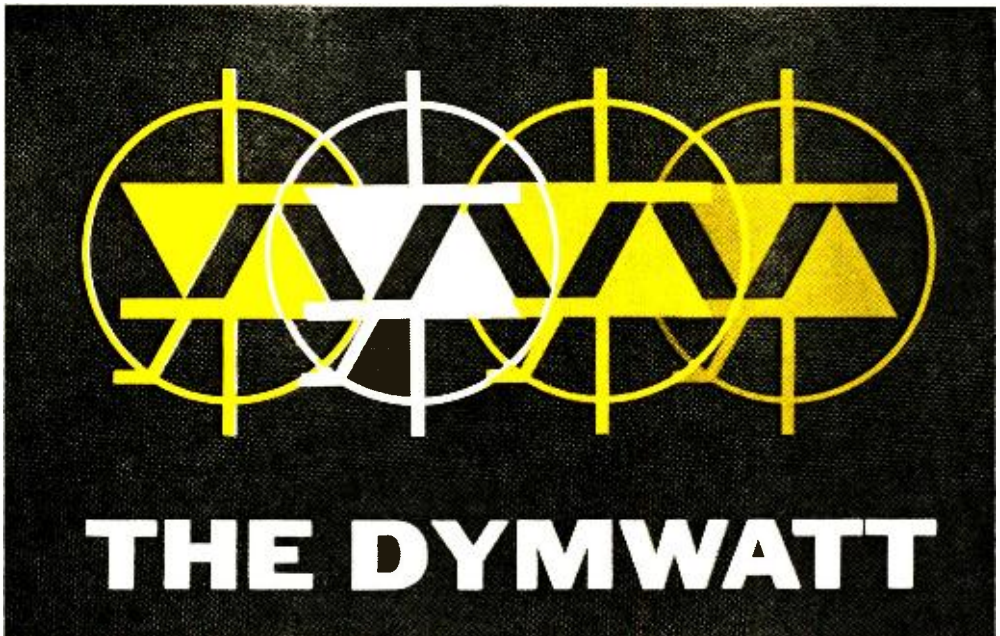
COUNTRY	STATION	FREQUENCY (kc.)	TIMES (EST)
Argentina	Buenos Aires	11,780, 9690, 6090	2200, 0100 (Mon.-Fri.)
Australia	Melbourne	17,840, 15,220	2030, 2130, 2230
		9580	0745
Bulgaria	Sofia	6070	1950, 2300
		7290	1630
Canada	Montreal	15,190, 11,760, 9625	1800 (Caribbean)
		9625, 5970	0215, 0300 (W. Coast)
		5970	0800
Congo (East)	Leopoldville	11,755	1630
Congo (West)	Brazzaville	15,370, 11,930	1430
Czechoslovakia	Prague	11,990, 9795, 7345, 7115, 5930	2000, 2230
Denmark	Copenhagen	15,165	0730
		9520	2100
West Germany	Cologne	11,795, 9640, 9545	1010
		9640, 6160	2040
		9735, 9575, 6160, 6145	0000
Hungary	Budapest	9833, 9540, 7305, 6234	1930, 2030
		9833, 7305, 7215, 6234	2200, 2330
Italy	Rome	9575, 5960	1930, 2205
Japan	Tokyo	15,135, 11,780	1900
Jordan	Amman	9555	2015
Lebanon	Beirut	9750	2130
Netherlands	Hilversum	15,425, 11,950	1130 (Tues., Fri.)
		15,425, 11,730	1535 (Tues., Fri.)
Netherlands Antilles	Bonaire	9685	2300
Portugal	Lisbon	6185, 6025	2100, 2245
Romania	Bucharest	9590, 9570, 9510, 7225, 6190, 5990 (9570 not used at 2030)	2330, 2200, 2030
Spain	Madrid	11,715, 9615, 6140	2200, 2100, 2000
Sweden	Stockholm	15,300	0900
		5990	2215, 2045
Switzerland	Berne	9535, 6105, 6080	2015
		15,305	2315
Turkey	Ankara	15,165	1700
United Kingdom	London	15,300, 11,860	1100
		9510, 6195	1700, 1800, 1900, 2100
U.S.S.R.	Moscow	15,180, 15,140, 9730, 9660, 9640, 9630, 9570, 9540, 7360, 7330, 7320, 7310, 7290, 7250, 7240, 7230, 7200, 7150, 7130, 6070 (may not all be in use at any one time)	1730, 1900, 2000, 2100, 2300, 0040
Vatican City	Vatican City	9645, 7250, 5985	1950

cated in countries that do not have tropical frequency allocations. It is not known at this time if such stations would be permitted to continue operating on their present frequencies when and if the plan goes into effect.

BCB Loggings. One of our Monitor friends in the New York area reminds us that it is entirely possible to log four countries on one medium-wave outlet within a couple of hours—if you happen to be lis-

tening when conditions are just right. On 800 kc., for instance, late in the afternoon, you can catch one of the U.S. daytime stations. Then, after it signs off, you can go after CKLW, Windsor, Ontario (Canada); PJB, Bonaire (Netherlands Antilles); and XELO, Ciudad Juarez (Mexico). The last three are all high-powered and are being reported in nearly all parts of the United States.

Last fall we ran a listing of beacon
(Continued on page 104)



By DON LANCASTER

Build a full-wave motor speed control and light dimmer with new Triac semiconductor and four other components

MEEET the "Dymwatt." It's a no-nonsense light dimmer and power-tool speed control that provides up to 600 watts of 117-volt a.c. with a symmetrical waveform and full-range, variable power output. The circuit uses only five electronic parts and fits in the palm of your hand.

With the Dymwatt, you can get precise control of incandescent lights, photo-floods, soldering guns and irons, and electric drills. It will also control any motor rated up to $\frac{1}{2}$ horsepower and equipped with brushes—including most, but not all, sanders, fans, and electric mixers. The only things this control can't handle are fluorescent lights and induction motors—but neither can most of the ordinary power controls.

The two special parts in the circuit, *Q1* and *D1*, price out at \$6.98 and \$2.25 respectively. This puts the Dymwatt's cost at less than \$10 if you've got a volume control, a box, and two stock capacitors.

The "Triac." Older control designs call for SCR's. A single SCR provides

a half-range type of control, as between half and full brightness, or between zero and half brightness. To provide full-wave, full-range control, you have to add parts—usually a second SCR, a single mechanically switched diode, or a full-wave bridge rectifier.

The "Triac" is a new semiconductor which makes possible full-wave control without the need for all the extra components. The electrical equivalent of SCR's back to back, it operates equally well in both current directions, and with either a positive or negative gate pulse!

Two of the Triac's three leads (*T1* and *T2*) are connected in series with the load. The third connection is the gate lead (*G*). (The designations *T1* and *T2* simply mean terminal 1 and terminal 2. Designations of anode and cathode, unfortunately, cannot apply in this case. An equivalent set of components for the Triac would contain seven transistors and several resistors.)

A small signal pulse can trigger the Triac so that it will fire just like a thyatron, and switch on full or partial

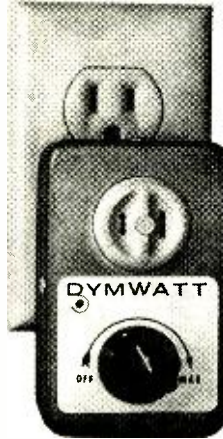
power to the load. Conduction stops when the current through the load circuit drops to zero. This happens every time the a.c. voltage goes through zero. It also happens when the load is removed, or the circuit is opened.

How It Works. Current through potentiometer *R1* (see Fig. 1) charges capacitor *C1* up to 30 volts, which is the breakdown voltage of the special pulse diode (*D1*). At 30 volts, the pulse diode "snaps" on and delivers a pulse to the Triac gate. The Triac then turns on, allows full current flow through the load, and shorts out the *R1*, *C1* circuit. Diode *D1* keeps conducting until *C1* is discharged, and then turns off. The Triac continues to conduct until the a.c. line voltage alternates and goes through a zero.

The larger *R1* is, the longer it takes to charge *C1* and the longer it takes to turn on the Triac. The fact that the Triac shuts off at the end of each 1/2 cycle of line voltage, plus the delayed start of conduction, reduces the conduction time and the effective voltage (r.m.s.) accordingly. Thus, it becomes apparent that increasing or decreasing

the value of *R1* controls the r.m.s. voltage. See Fig. 2.

If *R1* is nearly zero in value, *C1* charges very rapidly, and nearly full power reaches the load. If *R1* is very large in value, *C1* never reaches 30 volts within the 60-cycle swing. With each alternation of voltage, *C1* starts to charge in the other direction. Under this condition, gate pulses cannot be



Finished Dymwatt can be plugged into one opening of a duplex receptacle without obstructing the other. You have a choice of using the controlled or noncontrolled outlet. Cost of this full-wave unit is less than that of commercially available half-wave controllers.

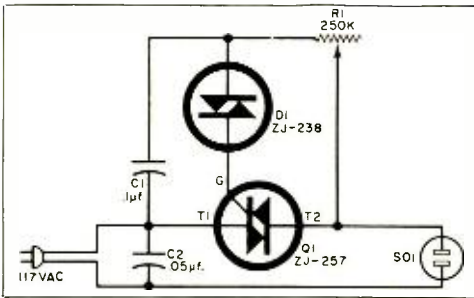
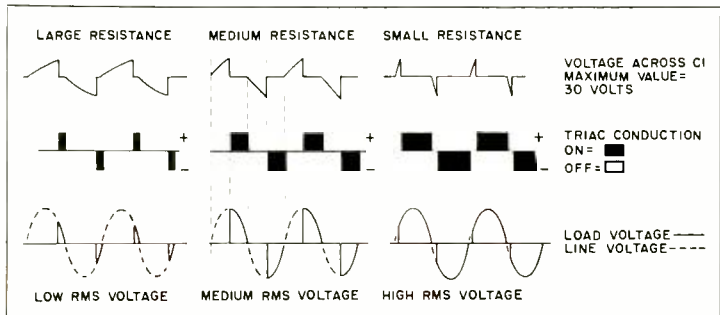


Fig. 1. The Triac (Q1) will conduct in either direction. A positive or negative gate pulse can trigger conduction and control r.m.s. output voltage.



The heat sink on the inside of the case and the dial plate on the outside are held in place by a rivet (hidden by the capacitor) and the potentiometer nut.

Fig. 2. When *C1* reaches 30 volts, *D1* conducts and triggers *Q1*. The sooner the gate pulse is developed with respect to the 60-cycle line voltage, the higher the effective output voltage. With little or no resistance in the circuit, the output is maximum. As the resistance increases, the output decreases. If the resistance is made high enough, the output is 0.



produced and the Triac remains cut off. By making *R1* variable, it is possible to adjust for maximum or minimum power output.

Capacitor *C2* is directly across the line to prevent any high-frequency pulse, which might be set up by the fast switching action of the Triac, from radiating down the power line and becoming a source of radio interference.

Construction. The Triac should be mounted on an aluminum heat sink. A 1/8"-thick piece of aluminum will do the trick. Bend it in a vise or small brake and then drill the holes. Use insulated mounting hardware and silicone grease to mount the Triac, as shown in Fig. 3. The Triac *must* be electrically insulated from the heat sink. Test the setup with
(Continued on page 95)

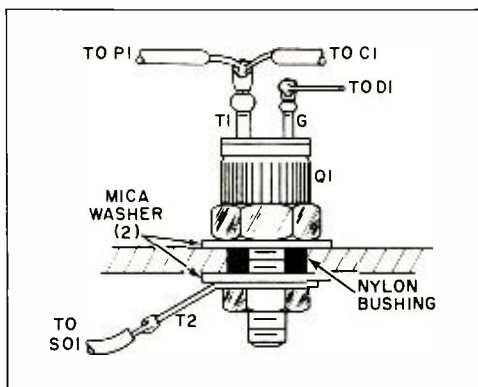


Fig. 3. Silicone grease, two mica washers, and a nylon bushing are used to mount Triac on heat sink to get thermal conduction without electrical contact.

PARTS LIST

- C1*—0.1- μ f., 600-volt capacitor
- C2*—0.05- μ f., 600-volt capacitor
- D1*—General Electric ZJ-238 diode, 30-volt avalanche trigger (or Transitron ER-900, or Texas Instruments TI-43)
- P1*—A.c. plug (Amphenol 61-M or equivalent)
- Q1*—General Electric ZJ-237 Triac
- R1*—250,000-ohm carbon potentiometer, linear taper
- SO1*—A.c. socket (Amphenol 61-F or equivalent)
- 1—2 1/4" x 2 1/4" x 1/4" case, and cover
- Misc.—Silicone grease, knob, 1/8" "Pop" rivets, spaghetti, solder, wire, nameplate, and 1/4" solderless terminal, 2 1/4" x 1 7/8" x 1/8" piece of aluminum, etc.

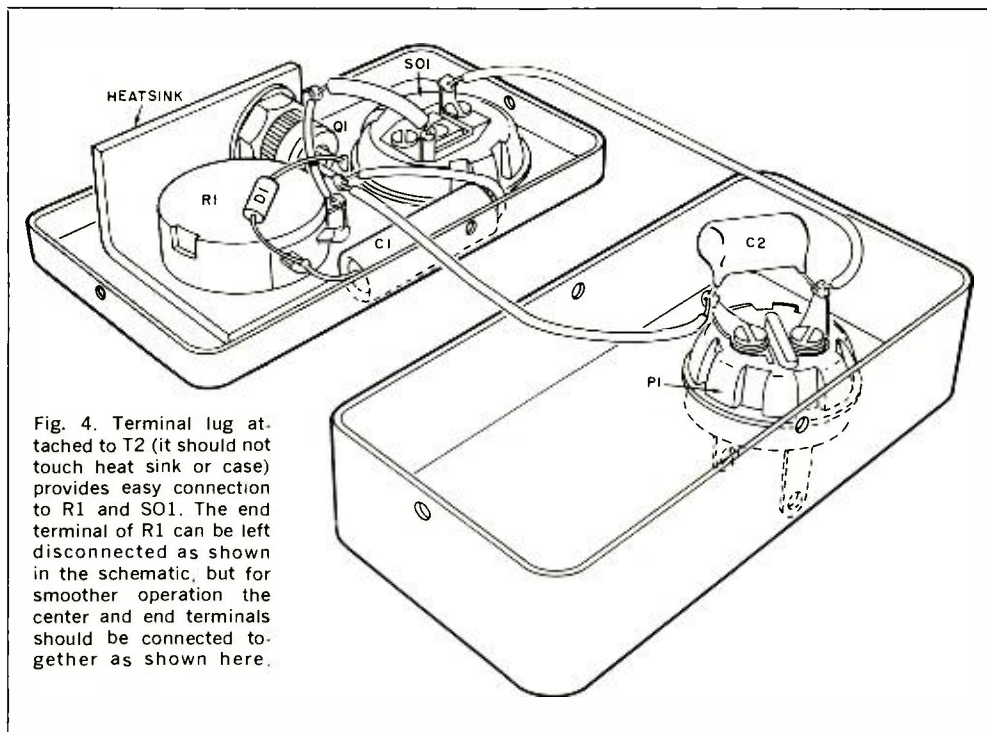


Fig. 4. Terminal lug attached to T2 (it should not touch heat sink or case) provides easy connection to R1 and SO1. The end terminal of R1 can be left disconnected as shown in the schematic, but for smoother operation the center and end terminals should be connected together as shown here.



Transistor Topics

By LOU GARNER, Semiconductor Editor

LAST MONTH we talked about the new gallium arsenide semiconductor developed at Bell Telephone Laboratories. This month we'll cover another gallium component currently being worked on: the gallium phosphide diode, which is used to modulate light waves. Two Bell scientists, Drs. D. F. Nelson and F. K. Reinhart, have been conducting a series of experiments to gain a basic understanding of the interaction of light with a semiconductor.

The optical properties of gallium phosphide are of interest because its transmission band lies within the operating frequency range of many lasers. It is only recently, however, that scientists have been able to control the chemistry of gallium phosphide so that they could investigate its properties.

One of the well-known properties of gallium phosphide is that it emits light when a forward bias is applied to it. By applying a reverse bias, light from an external source can be modulated. This is a linear electro-optic effect which appears as phase modulation; it is known as the Pockels effect. (The index of refraction of piezoelectric crystals is altered when a strong electric field is applied to them.)

In the case of gallium phosphide diodes, the effect takes place in the *pn* junction region when reverse bias is applied. The gallium phosphide in the junction region changes from an optically isotropic medium to a birefringent medium; or, in other words, from a crystal which has the same optical properties in all directions, to a crystal which has different optical properties in different directions.

The gallium phosphide diodes are basically phase modulators but can be converted for use as amplitude modulators. They can achieve large phase differences with small voltages (the phase difference is approximately proportional to the bias); they can

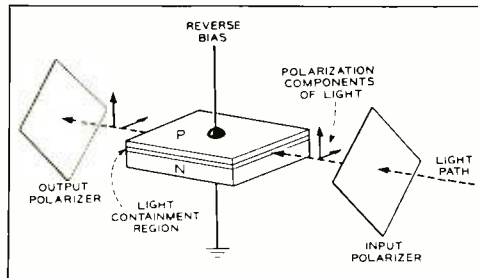
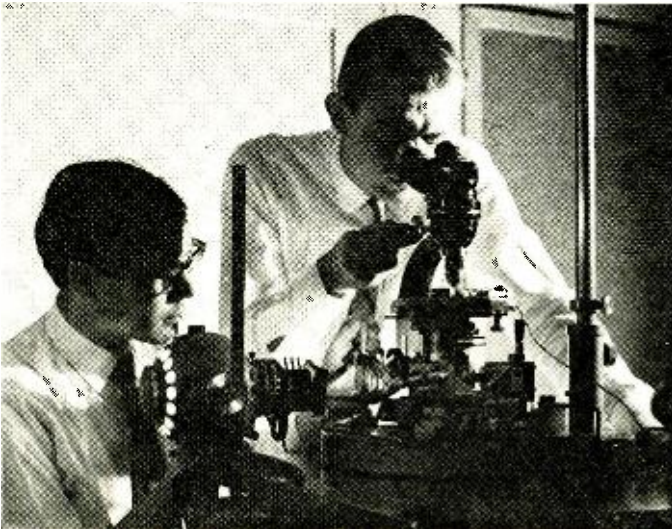


Fig. 1. Light waves passing through the *pn* junction of a gallium phosphide diode are modulated by an applied electric field. Light modulators are an important part of gear needed to work with laser beams.



Scientists Dr. Franz Reinhart (left) and Dr. Donald Nelson of Bell Labs are shown at work on one of a series of experiments being conducted to learn more about the interaction of light with a semiconductor.

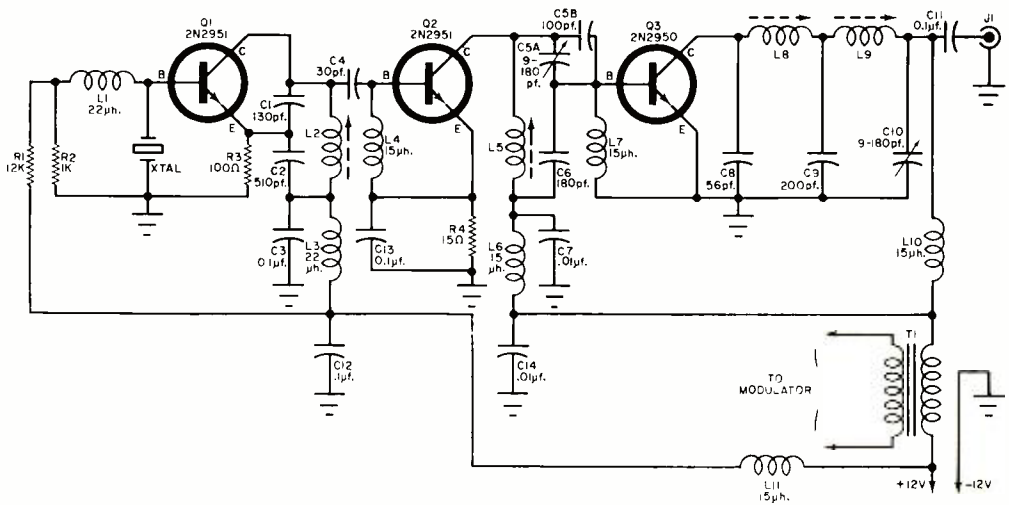


Fig. 2. Three-transistor, 2.5-watt r.f. transmitter circuit from Motorola operates in the 27-mc. Citizens Band. Appropriate changes of tuned circuits will enable this transmitter to operate on the ham bands.

be operated at room temperature; the length of the light path is short; and high-frequency modulation appears feasible.

To achieve phase modulation, polarized light is focused on an edge of the diode *pn* junction (see Fig. 1). The light is decomposed into two equal components and then guided along, and confined to the plane of the junction. Birefringence causes the two polarization components of the incoming light wave to travel at different velocities while in the *pn* junction. A change in velocity is tantamount to phase modulation of each polarization component. Amplitude modulation is accomplished by passing the phase-modulated components through a second output polarizer.

In their experiments, Drs. Nelson and Reinhart applied 31 volts to a gallium phosphide diode and measured phase differences up to 140° for green light of 5460 angstroms. This means that up to 88% of the light intensity entering the diode can be amplitude-modulated. The length of the diodes—which is also the length of the light path—is approximately 0.025 inch.

A mercury arc and a helium-neon laser were used as light sources, although any source that emits light in the gallium phosphide transmission range is suitable. One problem, however, is that the light must be coupled into the extremely narrow *pn* junction region which is only 5-10 microns thick. For this reason, finely focused light such as that generated by lasers is desirable. The scientists also observed light modulation by this effect in gallium arsenide and silicon carbide diodes.

This work is an outgrowth of earlier studies by Drs. A. Ashkin and M. Gershen-

zon, also of Bell Laboratories, who in 1961 suggested the use of reverse-biased *pn* junctions as light modulators.

Manufacturer's Circuit. Your Semiconductor Editor's mail generally includes a batch of requests for an all-transistor transmitter circuit. A practical circuit is shown in Fig. 2. Described in "Applications Engineering Report Number 101," this r.f. transmitter was designed by engineers at Motorola Semiconductor Products, Inc. (Phoenix, Ariz.). Although intended for use in the 27-mc. Citizens Band, the circuit should be equally suitable for amateur radio applications if appropriate changes are made in the tuned circuits.

With a c.w., r.f. output of 2.5 watts, the basic transmitter requires less than half an ampere at 12 volts d.c. for operation. When used as a radiotelephone transmitter, it requires only 2 watts of audio power for 80% upward modulation. Audio distortion is less than 5%.

The circuit employs three *npn* transistors. The common-emitter configuration is used in all three stages. Transistor Q1 serves as a Colpitts crystal oscillator. Component values are such that L1's tuning range covers the entire Citizens Band, yet detuning this coil does not cause subharmonic oscillation. The r.f. choke (L1) in the base circuit is self-resonant at 27 mc. This keeps the bias network, R1-R2, from loading the feedback path and thus insures smoother tuning of L2.

The r.f. signal supplied by Q1 is coupled to the driver stage, Q2, through C4; this capacitor can be made variable, if desired, for convenient drive adjustment. Transistor

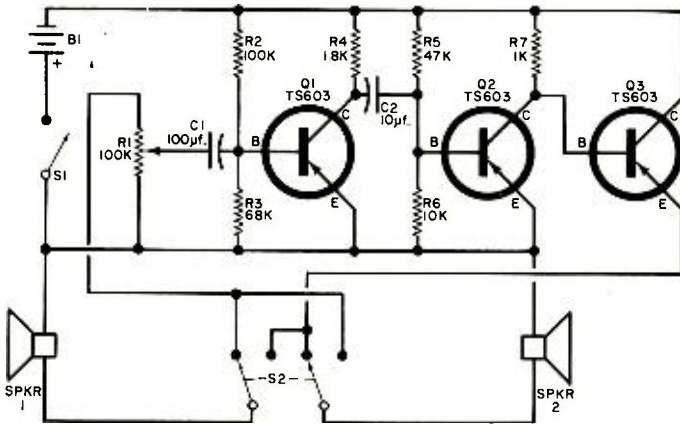


Fig. 3. Transformerless intercom submitted by reader Ronald Cook provides low but sufficient volume for home or place of business. The 3-transistor circuit can be easily assembled.

Q2 is operated at zero bias by placing a 15- μ h. choke (L4) between its base and emitter. The 15-ohm emitter resistor (R4), bypassed by C13, limits Q2's dissipation during modulation peaks and thus provides more reliable driver operation.

A capacitive impedance-matching divider network couples the driver stage, Q2, to the final, Q3. This network consists of C5a, C5b, C6 and Q3's base-emitter input capacitance. Transistor Q3 is operated at zero bias and no current limiting is required. A two-section pi-network, made up of C8, L8, C9, L9 and C10, is used for loading and filtering. The output signal is coupled through d.c. blocking capacitor C11 to antenna jack J1.

Collector modulation is applied to the driver to enable the final to fully down-modulate, for if drive were applied only to the final during modulation, base-to-collector feed-through would prevent 100% down-modulation. In addition, more drive is required by the final during up-modulation to insure reliable driver operation.

All three transistors are epitaxial mesa units. The resistors are half-watt units. Except for the variable capacitors and trimmers, which may be air-dielectric types, all capacitors are mica or ceramic units. Standard r.f. chokes are used. The tuning coils are hand-wound; L2 has six turns of #22 enameled wire on a 1/2"-diameter form, L5 has four turns of #22 wire on a 1/4"-diameter form, L8 has three turns of #20 wire on a 3/8" form, and L9 has four turns of #20 wire on a 3/8" form.

The layout should be carefully planned to avoid interstage interference and to minimize distributed wiring capacitance. All leads should be kept short and direct, and appropriate heat sinks should be provided for Q2 and Q3.

The Motorola people did not supply construction or circuit adjustment details in their report; neither did they specify the

type of modulation transformer (T1). For CB applications, FCC approval is necessary before the transmitter can be legally operated. While the total cost of the transmitter is small, the 2N2950 transistor sells for \$13.50 and the 2N2951's for \$4.50 each.

Reader's Circuit. The three-stage transformerless intercom circuit in Fig. 3 was submitted by reader Ronald Cook (7 Montgomery St., Saugus, Mass.). It should be suitable not only for home use but for small offices and stores. Due to its limited output power, however, it would not be too useful for paging, or in applications where excessive background noise is present, as in garages and machine shops. Transistors Q1 and Q2 are used as common-emitter amplifiers while Q3 serves as a direct-coupled emitter follower.

In operation, each speaker serves alternately as a microphone or a speaker, depending on S2's position. The signal developed across R1 is coupled through C1 to Q1's base-emitter circuit. The base bias of Q1 is developed across voltage-divider R2, R3. Capacitor C2 couples the signal to Q2. Transistor Q2's base bias is taken from voltage-divider R5, R6. Resistors R4 and R7 serve as collector loads. The output signal of Q2 is direct-coupled to the emitter follower, Q3, which, in turn, drives one of the speakers. Transistor Q3's base bias is developed by the resistive divider made up of R7 and Q2's collector-emitter impedance. Power is obtained from B1 which is switched on or off by S1.

Standard components are used in the circuit. The transistors are all Tung-Sol TS-603's. Potentiometer R1 is a 100,000-ohm linear-taper control, and all resistors are half-watt units. Capacitors C1 and C2 are 25-volt electrolytics. Switch S1 is a s.p.s.t., and S2 is a d.p.d.t. slide, toggle, rotary, or
(Continued on page 96)

Predicted Radio Receiving Conditions

How the short-wave bands will be throughout the summer plus some information on the brand-new sunspot cycle

By **STANLEY LEINWOLL**, Radio Propagation Editor

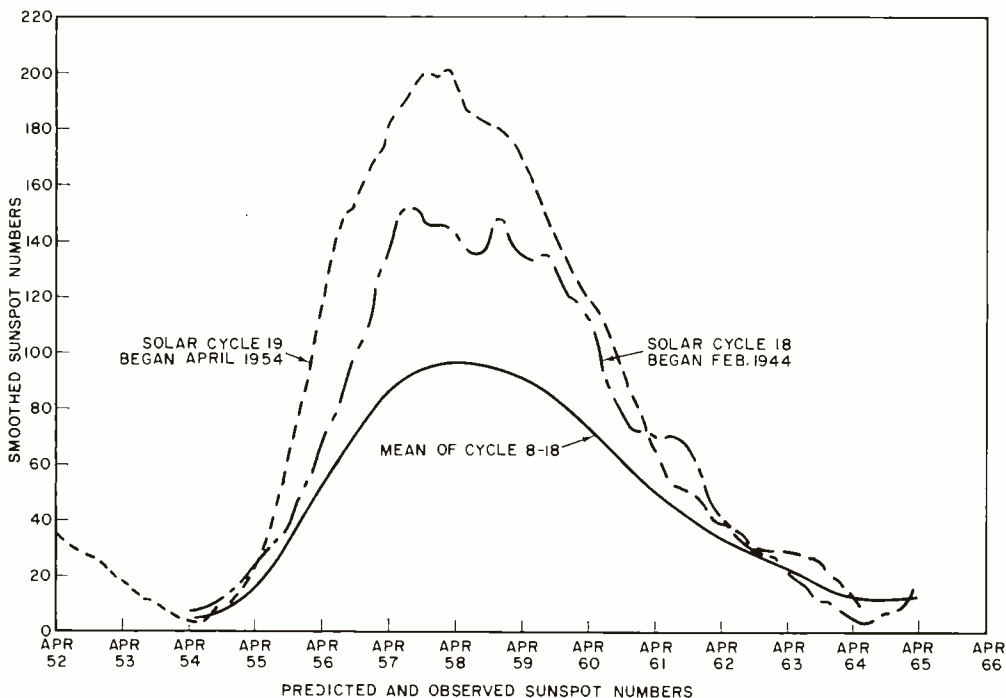
BACK IN 1958, when the number of spots on the sun was greater than ever before, radio receiving conditions were unsurpassed. FM and TV DX were commonplace occurrences. The amateur 10-meter band, the Citizens Band, and the 11-meter international broadcast band were all open day after day for much of the time, and broadcasters were able to schedule their transmissions for a minimum of crowding.

As the number of spots on the sun decreased during the following years, the available spectrum space also decreased, thereby forcing the world's broadcasters, whose number was increasing, into the fewer remaining useful bands. This situation continued until recently, when, with sunspot activity at a minimum and the number of

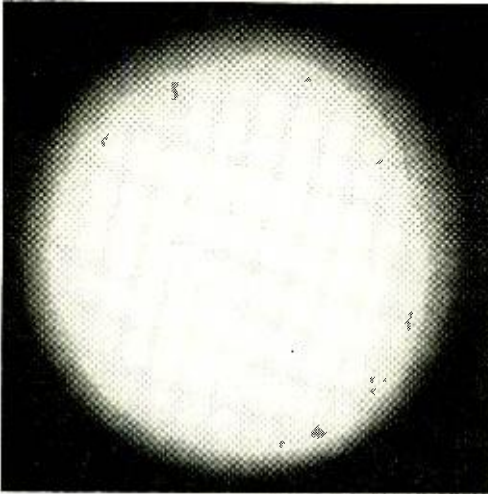
transmitters in service at an all-time high, extreme crowding occurred.

Now, with sunspot activity at last moving upward again, some relief in the recent congestion can be expected. Since the number of countries engaged in international broadcasting is still increasing, however, the extent of the relief from greater sunspot activity is problematical.

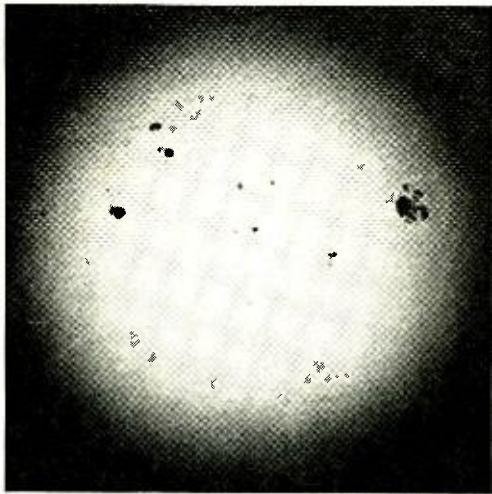
The accompanying chart shows how the number of spots on the sun has varied over the past decade. It can be seen that this number varies between maximum and minimum values, and it has been found that an average of 11 years elapses between one minimum and the next. This variation in the number of spots on the sun is known as the sunspot "cycle."



The effect of sunspots on communications is well known. As the number of sunspots goes down, the maximum usable frequency also drops. As sunspots go up, the reverse is true. The sunspots vary in an 11-year cycle. The bottom of the present cycle has been reached and conditions will improve for the next 4-5 years.



Taken in 1964, this photograph of the sun shows its unblemished appearance. Photos taken within the past few months show a few spots of the new cycle.



This is how the sun looked six years ago at peak sunspot activity. The photos were taken by the U.S. Navy during a daily sunspot monitoring program.

The previous sunspot cycle, from 1944 to 1954, is also shown on the chart, as well as an average of all previously observed cycles since regular observations began in the middle of the eighteenth century. Thus far, there have been 19 complete cycles observed. The nineteenth began in April, 1954, reached an all-time high in March, 1958, and has now ended. It will be several months before all the data necessary to determine exactly when the nineteenth cycle ended, but the evidence is unmistakable, and the listener can begin to take heart: sunspots are on the upswing, and conditions will soon begin to improve noticeably.

Summer Band Conditions. On May 2, most of the world's short-wave broadcasters, with the exception of *Radio Moscow*, will make major schedule changes in accordance with the Geneva Radio Regulations. The U.S.S.R. will make its schedule change somewhat earlier, around the middle of April. For the most part, once schedules for the summer have been implemented, they will continue without significant changes until the beginning of September. The following is a general summary of receiving conditions expected from May through August, 1965.

FM and TV. There should be a sharp increase in the number of DX openings beginning around mid-May and continuing to mid-August. Peak reception will take place from mid-morning to late afternoon, local time, although openings will also occur at other hours. Television channels 2 and 3 will be best for DX, with reception decreas-

ing as the channel number increases. The same situation will apply to FM DX reception, but openings will not be as frequent, even on the lower channels. At this phase of the sunspot cycle, FM and TV DX are primarily summertime phenomena, and are caused by small, dense clouds of ions in the E region of the ionosphere, about 50 miles above the earth. These clouds, which are capable of reflecting very high frequencies, are relatively short-lived and rarely last more than an hour. Openings to distances up to about 1000 miles will occur, however.

11 Meters. Although the minimum of the sunspot cycle has been reached and solar activity has begun to increase, conditions are not expected to improve to the point where 11 meters will be useful for another two years. Since 11 meters will not propagate with any reliability, none of the world's broadcasters have scheduled anything in this band.

13 Meters. Schedules in the 21-mc. broadcast band will be sparse, with the principal users being the BBC, VOA, and U.S.S.R. *Radio Australia*, on 21,540 kc., should provide a DX challenge in this band; it will sign on at 8:45 p.m. EDST, and will have to be heard during the early hours of the transmission on the East Coast—if at all—since reception will become impossible several hours after dark. Reception in the western half of the United States should be better.

16 Meters. With the hours of daylight at a maximum, there will be an increase in the
(Continued on page 97)



Across the Ham Bands

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

GETTING THE MOST OUT OF A SIMPLE COMMUNICATIONS RECEIVER

AS MENTIONED last month, a good receiver is usually more helpful than high transmitter power when it comes to successful hamming. The trouble is that not all hams can afford a de luxe receiver. If you are one of the many who have this problem, the following suggestions may help you get a little better performance from what you have.

First, use your transmitting antenna on your receiver as well as on your transmitter. A good antenna makes the sensitivity of an inexpensive communications receiver entirely adequate for operation up to at least the 7-mc. amateur band, and it improves the signal-to-noise ratio of more expensive receivers.

Even if the separate receiving antenna is as efficient as the transmitting antenna, the directional patterns of the two are certain to be different. As a result, you transmit best in some directions and receive best from other directions—hardly an ideal ar-

rangement. Also, if the receiving antenna is close to the transmitting antenna, the transmitter can pump enough r.f. power into the receiver to damage the antenna coil.

The most successful method of switching an antenna between a receiver and a transmitter is by means of an antenna change-over relay controlled by the station send-receive switch (or "VOX" circuit on SSB). A manually operated switch with good r.f. insulation (not a toggle switch) can also be used for the purpose, although it is less convenient than the relay.

Above the 7-mc. band, inexpensive communications receivers seldom have sufficient sensitivity for weak-signal reception even when used with a very good antenna. But *if the receiver is otherwise satisfactory*, an external r.f. preamplifier can make a dramatic improvement in its usable sensitivity above 14 mc. Commercially available receiver preamps are relatively expensive, but a unit suitable for home construction was de-

Thirty-one states and Canada confirmed is the record of Eric Schorman, WAØKOP. Operating out of Cedar Falls, Iowa, Eric transmits with a Knight-Kit T-60 and receives on a National NC-98. He likes to build things too, as shown by his home-built VFO, c.w. filter, electronic keyer, and all-band vertical antenna. Eric will receive a one-year subscription to POPULAR ELECTRONICS for submitting the winning photo for May in our Amateur Station of the Month contest. If you would like to enter the contest, send us a clear picture of your station—preferably showing you at the controls—along with some information about yourself, your equipment, and your operating achievements. Entries should be addressed to: Amateur Photo Contest, c/o Herb S. Brier, Amateur Radio Editor, Box 678, Gary, Ind. 46401.

Amateur Station of the Month





Bob Butler, WN3BHQ, of Washington, D.C., is waiting for his General Class ticket to arrive. His Novice record: 40 states worked with his Hallcrafters HT-40 transmitter and S-108 receiver.

Leighton "Jack" Pearce, W1ZYZ, St. Johnsbury, Vt., is a DX chaser. He keeps his Globe King transmitter and National NC-300 receiver on 20-meter phone. "Jack" has received several Public Service Certificates for his work in various emergencies.

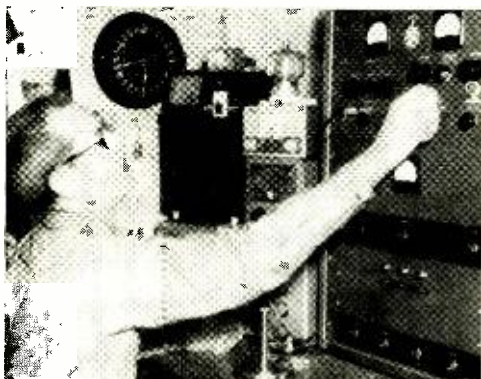


Photo courtesy Caledonian-Record, St. Johnsbury, Vt.

scribed on page 76 of *POPULAR ELECTRONICS* in February, 1963.

Undoubtedly the greatest deficiency of low-priced amateur receivers is inadequate selectivity. Luckily, if the receiver has an i.f. amplifier in the 465-kc. region—and most of them do—adding a Q-multiplier will greatly improve selectivity. Suitable Q-multipliers are available from several sources, and construction plans have appeared in various amateur publications. See page 74 of *POPULAR ELECTRONICS*, July, 1963, for one such unit.

Many receivers drift for 30 minutes or longer after they are turned on. One way to combat this defect is to turn on the receiver at least a half hour before starting an operating session, and leave it on until you close down for the evening. Going a step further, in order to achieve the greatest thermal stability some hams *never* shut

off their receivers or transmitter VFO's. This practice also protects the equipment against excessive moisture absorption in a damp operating room.

If you operate regularly, leaving the receiver on all the time will not decrease tube life appreciably, and the cost of the power consumed is very small. Incidentally, some of the newer receivers and transmitters are designed so that a separate filament transformer continuously heats the oscillator tube filaments as long as the equipment is plugged in.

ARRL Board Meeting. Early in May, the board of directors of the American Radio Relay League, Inc., will hold its annual meeting in Newington, Conn. As usual, much of the board's attention will be devoted to problems involving the welfare and future of amateur radio. The board's decisions on these matters determines what recommendations the ARRL will make to the Federal Communications Commission regarding regulations and licensing procedures.

Also scheduled for discussion are the lengths of, and rules for, future ARRL DX contests and other operating activities. At present, the phone and c.w. DX contests each occupy two weekends. Many hams believe that a single weekend—one for phone and one for c.w.—would be desirable, but this view is far from unanimous. If you have any opinions on the subject, or on other matters, why not let the ARRL director for your area know them. His address can be found in any recent issue of *QST*. Your opinions will be respected whether or not you are an ARRL member, because these men try to represent the best interests of all amateurs.

175-Mile Travel Rule Finalized. In spite of some opposition on the part of individual amateur radio operators, the FCC has carried through on its proposed rule amendment regarding Conditional Class license applicants. Under the amendment, applicants who live within 175 miles—instead of the previous 75 miles—of any FCC engineering field office or semi-annual examination point must appear personally at the nearest field office or exam point to take the test. Only those applicants who live beyond the new 175-mile limit will still be able to take the Conditional Class license examination by mail. According to the FCC, this amendment had more support than opposition.

Amateur Contests. A common complaint of the sponsors of amateur contests is that only a small percentage of the participants
(Continued on page 100)



On the Citizens Band

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

THE National Headquarters for REACT (Radio Emergency Associated Citizens Teams), sponsored nationally by the Hallcrafters Company, has announced the opening of the first full-scale, fully-equipped CB monitor station to cover an entire major metropolitan area. It became official at an

REGIONAL REACT MONITOR

impressive ceremony in Wheaton, Md., suburb of Washington, D.C., with almost a hundred people in attendance—including representatives from the Federal Communications Commission, the Red Cross, and the American Automobile Association, as well as local civic officials.

The National Capitol REACT Monitor is the result of an idea by Noel Nelson, REACT coordinator for the Washington area. Located in space donated in the main-entrance area of the eight-story Howard Johnson Motor Lodge in Wheaton, the new monitor station is being manned on a shared schedule by seven Washington area teams. A great deal of the preliminary organizational work was done by members of these teams, including construction of the monitor desk and installation of all equipment.

These seven teams include: Arfax Radio

Club, Arlington, Va.; Citizens Radio Emergency First Aid Squad, Washington, D.C.; Fort Belvoir Radio Club, Fort Belvoir, Va.; Freestate CB Club, Upper Montgomery County, Md.; Radio Associates of Montgomery County; Southeast REACT Emergency Aid Squad, Southeast Washington; and the Tri-County REACT Team, Berwyn Heights, Md.

The new station provides coverage over an area of approximately 15,000 square miles. Of the 784 contacts logged in its first 20 days of operation, more than 50 percent were bona fide calls for automotive assistance or emergency help; 54 of these calls—better than two per day—involved either automobile accidents or fires. Six hundred man-hours were logged during this period, 504 of which were actual monitoring hours.

REACT Facts. REACT was established in 1962 as a nationwide affiliation of Citizens teams organized to provide instant communications in local emergencies through CB radio. The organization has grown to over 700 teams and 20,000 currently active members as of February, 1965.

REACT teams are designed to furnish instant radiotelephone communications with REACT headquarters; to promote close cooperation with all forms of radio communications; and to allocate a specific channel

The honor of completing the first officially logged contact at REACT's new regional monitoring center in Wheaton, Md., went to Bob Bradshaw, president of the National Capitol Regional REACT Headquarters. Standing (left to right) are: John Finley, Hallcrafters representative; Noel Nelson, chairman of the board, NCRRH; and Alexander Guss, co-owner of the Howard Johnson Motor Lodge where the monitoring center is located.



1965 OTCB JAMBOREE CALENDAR

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

- Durant, Miss. May 2**
Sponsor: Bi-County CB Radio Club. Contact: The "Colonel," Bi-County CB Radio Club, Durant, Miss.
- Rockford, Ill. May 23**
Event: First CB Jamboree. Location: Illinois National Guard Armory, 605 N. Main St. Sponsor: Rock River Valley CB Club. Contact: RRVCCB Jamboree, Box 793, Rockford, Ill.
- Danville, Ill. May 29-30**
Event: Nationwide Jamboree. Location: Eastern Illinois Fairgrounds. Sponsor: Kickapoo 5-Watters Class D Radio Club. Contact: Mike Reik, Communications Chairman, 720 Sheridan St., Danville, Ill.
- Utica, Mich. June 5-6**
Event: Southeastern Michigan Jamboree. Location: Swiss Valley Park. Sponsor: Southeastern Michigan 11 Meter Radio Club. Contact: Jamboree Committee, 17542 East 9-Mile Rd., East Detroit, Mich.
- Marion, N.C. June 11-13**
Event: Second Annual National CB Grandfather Mountain Jamboree. Location: Grandfather Mountain, MacRea Meadows. Sponsors: Lake City CB Club and McDowell County Rescue Squad. Contact: Grandfather Mountain Jamboree, Box 656, Marion, N.C.
- Aurora, Ill. June 13**
Location: Phillips Park. Sponsor: Aurora 5-Watters. Contact: Jamboree Chairman, 2330 Brentwood, Aurora, Ill.
- Canton, Ohio June 13**
Event: CB picnic. Sponsor: Hall of Fame CB Radio Club.
- Rock Island, Ill. June 19-20**
Event: Iowa-Illinois CB Club Jamboree. Location: Rock Island County Fairgrounds.
- Hobart, Ind. June 19-20**
Location: Porter County Fairgrounds, Valparaiso, Ind. Sponsor: Northwestern Indiana Citizens Radio Association, Inc. Contact: H. Lee Gray, 665 Lake St., Hobart, Ind.
- Nashville, Tenn. June 25-27**
Event: Music City CB Jamboree. Location: Tennessee State Fairgrounds Coliseum. Sponsor: Donelson CB Radio Club. Contact: Music City CB Jamboree, Box 2301, Nashville, Tenn.
- York, Pa. June 26-27**
Event: York CB Assistance Club Jamboree.
- Rutland, Vt. June 27**
Event: Third Annual Vermont CB Jamboree. Sponsor: Otter Valley Citizens Band Radio Club, Inc. Contact: Vermont CB Jamboree, Box 669, Rutland, Vt.
- Kentland, Ind. June 27**
Location: Newton County Fairgrounds. Sponsor: Central Illiana CB Club. Contact: Donna LaCoss, Publicity Chairman, Morocco, Ind.
- Oxford, N.Y. June 27**
Event: Second Annual CB Rally. Location: Community Field, Greene, N.Y. Sponsor: Chenango County Citizens Band Radio Club. Contact: CCBRC, Box 141, Oxford, N.Y.
- New Castle, Pa. June 27**
Event: Second Annual CB Jamboree. Location: Lawrence County Sportsman's Association Grounds. Sponsor: Lawrence County CB Radio Club, Inc. Contact: Robert Kerber, LCCBRC, Box 404, New Castle, Pa.
- Alliance, Ohio July 11**
Event: CB Picnic. Sponsor: Carnation City CB Club.

and promote its proper use. They are encouraged to maintain and foster proper communications; operate and maintain equipment in accordance with FCC regulations; and locate and report sources of radio interference.

The heart of the individual REACT team make-up evolves around the mandatory monitoring of a designated emergency channel 24 hours a day. As of September 30, 1964, channel 9 has been the REACT national emergency channel. (Channel 9 was proposed as the national emergency and calling channel by POPULAR ELECTRONICS early in 1962.) Local teams may, at their discretion, also utilize a secondary emergency channel of their choice to suit local conditions, but "9" must be maintained as the primary contact 24 hours a day, 7 days a week.

With REACT, emphasis is wholly on local problems, local solutions, and local autonomy. Each team is free to organize and operate according to the precise needs of its own community. There are no national dues or assessments of any kind, and membership materials, including *The National REACTer* bimonthly bulletin, are furnished in the public interest by Hallicrafters, which administers the entire national program.

Among the materials supplied is an excellent 10-minute slide-film presentation which is available on loan to REACT team leaders. The film explains the objectives of REACT, traces its history, explains the value of REACT to a community, and urges viewers to join or at least get behind REACT. Team letterheads are also available, as are REACT "You have been assisted . . ." cards.

Besides their own communications gear, the majority of REACT teams either own, or have available on a team basis, substantial emergency equipment such as: portable generators, power boats, aircraft (one team has four) inhalators, and special emergency vehicles.

REACT teams have handled an estimated 30,000-plus individual local emergencies since the inception of the program. Individuals or CB clubs in areas not yet covered by REACT can get the full story by writing to REACT National Headquarters, Dept. HK, 5th and Kostner Aves., Chicago, Ill. 60624.

Emergency Action. Herbert Whittred, Medicine Hat, Alberta, Canada, reports that a "hats off" is deserved by ham and CB radio operators in that area who were instrumental in getting aid sent to a ship in trouble off the coast of California. A farm communications system picked up the dis-

(Continued on page 98)

LIVE BETTER ELECTRONICALLY with LAFAYETTE RADIO ELECTRONICS

HI-FI AND CB EQUIPMENT Headquarters



Model HB-50G
139⁵⁰
99-3027WX

NEW! LAFAYETTE 70-WATT COMPLETE AM-FM STEREO RECEIVER

Just Add Speakers and Enjoy FM, FM Stereo and High-Quality AM Reception

■ A powerful 70-Watt Amplifier plus Complete Pre-amplifier Control Facilities plus a Standard AM Tuner plus a sensitive FM Tuner plus an FM Stereo Tuner—all on One Compact chassis ■ Amazing FM "Stereo Search" Circuit Signals Presence of Stereo Broadcasts ■ Tuned Nuvistor "Front End" provides Greater Sensitivity, Lower Noise ■ Bar-Type Tuning Indicator for AM and FM ■ Variable AFC Control ■ Imported

TAKES REELS UP TO 7"



† adaptable to stereo playback

DYNAMIC MICROPHONE

THE WIDELY ACCLAIMED LAFAYETTE RK-137A TAPE RECORDER

FEATURING **4-TRACK STEREO PLAYBACK**†
4-TRACK MONAURAL RECORD PLAYBACK

With Electronic Track Selector Switch, VU Recording Level Meter and Pause Switch For Instant Editing

Includes Lightweight carrying case, dynamic microphone, output cable, 7 inch empty tape reel.

• Two Speeds—3¾ & 7½ ips • Pause Lever Provides Instant Stop for Editing • Record—Erase Safety Switch • Fast, Rugged Shift Lever Control • Extension Speaker Jack • High Impedance Monitoring Jack • VU Meter Recording Level Indicator • Electronic Track Selector Switch • Specially Designed Heavy-Duty 6x4" PM Speaker • Separate Erase and Record Heads • Imported



Model LR-800
199⁵⁰
99-0005WX

Small... Quiet... Powerful! NEW! LAFAYETTE SOLID-STATE DUAL CONVERSION 5-WATT CB TRANSCEIVER

With Authentic Mechanical Filter

- ✓ Only 3" high—fits easily in any car
- ✓ Special multi-stage noise limiting circuit ends problem of mobile noise
- ✓ The same output as the most powerful tube unit yet uses only 1/50th of the battery power

The Perfect Unit For Mobile!

• 12 Crystal Transmit and Receive Positions • 23 Channel Tunable Receiver With Spotting Switch • 3-Stage Transmitter Rated For Full Legal Power • Dual Conversion Receiver with 5/10 μ V Sensitivity • Multi-Stage Automatic Noise Limiting Circuit • Rugged Silicon Mesa Transistors • Compact—3"Hx11¾"Wx6¼"D • 12V DC Mobile Operation (Negative or Positive ground) • 117V AC operation when used with Matching Solid-State AC Power Supply (Optional at \$16.95)

Model RK-137A
89⁵⁰
99-1511WX



NEW! LAFAYETTE 23-CHANNEL 5-WATT CB TRANSCEIVER

Double Side Band Full Carrier

- ✓ 17-Tube Performance with 13 Tubes
- ✓ Low Noise Nuvistor "Front End"
- ✓ 5 Double-Tuned IF Transformers
- ✓ Meets All FCC Requirements

With Advanced "Range-Boost" Circuit

• Frequency Synthesized Circuit Provides 23 Crystal-Controlled Transmit & Receive Channels—No Extra Crystals to Buy • Continuous One-Control Channel Tuning • Full 5-Watt Input • Push-To-Talk Microphone & Electronic Switching • Dual Conversion Receiver With 3/10 μ V Sensitivity • Delta Tuning Offers "Fine Tuning" of ± 2.5 Kc on Receive • Illuminated "S" and RF Output Meter • Variable Squelch, Variable Noise Limiter, AGC • Built-in 117V AC & 12V DC Power Supply • "Vari-Tilt" Mounting Bracket for Easy Mobile Installation • Plug-in Facilities For Lafayette Selective Call Unit

FREE!

LAFAYETTE RADIO ELECTRONICS

1965 CATALOG NO. 650 516 PAGES!

See The Largest Selection in Our 44-Year History

- Stereo Hi-Fi — Famous Brands plus Lafayettes own Top-Rated Components
- Citizens Band Equipment
- Tape Recorders • Ham Gear

- Radio's, TV's and Accessories
- P.A. Equipment; Intercoms
- Test Equipment • Optical Goods
- Auto Accessories • Musical Instruments

LAFAYETTE RADIO ELECTRONICS
Dept. IE-S P.O. Box 10
Syosset, L.I., N.Y. 11791

Send me the FREE 1965 Lafayette Catalog 650 \$ enclosed; send me (Prices do not include shipping charges).

Name _____
Address _____
City _____ State _____ Zip _____

CIRCLE NO. 19 ON READER SERVICE PAGE

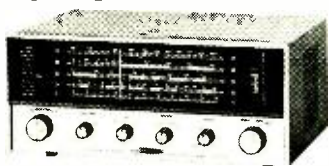
WHO SAYS HOBBIES HAVE TO BE EXPENSIVE?

**for less than \$50
you can open a
new world of fun
with
HEATHKIT® ELECTRONICS!**

start now by sending for this FREE catalog



Shortwave!



GR-64
\$39⁹⁵

Heathkit Shortwave Listener's Radio

Covers 550 kc to 30 mc—includes AM plus 3 shortwave bands; 5" speaker; lighted bandspread tuning dial, relative signal strength indicator & 7" slide-rule dial; 4-tube circuit plus 2 rectifiers; low-boy cabinet styling; 13 lbs.

Repair!

Heathkit Vacuum Tube Voltmeter

Single AC/Ohms/DC probe; 7 AC/DC/7 ohm ranges; 1% precision resistors; freq. response ± 1 db from 25 cps to 1 mc; voltage doubler rectifier; 5 lbs. (also available wired, IMW-11 . . . \$39.95).



IM-11
\$24⁹⁵

CB!



Heathkit 9-Transistor "Walkie-Talkie"

Up to 1-mile inter-unit operation; no FCC license required; crystal-controlled transmit & superhet receiver; includes crystal (specify freq.); less battery; 3 lbs. (pair @ \$74.95).

GW-21 **\$39⁹⁵** each

Workshop!



GD-973
\$17⁵⁰

Heathkit Motor Speed Control

Reduces power tool speed without loss of efficiency; maintains high torque power; extends life of any power tool with AC-DC motor rating of 10 amps or less; simple to build; 3 lbs.

Ham!



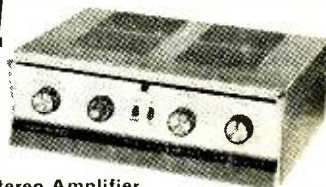
Heathkit 2-Meter Transceiver

Ideal for local net, MARS, CAP, & emergency operations; crystal-controlled transmitter; 5 watt input; tunable super-regenerative receiver with RF stage; 9 lbs. (6-meter model HW-29A., \$44.95).

HW-30 **\$44⁹⁵**

Stereo!

AA-32
\$39⁹⁵



Heathkit 16-Watt Stereo Amplifier

4 stereo inputs . . . mag. & ceramic cartridges, tuner & auxiliary; 20 watts 1HF music power; full controls; easy-to-build; 16 lbs. (matching FM stereo tuner AJ-13 available @ \$49.95).

Auto!

GDP-134
\$34⁹⁵



Heathkit/NELI "Trans-nition" System

4-transistor, zener diode protected circuit; operates on 6 or 12 v. DC batteries; completely sealed against moisture, corrosion; simple to assemble & install; save \$35! 7 lbs.

Home Study!

EK-2A
\$19⁹⁵
Part I



Heathkit 2-Part Basic Radio Course

Learn radio & communications theory; simplified text & kit; Part I results in regenerative receiver; Part II, also, \$19.95, results in 2-band superhet radio; 7 lbs.



FREE CATALOG!

See these & over 250 other Heathkits. Save up to 50% by doing the easy assembly yourself. Send for your free copy today.

HEATH COMPANY, Dept. 10-5
Benton Harbor, Michigan 49023

In Canada: Daystrom, Ltd., Cooksville, Ontario

Enclosed is \$_____ plus postage. Please send model(s) _____
 Please send my Free 1965 Heathkit Catalog.

Name _____
(Please Print)

Address _____

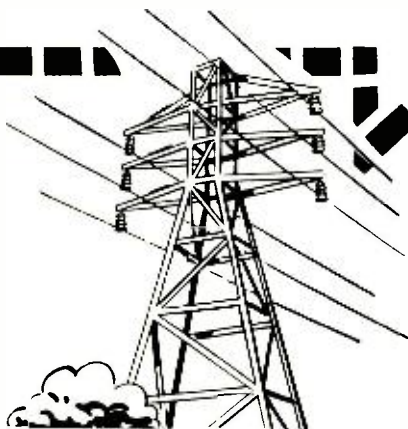
City _____ State _____ Zip _____

Prices & specifications subject to change without notice.

CL-201

CIRCLE NO. 11 ON READER SERVICE PAGE

SELLING YOUR TRANSCEIVER? BUYING THAT AMPLIFIER?



The 415,000 Live Wires who buy POPULAR ELECTRONICS each month will make it worth your while to place a classified ad at the low personal rate of only 45¢ a word.

This, the largest readership in its field in the world, offers the perfect market for making contacts. It's possible a great many of these readers are practically neighbors of yours, yet it is only through the medium of our classified columns that your mutual needs may be met.

Take advantage of our special personal rate of 45¢ a word (including name and address)

NO MINIMUM REQUIRED

a saving of 30¢ a word from our commercial rate of 75¢.

A small investment is sure to bring large results. Write your ad today and mail it with your payment, to:

Hal Cymes
Classified Advertising Manager
POPULAR ELECTRONICS
One Park Ave., New York, N. Y. 10016

JULY ISSUE CLOSES MAY 3RD

NEW CB RULES EFFECTIVE APRIL 26, 1965

FCC Denies Petitions for
Reconsideration of Part 95

AFTER adding only pertinent examples to the section specifying types of prohibited CB communications, the FCC finalized sweeping changes in the Part 95 Rules and Regulations governing the Citizens Band. The changes were itemized in "Do's and Don'ts" on page 55 of the October, 1964, issue of POPULAR ELECTRONICS.

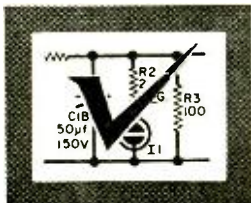
In quick summary, the new Rules say: Use only channels 9, 10, 11, 12, 13, 14, and 23 for communications between CB stations of different license holders. Use all other channels for communications with your base or mobiles only. Hobby-type communications on *any* channel are specifically prohibited. Communications on the seven channels used for inter-station contacts must be held to five minutes on and five minutes off.

EDITOR'S COMMENT: Has the FCC settled the CB dilemma? This question will undoubtedly remain unresolved for many months to come. Implementing the new Rules will be a Herculean task; the FCC has not, to date, demonstrated that it can perform such a task.

By adopting the new Rules years too late, the FCC has simply shifted CB operations from chaos to bedlam. It would have been far more logical for the Commission to adopt a reasonable attitude rather than disclaim the parenthood of CB and the licensing of hundreds of thousands of transceivers that have been put on the air. By ignoring its own part in conceiving the Citizens Radio Service, the FCC has thrown down a gauntlet—a challenge—to thousands of CB'ers.

Let's not let them kill CB! Its value to the community and the individual are about to be tested. Let's clean up the channels and put the house in order.

Operation Assist



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

Schematic Diagrams

Philco Model 46-1203 receiver and 78-rpm phono, code 122, circa 1946. Part #39-7974. Has 6 tubes. **Motorola** Model 59R1 receiver, ser. 117944, circa 1945. Has 5 tubes. (Michael Mark, 220 Forest Dr., Jericho, L. I., N. Y. 11753)

American Bosch Model 28 receiver, ser. 57783, circa 1928. Tunes 550 to 1500 kc. Has 8 tubes. (Vernon Kinlestiver, 189 Main St., Tidououte, Pa.)

Philmore 7001C regen receiver. Has 3 tubes. (J. Schmelzer, 171 Shenandoah Rd., Buffalo, N. Y. 14220)

Patterson Model P.R. 15 communications receiver. (R. W. Aising, 3386 Slusser Rd., Windsor, Calif.)

Superior utility tester. **Ultra Precision** Model 1A1 signal generator. (L. Daignean, 2164½ Broad St., Cranston, R. I. 02905)

Guthman Model U-50 receiver, ser. 2335. Tunes .55 mc. to 62 mc. on 6 bands. Has 12 tubes. (Alan Walls, 1411 Larchmont Dr., Annandale, Va. 22003)

Weston Electric Model CW-52063A transmitter, part of Model GP-12, circa 1941. Tunes 7350 to 9050 kc. Uses pair of 837's. (Brian D. O'Neil, 36 St. Stephens St., Boston 15, Mass.)

Zenith Model AKB-1 VHF receiver, type CZR-43AAY, made for U.S. Navy. (Ronald Gang, 114 Hillmount Ave., Toronto 19, Ontario, Canada)

Monitor Products Model "Crystaliner" oscillator, circa 1940. (Charles L. Slane, R.R. 3, Box 156, Rochester, Ind. 46975)

Crosley receiver, ser. 1653832, circa 1938. Tunes BC. Has 25Z5 rectifier, 6KT, 25A6, and 6J7. (Andrew Atkinson, Box 208, Prattville, Ala.)

Hallcrafters "Skyrider" marine receiver. Tunes 140 kc. to 18 mc. Has 9 tubes. (George LaBelle, 1374 46 Ave., San Francisco, Calif. 94122)

Zenith "Long Distance" receiver, circa 1937. Tunes BC to 16 mc. on 4 bands. (P. F. Austin, 4944 W. 91 Pl., Oak Lawn, Ill. 60453)

McMurdo Silver "Masterpiece IV," #1731, circa 1933. Tunes 100 kc. to 30 mc. on 5 bands. Has 17 tubes, and rectifiers. (Dan McCabe, 3309 McGuffey Rd., Columbus 24, Ohio)

(Continued on page 88)

May, 1965

outstanding performance
WITHOUT HOLES IN YOUR CAR
NEW MONOWHIP MODEL SM-27A

'HOT ROD'

27 Mc

CB MOBILE ANTENNA

Center-fed Monowhip design extends range by lowering angle of radiation instead of wasting signal high in the air



Equal signal strength in all directions—no dead spots

Low VSWR—better than 98% radiation efficiency over all 23 channels, without any adjustments

Mounts on B&K HWM-17 or almost any other bumper mount. Insulated mount not required.

Also excellent for rear deck or roof-top single-hole mounting

40-inch flexible whip. 32-inch high-strength lower section

Includes 20 ft. coaxial cable

See your Distributor or Write for Bulletin No. 647-P

B & K/MARK

DIVISION OF DYNASCAN CORPORATION
1801 W. BELLE PLAINE AVE. • CHICAGO, ILL. 60613

Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 123 Grand St., New York 13, U.S.A.
CIRCLE NO. 41 ON READER SERVICE PAGE

Operation Assist

(Continued from page 87)

Heath Model QF-1 Q-multiplier kit. (John Lube, 5750 Wigton Dr., Houston, Tex. 77035)

Admiral Model 1215-C7 receiver, year unknown. Tunes AM and 9.2 to 9.8 mc. Has 7 tubes. (Dickie Bailey, 912 N. 2 St., Dardanelle, Ark.)

Philco Model 12-130 receiver, code 121, year unknown. Tunes BC and s.w. bands to 15 mc. Has 7 tubes. (Sid Grant, 1491 S. Penn. Ave., Wellston, Ohio)

Zenith receiver, chassis #6A05 8843266, circa 1940. Tunes 515 to 1570 kc. and 5.1 to 18.3 mc. on 2 bands. Has 6 tubes and push-button console. (P. R. Oja, Box 273, Hancock, Mich. 49930)

GE Model 60S receiver, circa 1950. (Mel Newman, Route 1, Ardmore, Tenn. 38419)

Capri-Dyson "Custom Line" amplifier, circa 1958. Has 3 tubes and rectifier, power transformer and printed circuit. (Clarence Lee, 1251 Kearny St., San Francisco, Calif. 94133)

Atwater Kent Model 60, ser. 3054073, year unknown. Tunes BC and s.w. bands. Has 7 tubes. (Choice A. Taylor, Jr., 601 W. Francis, Madill, Okla. 73446)

RCA Model TMV-122 B (or D) oscillograph. Made for U.S. Navy. Has 5 tubes. (Earl King, 6610 S. Oxford, Indianapolis, Ind. 46227)

Hammond "Solovox" organ, keyboard Model K, Series B, ser. 71695, and cabinet Model K, Series B, ser. 65086, circa 1916. Has 18 tubes. (James Youngren, 122 Gregory St., Rockford, Ill. 61108)

Special Data or Parts

Philco Model 50-T1143 receiver, circa 1949. Deflection yoke needed. (Jay DeLane, 17 Seldin Ave., Staten Island, N. Y. 10311)

Admiral Model 30B1-SE TV receiver, year unknown; has 9" picture tube. Schematic and parts source needed.

Zenith Model 39A receiver, circa 1930; tunes 550 to 1500 kc.; has automatic tuner. Chassis layout and schematic needed. (Lee Snow, 255 Grove St., Randolph, Mass. 02366)

Hallicrafters Model 8-3SC receiver; tunes AM and c.w. on 4 bands. Schematic, operating manual, and source for parts needed. (Robert Scholz, 117-17 Hoover Ave., Jamaica 35, N. Y.)

Bell & Howell "Utility" 16-mm. sound projector. Service notes and schematic needed. (Stanley Roszczewski, 22 Ellington Ave., Rockville, Conn.)

Guided Radio Model A-121 electric megaphone system. Type PAE-1, ser. 3063, circa 1941; has 6 tubes. Schematic, parts list, and battery needed. (Robert Martin, 1223 West "G" St., Wilmington, Calif. 90711)

Hallicrafters Model R-15/ARR-7 receiver, ser. 1432, and **Hammarlund** Model SP-600-JX-17 receiver, made for U.S. Air Force. Complete Air Force tech manuals needed. (Alfred Kohlberg, Jr., 120S Lemoyne Ave., Syracuse, N. Y. 13208)

Hickok Model KN-5727-1-1 tube tester. Roll chart needed. (MSgt E. Jones, Box 7408, APO 282, New York, N. Y.)

IRC "Kadette" Model K-617 receiver; tunes BC and s.w. bands; has 6 tubes. Alignment data and schematic needed. (Jerry Stankas, Box 231, Daly City, Calif. 94016)

Federal Telephone & Radio Model OAN (CFT 60051-A) test oscillator. Navy surplus. Operating and calibration manuals needed. **Weston** (?) Model TS-375A/U vacuum-tube voltmeter. Instruction manual needed. (Eugene H. Leger, 183 Middlesex Turnpike Rd., Billerica, Mass.)

National Model 156-1 communications receiver. Navy RBH. Maintenance manual needed. (A. A. Wicks, 23015 Altamead Dr., Mountain View, Calif. 94010)

Link Model 5000-30-VF-C1 transceiver, ser. 1251032; tunes 150-mc. band; operates on 12 volts, d.c. Schematic, crystal data, and operating manual needed. (Neal W. Chapman, P.O. Box 56, Providence, R. I. 02901)

Howard W. Sams T-G-1 Guides, Volumes 2 and 3. (James Roland Day, 1721 S. Second St., Enid, Okla. 73701)

Stewart-Warner Model 301-A receiver; tunes 2 bands; has 2 tubes. Schematic and source for case, tubes, and dial plate needed. **Philco** receiver, circa 1939; tunes 510 to 1700 kc. and 5.5 to 19.2 mc.; has 5 tubes. Schematic, source for case and tubes needed. (David G. Mahoney, 39 Oakdale Rd., N. Wilmington, Mass.)

Columbia Model 1232 receiver, circa 1961. 12ZE8 tube tested. (Gus E. Robertson, P.O. Box 383, Port Neches, Texas 77651)

Radiotecnico Laboratory Model 120 tube tester, circa 1912. Tube chart and diagram needed. **Electronic Design** Model 100 VTVM. Diagram, meter, and power transformer needed. (Felix C. Paul, Etrega General de Correo en Colon, Panama, Rep. de Panama)

Megard "Hollywood" Model HE 621 receiver, circa 1946-17; tunes 2 bands; has 6 tubes. Schematic and service info needed. (Thomas G. Slater, 929 N. Belleview Pl., Indianapolis, Ind. 46222)

Centralab Model TA-11 ultraminiature molded 4-stage transistor amplifiers. Source for the amplifiers needed. (William N. Single, 3 Ave. A, West Keansburg, N. J. 07735)

Type 30 receiving tube wanted for old set. (James G. Wright, 1 Amawalk Ct., Ossining, N. Y.)

Autoplex receiver, circa 1920. Schematic and two Atwater-Kent molded variometers needed. (A. L. Murphy, P.O. Box 7106, Oakland, Calif. 94601)

Radiosonde modulator, ser. 53727, order #10958-Phila., and connected equipment; made for U.S. Signal Corps by Johnson Service Company. Schematic, operating and maintenance data needed. (Mack Haynes, Jr., P.O. Box 139, Sunset, La.)

"**Challenger**" game computer, details published in P.E., Sept., 1957, p. 83. Complete game or Type 88-6 self-pulsing relay (22 positions, 5 decks, 6-12 volt coil) wanted. (Cyril Wezeman, 18001 Meyers Rd., Detroit, Mich. 48235)

R-237B/UR receiver. Army surplus. Technical manual TM-11-607 needed. (John Seiverling, 2327 Johnson Dr., Henderson, Ky.)

-30-



Pre-tuned/pre-packaged IF strip

Model 8902 pre-tuned 455 KC IF strip provides excellent gain (55 db) and selectivity (6 db bandwidth: 8 KC). No alignment is required. Included among the 21 components on the PC board are a mechanical filter, 2 transistor amplifiers and a diode detector capable of driving earphones. Overall dimensions: $\frac{1}{2}$ " x $\frac{1}{2}$ " x $1\frac{1}{2}$ ".

Model 8901 input IF transformer adapts the IF strip for use with a converter in capacity detectors, AM and CB receivers. Both units are included for \$5.75 net.

J. W. MILLER COMPANY

5917 SO. MAIN STREET • LOS ANGELES, CALIFORNIA 90003

NOW ON DISTRIBUTOR SHELVES

CIRCLE NO. 42 ON READER SERVICE PAGE

Antenna Quiz Answers

(Quiz appears on page 54)

- 1 — G The BATWING antenna is an element of the Super Turnstile used in FM broadcasting. The length of the horizontal side rods is made inversely proportional to the amount of current in each rod in order to produce uniform radiation.
- 2 — A The CONICAL antenna is a popular all-channel VHF TV receiving antenna.
- 3 — L A CORNER REFLECTOR is useful for UHF TV reception even in fringe areas.
- 4 — E The CUBICAL QUAD is a compact version of a two-element beam tuned by a shorting bar for minimum reflected power.
- 5 — F The DOUBLET is a center-fed, half-wave dipole, and is bidirectional.
- 6 — K The FOLDED DIPOLE has four times the impedance of a conventional dipole and can therefore be used with high-impedance transmission lines for reduced line losses.
- 7 — J A GROUND PLANE antenna is an omnidirectional vertical type. Its low angle of radiation makes it desirable for communication between ham and CB base stations and mobile units.
- 8 — C The J antenna consists of a half-wave vertical radiator and a quarter-wave matching stub resonated by a sliding shorting bar.
- 9 — B The LAZY H antenna is a combination of two collinear arrays phased to obtain a broadside response which is bidirectional in both the horizontal and vertical planes.
- 10 — D The RHOMBIC antenna is a popular fixed station antenna widely used for point-to-point, long-distance, high-frequency transmission and reception.
- 11 — I A STERBA CURTAIN consists of two collinear arrays whose unique design provides a closed circuit for power-frequency currents used to heat the antenna elements and prevent ice formation.
- 12 — H The YAGI is a high-gain, high-directivity, narrow-band type of beam antenna.

**FULLY EQUIPPED FOR
IMMEDIATE OPERATION
ON ALL 23 CHANNELS**

reach
way out
with
the NEW
Cobra CAM-88



**23-CHANNEL CB
mobile and base station
AM TRANSCEIVER**

The satisfaction you get from CB-ing with the new *Cobra* CAM-88 is a richly rewarding everyday experience. It's rugged, handsome to have in your car or home base—and it operates like you want it to—for personal, professional or business 2-way communications in the 27 mc Citizens Band.

Outstanding Features

- Fully-Equipped for Immediate 23-channel Transmit and Receive
- Double Conversion Superheterodyne Receiver
- Transistorized 117V AC/12V DC Power Supply
- Maximum Talk Power
- Delta-Tune Fine Tuning
- Squelch Control and Standby Switch
- Illuminated Dual-Purpose Meter Power-in (Receive)—Power-out (Transmit)
- Modulation Indicator
- Plug-in Microphone
- Convertible for Public Address

Carefully engineered design makes the *Cobra* completely reliable and easy to operate. Completely self-contained. No additional crystals needed. **\$214.95**

See your Distributor or Write for Bulletin No. 611-P

B & K MANUFACTURING CO.



**DIVISION OF DYNASCAN CORPORATION
1801 W. BELLE PLAINE AVE. • CHICAGO, ILL. 60613**

Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 123 Grand St., New York 13, U.S.A.

CIRCLE NO. 44 ON READER SERVICE PAGE



There are **72** reasons why you will want this exciting book of electronics projects:

- Car Battery Saver • Electronic Stop Watch
- Build a Telephone Beeper • Plug-In Transmitter
- Crystal Switch • 40-Meter Antenna for Small Roof
- and 67 other great projects...

- One Tube Screen Modulator • X-Line Tachometer • Build a Stereo Indicator • Nonsense Box • Better Model Control
- X-Line Charger • Cheater Cord Deluxe • 60-Cycle Repulsion Coil Resonance Engine • Automatic Safety Flasher • Handy EP Pack • 2-Meter Simple Superhet • The Signal Stethoscope • VHF Listener • 2-Tube Superhet for 80 Meters • Transistorized 6-Meter Converter • SCR Tester • Multiple Meter Test Set • The Squealer • Build The Reflectoflex • The Cloud Sentinel • Sports Car Mike Stand • Boost Box • Loud Hailer For The Telephone • Extra "Lamp Handee" • Footpads for Headphones • The Identio-Minder • AND MANY MORE...

HERE IS THE LATEST, MOST EXCITING COLLECTION OF ELECTRONICS PROJECTS AVAILABLE ANYWHERE.

Each project is complete with detailed charts, circuit diagrams, cutaways, photographs, step-by-step instructions—and each one means hours of fun and excitement.

If you enjoy the challenge of building useful electronic devices... this is the book for you! **only \$1.25**

- FILL IN, DETACH AND MAIL THIS COUPON TODAY! -

ZIFF-DAVIS SERVICE DIVISION, Dept. EEH
 589 Broadway, New York, N.Y. 10012
 Please rush my copy of the all-new 1965 ELECTRONIC EXPERIMENTER'S HANDBOOK. My \$1.25 (plus 15c for shipping and handling; 25c outside U.S.A.) is enclosed.

name please print

address PE 55

city state zip code

Selecting a UHF Antenna

(Continued from page 55)

four areas represent prime (or local), intermediate, fringe, and deep fringe regions.

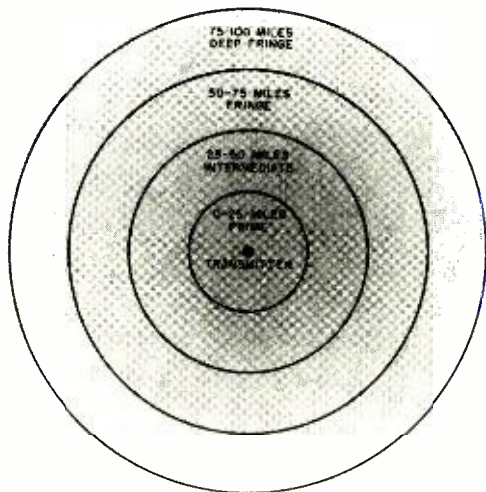
Indoor antennas can be used quite successfully in many *prime* locations. However, to receive a good ghost-free, clean signal, you should use an outdoor antenna, such as: a dipole with screen reflector (≈ 2 in the chart on page 56); bow-tie type with screen reflector (≈ 3); corner reflector (≈ 5); periodic antenna (≈ 6); and log periodic antenna (≈ 8).

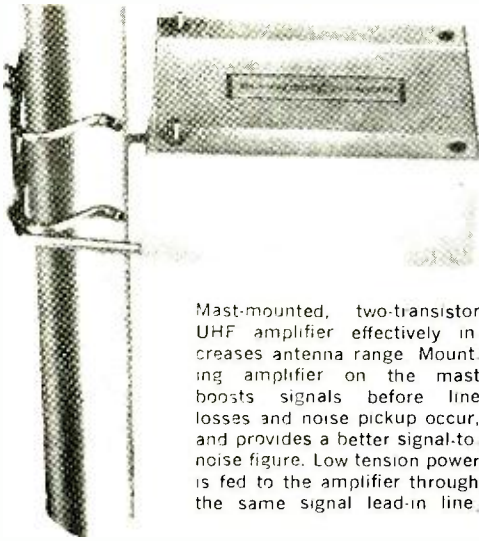
In the *intermediate* area, the following antennas can be used: two bow-ties, stacked, with screen reflector (≈ 4); corner reflector (≈ 5); periodic (≈ 6); two periodics, stacked (≈ 7); or a log periodic (≈ 8).

Antennas recommended for the intermediate area can be used in the *fringe* area with a booster. Otherwise, higher gain antennas are required. You can use two periodic antennas, stacked (≈ 7); a higher gain log periodic model (≈ 8); higher gain yagi (≈ 9); or a bow-tie array (≈ 10).

The antennas recommended for fringe areas can be used in *deep fringe* areas

There is actually no sharp delineation between one reception area and another. Much depends upon topography, signal strength, and receiver sensitivity.





Mast-mounted, two-transistor UHF amplifier effectively increases antenna range. Mounting amplifier on the mast boosts signals before line losses and noise pickup occur, and provides a better signal-to-noise figure. Low tension power is fed to the amplifier through the same signal lead-in line.

with a booster. Generally only the top-rated antennas should be considered, however. You can use the highest gain yagis (≈ 9); highest gain bow-tie arrays (≈ 10); or parabolic dishes (≈ 11 and ≈ 12).

When selecting an antenna, also keep in mind that (1) hills, buildings and foliage would, in effect, move the circles of the graph inward; (2) atmospheric conditions can cause signal decrease; and (3) different manufacturers' ratings and evaluations vary, based on their own experience.

Antenna Lead-In. One of the best types of antenna lead-in wire now available is a foam polyethylene rectangular-shape cable made by Belden (Permohtm $\approx 82-85$). The conductors in the cable are located well within the insulation. It is possible to run this transmission line through a 100-foot length of steel pipe without any significant loss of signal.

Ordinary flat 300-ohm lead-in has a large loss at UHF, more so when it is old, wet, or dirty, and especially in the sea coast areas.

Oval cable exhibits a low-loss characteristic, but the conductors are near the edge of the plastic insulation. When the cable is run near any piece of metal, as is usually the case in many installations, it creates traps and standing waves. Oval cable can have adverse effects on color, and sometimes will knock out an entire channel.

-30-



You've never seen an American made transceiver like this. Pacer not only comes fully assembled, you get eight crystal-controlled channels. And a 23-channel, tunable, superhet receiver (just like the high-priced spreads). Plus plenty of other important features: positive squelch control, illuminated "S" meter, spotting switch, ANL, quick-change external crystal socket.

But that's only half the story. Pacer comes complete with everything you need for base or mobile operation (AC and DC power cords, mobile mounting bracket, PTT mike). And you get all this for less than \$100. Put away that soldering iron. Put your money in a Pacer.

Complete and ready to operate \$99.95

NOW . . . GET STARTED IN CB FOR JUST \$74.95

Here's everything you need to get on the air in one low-priced package. Our Mustang features six-channel crystal-controlled transmit, and a 23-channel tunable receiver. Other features include: PTT mike, positive squelch control, ANL, built-in speech clipping. Complete, ready to operate, AC cord \$74.95



METROTEK ELECTRONICS, INC.
a subsidiary of Regency Electronics, Inc.

7900 Pendleton Pike • Dept. P-5 • Indianapolis, Indiana

CIRCLE NO. 36 ON READER SERVICE PAGE

Bantam Hi-Fi Speaker Systems

(Continued from page 43)

ple sound, filling even a large room without breaking up. The KLH, being the largest and heaviest of the four, also has the greatest power capacity. It won't quail even under thunderous orchestrations, and will take 40 watts (per channel) amplifier output without budging into distortion.

Among the rest of the compact clan, individual differences were far more apparent. The Scott S-5 (\$59.95) is a close runner-up to the best in the group. It has a bright, clean sound that makes you feel close to the music and that makes brass and wind instruments sound especially lively. For some listeners, it may sound a little too bright in the strings. The bass is pleasant and free of boominess. But the Scott's 6-inch woofer doesn't quite match the tonal richness of its 8-inch and 10-inch competitors.

Sonotone's RM-1 (\$42.50)—at least the sample we heard—had a trace of harshness in the highs and needed a little bass boost from the amplifier to bring out the bottom notes. It also uses a 6-inch woofer.

Smallest and Cheapest. Three other compact systems deserve special mention—because they are the smallest and/or the cheapest. First on the list, the Goodmans "Maximus I" (\$59.50) is what you'd call a compact compact. With its 5½ x 7¼ x 10½ inches, you might mistake it for a cigar box at first sight. Into this small space Goodmans' British designers have crammed a 3½-inch woofer—no doubt the smallest woofer ever made—a separate tweeter, and a crossover network.

How does the "Maximus I" sound? Frankly, this musical snuffbox needs quite a bit of help from the amplifier. You have to crank up the bass control nearly all the way to get a fair balance between highs and lows. Besides, the small size was achieved at the cost of efficiency; so this bantam gobbles up more watts than others in this group to reach a given volume. Even with bass boost, it is not nearly as warm and full as the other speakers. Despite company

claims of frequency response down to 45 cycles, you don't hear very much at the low end. The cone just isn't big enough to pump out sufficient bass power. There's no denying that the midget puts out amazing sound for its size—but size isn't everything. To sum it up, the Goodmans "Maximus I" is useful primarily for very cramped quarters.

If you have been going without lunches to save up for a stereo system, the Heath Company may soon put you on a regular diet again. At a price of \$17.50, the Heath AS-81 is the economy champion of compact speakers. Strictly on a sound-per-dollar basis, it's hard to beat. Consisting of a 6-inch woofer working in combination with a 3-inch tweeter, the AS-81 needs very little driving power and won't strain even the smallest amplifier.

In fact, the AS-81 only handles about 6 watts amplifier output, which limits its usefulness with more hefty electronics. Also, it lacks the very sparkling highs and booming rich lows of the best compacts, and its sound gets a trifle muddy in the loudest passages. Yet, even without extreme highs and lows, the sound coming from this little speaker system is very enjoyable at moderate volume levels. The AS-81, having been on the market somewhat longer than the other units in this group, may be regarded as a forerunner of the compact trend.

The designers of the AS-81 would be the first to admit that they weren't really aiming for stringent high-fidelity standards. The Heath Company has other models for that. But they have achieved a lot of performance for the price. As a result, the AS-81 can be highly recommended for minimum-cost sound systems.

A competitor for the title of the smallest system—and the cheapest of the three (\$14.98)—is the Olson "X" Air. While many of the comments above regarding the "Maximus I" apply to the "X" Air, our listening jury felt that the Olson speaker system had slightly better power-handling capabilities, and the claimed low-end frequency response of 65 cycles was realistic.

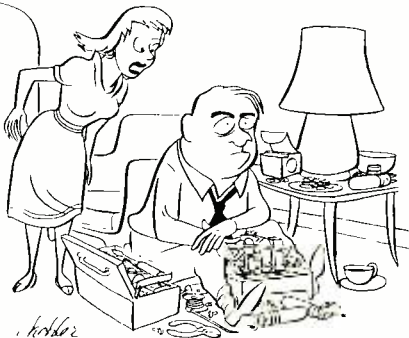
Compact Theory. Skeptical customers might raise the question, "How come they make good speakers so small and cheap now when they couldn't do it before?" Part of the answer is the air

suspension principle discussed at the outset of this article. But other factors are involved.

In the course of their efforts to get bigger sound from smaller boxes, audio engineers learned that good bass doesn't necessarily depend on speaker size. What counts is the amount of sound pumped out by the speaker, along with the natural resonance of its cone. Normally, it is true, big speakers have the advantage because their larger cones have a lower natural resonance and they move more air. But designers found that they could lower the resonance of even a small cone by adding to its weight and by mounting it in a soft, floppy suspension. Then they lengthened the distance traveled by the cone on each back-and-forth stroke so that the cone scoops up a larger quantity of air on each trip.

In theory, this sounds simple. But it took years of cut-and-try experimenting to work out practical details—to find suitable materials for the cone and its suspension, to design magnets and voice coils that permit longer cone travel and at the same time keep tight control over the cone motion throughout its travel span. Ultimately these efforts were successful. Today it is possible to make an 8-inch or even a 6-inch woofer do the work that required a 12-inch cone just a few years ago.

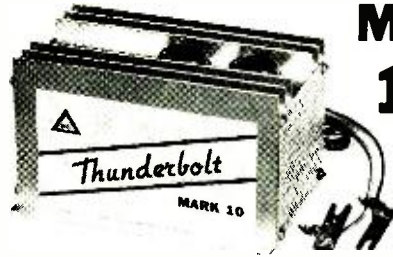
As for lower price, that's partly a natural by-product of compactness. Smaller enclosures cost less. Moreover, manufacturing operations have been standardized and automated by many audio firms. Put these factors together and they logically add up to the compact low-cost speakers—an important new breed in the evolution of high fidelity. —50—



“John Jones! What a perfectly awful thing to call a poor defenseless tuner!”

SCR Thunderbolt

MARK 10[®]



It's Delta's new Series 112, Mark 10 SCR Capacitive Discharge Ignition System, the true electronic solution to major problems of engine operation.

You read about it in the October 5 edition of *Electronics*, and the November issue of *Electronics World*. These earlier models have undergone millions of miles of field testing from Cape Town to Fairbanks.

Now, from Delta, the original designer of the famous Thunderbolt Mark 10, comes a radically improved, high performance model, offering new levels of performance and economy. Series 112, with its higher energy output and improved circuitry, easily outperforms any other ignition system, regardless of cost.

AND, the Mark 10 DeltaKit can give you the fun of making this system yourself, with its easy to follow instructions.

BOTH units available in 6 or 12 volt, positive or negative ground. A Delta Exclusive! Specify automobile year and model with order.

Assembled Unit	MARK 10 DELTAKIT
\$49.50	\$34.95

from dealers or factory

available **ONLY** from factory

Dealer and distributor inquiries invited

DELTA PRODUCTS Box 974
Grand Junction, Colo.

Enclosed is \$_____ Ship Prepaid— C.O.D.

Please send:

Mark 10 Assembled at \$49.50

Mark 10 DeltaKit at \$34.95

SPECIFY— Positive or Negative— 6 or 12 Volt

Car Year _____ Make _____

Name _____

Address _____

City _____ State _____

CIRCLE NO. 37 ON READER SERVICE PAGE

Get Your First Class Commercial

F.C.C. LICENSE

QUICKLY!

Career opportunities in *communications electronics* are almost unlimited. Prepare now. Let Grantham train you—by correspondence, or by classroom and laboratory instruction. Get your *first class commercial* F.C.C. license in as little as 3 months, or at a slower pace if you prefer. Then, continue in more-advanced electronics training if you wish. Diploma awarded. Our catalog gives full details.

Learn how our training can prepare you for your F.C.C. license; write or telephone the School at any one of the teaching divisions listed below, and ask for "Catalog 53."

Grantham School of Electronics

1505 N. Western Av., Hollywood, Cal. 90027
(Phone: HO 9-7878)

408 Marion Street, Seattle, Wash. 98104
(Phone: MA 2-7227)

3123 Gillham Road, Kansas City, Mo. 64109
(Phone: JE 1-6320)

818-18th St., NW, Washington, D.C. 20006
(Phone: 298-7460)

Color TV Antenna Installations

(Continued from page 53)

later. This time delay shows up on the TV screen as a horizontal displacement, a close-spaced ghost. Because there are usually a number of standoffs, and because the reflected signals keep bouncing around in the twin lead, you actually get a multiplicity of these ghosts.

How have we been able to put up with these lumps and reflected signals for so long—even in black and white TV? Actually, it's not nearly as bad as it sounds. In the first place, the reflected signals are quite a bit weaker than the direct signals. In the second place, the time delay is very slight. These signals move through the twin lead at almost the speed of light. A signal would have to travel about 700 extra feet to cause a quarter-inch displacement on a 17" TV screen. Therefore, all these reflected signals actually cause more of a smearing or blurring of picture details, rather than real ghosts, on monochrome TV.

Color TV is an entirely different story. A time delay is synonymous with a phase change. Thus, the reflected signals cause actual color changes. You might not notice a pale, faint gray ghost, but when it shows up in brilliant technicolor, you have a real problem.

Use Coaxial Cable. The only way you can be sure of consistently good color pictures is to use properly installed co-



Proper impedance match minimizes standing waves, loss of signal, and other forms of distortion. Here, a matching transformer is used to match the 75-ohm coaxial transmission line to the 300-ohm TV set.

UNUSUAL BARGAINS

SOLVE PROBLEMS! TELL FORTUNES! PLAY GAMES!

NEW WORKING MODEL DIGITAL COMPUTER

ACTUAL MINIATURE VERSION
OF GIANT ELECTRONIC BRAINS

Fascinating new see-through model computer actually solves problems, teaches computer fundamentals. Adds, subtracts, multiplies, shifts, complements, carries, memorizes, counts, compares, sequences. Attractively colored, rigid plastic parts easily assembled. 12" x 3 1/2" x 4 3/4". Incl. step-by-step assembly diagrams, 32-page instruction book covering operation, computer language (binary system), programming, problems, and 15 experiments.
Stock No. 70,683-AV\$5.00 Ppd.

7x50 BINOCULARS WAR SURPLUS! American-Made!

Big savings! Brand new! Crystal clear viewing — 7 power. Every optical element is coated. An excellent night glass—the size recommended for satellite viewing. Individual eye focus. Exit pupil 7mm. Approx. field at 1,000 yds. is 376 ft. Carrying case included. American 7 x 50's, normally cost \$274.50. Our war surplus price saves you real money.
Stock No. 1544-AV Only \$74.80 Ppd. (Tax incl.)
7 x 35 AMERICAN MADE BINOCULARS
Stock No. 964-AV\$69.50 (Tax incl.)
6 x 30 Binoculars—similar to above.
Stock No. 963-AV \$33.00 Postpaid (Tax incl.)



Recharge Old Magnets—Magnetize Small Tools

POWERFUL 2000 GAUSS GAP MAGNET

Recharge old magnets, de-magnetized magnets, temporarily magnetize small hand tools without weakening gap magnet. Simply pass through gap hole. Does not magnetize to saturation point. Efficiently handles magnets up to 3/4" diam. x 1-3/32" long. Level portion on base 2 1/2" x 1" W. has 2 holes, tapped with 10-32 thread, for easy right mounting. 378" lg. x .078" h. x 1.33" thick. Wt. 3 lbs., 4 oz.
STOCK NO. 60, 461-AV\$12.50 Ppd.
ORDER BY STOCK NO.—SEND CHECK OR M.O.—Money Back, via ante-
EDMUND SCIENTIFIC CO. BARRINGTON, NEW JERSEY

FREE! Write for Giant CATALOG "AV"

Completely new, 1965 edition, 148 easy-to-read pages packed with 100's of industrial on-the-job helps . . . quality control aids. Many war surplus bargains. Imported instruments! For industry, research labs, hobbyists, experimenters.

Send for free catalog "AV"

EDMUND SCIENTIFIC CO. Barrington, N.J.
CIRCLE NO. 6 ON READER SERVICE PAGE

axial cable as the down lead. Coax is completely unaffected by its surroundings. The only thing you must not do to coax is to crush it. Crushing changes the spacing between the conductors, thus changing impedance.

In order to use coax, however, you must match it to 300-ohm antennas and TV sets. Both an outdoor matching transformer, used to match the antenna to 75 ohm coax, and an indoor unit mounted on a TV set are illustrated in this article. Some TV antennas are already matched to 75 ohms, and eliminate the need for an outdoor matching transformer.

Coax is very easy to run. You can tape it to the mast or run it through a metal conduit. If you have any left over, you can coil it and hang it up behind the TV set (don't try this with twin lead, incidentally).

Although it does cost more than twin lead initially, coax lasts much longer. It is impervious to changing weather conditions, won't pick up interference, and can deliver good color pictures. -30-

The Dymwatt

(Continued from page 73)

an ohmmeter to be sure there is no electrical connection.

An aluminum case will help the heat sink do its work. Do not use a smaller box than the one specified—it might get too hot to touch and could damage the Triac. The case used by the author remains relatively cool for all but the heaviest power loads; above 400 watts it becomes noticeably warm.

See Fig. 4 for parts layout. The heat sink on the inside and a dial plate on the outside of the case are held in place with a "Pop" rivet and the mounting nut of the potentiometer. Avoid overheating either *Q1* or *D1* when you are soldering. If you wish, a NE-83 neon lamp can be substituted for *D1* to reduce cost, but it will also reduce the control range.

As long as the Dymwatt is used within its ratings and only for its intended types of loads, it is capable of long life and trouble-free service. -30-

USERS SAY . . . "Fabulous,"
"Terrific," "Improves radio 100%!"



VERBA-MATIX REVERBERATION

America's Prestige Reverb System

The only system with

- 4 Transistors • Heavy 7 oz. Ceramic-Magnet Speaker • Complete Control Panel (with Reverb % Control) • No Drilling, No Screws, for easy installation • Fits all Cars, Neg. or Pos. Ground (12 volt) • All Speakers 2 to 40 ohms • No Noise Driving Over Bumps.

Made in U.S.A.

For complete details see your
 Distributor or write



kinematix, inc.

2040 W. Washington Blvd., Chicago, Ill. 60612

Area 312 — 666-0066

PE-5

CIRCLE NO. 34 ON READER SERVICE PAGE

action CITI-FONE SS



WRITE
 WIRE OR
 PHONE TODAY FOR
 COMPLETE INFORMATION

COMPLETE

\$169.50



MULTI-ELMAC COMPANY

21470 COGLIDGE HIGHWAY OAK PARK 37, MICH.

Name

Address

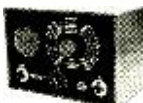
City Zone State

CIRCLE NO. 22 ON READER SERVICE PAGE

NEW - - by KUHN

AM/FM VHF RECEIVER

New model now covers 26-54 and 88-174 MC in eight overlapping calibrated bands with large full vision dial. New circuitry. High sensitivity. Ideal for listening to Aircraft, CB, Police, Fire, Amateur, or other signals as well as regular FM broadcast stations. Completely self-contained with headphone jack for private listening.



353B \$59.95
inc. FET

AIRCRAFT • POLICE • FIRE



348A
Complete
\$34.95

315-B
5-54 MC
\$17.95

115-160 MC
\$18.95



Transistorized, directly tuneable converter. Powered with self-contained mercury cell. Excellent sensitivity and stability. Designed for car, home or portable receivers.

Converts home or car radios to receive Fire, Police, Aircraft, CB, SW, etc. Exceptional sensitivity on High and Low Bands. High Band type adjusts to bracket 115-160 MC. Low Band type should be ordered for 33-47 MC, 40-52 MC, 26-30 MC, 9-12 MC, etc. May be adapted for transistorized car radios.

Order today or send for free catalog on full line of converters and receivers for every application.



20 CLENWOOD
CINCINNATI 17,
OHIO

CIRCLE NO. 17 ON READER SERVICE PAGE

TAPE RECORDER



(liquidation stock)

\$8.99

Liquidation of our special purchase of tape recorders complete with excellent 2 1/2" speaker and microphone. A \$20

value. This production left over from giant national department store promotion where recorders were taped with a message to give to passing customers. Comes complete with standard 1/4" magnetic tape. Use for messages, rig with remote control invisible thread for detective work. Has unique endless loop feature. Hide anywhere, conceal in toy animal and let it make outrageous remarks to guests. Hundreds of uses. While they last. Send \$1 deposit for C.O.D. 14-Day Money Back guarantee.

MISSION LIQUIDATORS,

735 Celis Street, San Fernando 13, California

GET
INTO

ELECTRONICS



V.T.I. training leads to success as technicians, field engineers, specialists in communications, guided missiles, computers, radar, automation. Basic & advanced courses. Electronic Engineering Technology and Electronic Technology curricula both available. Associate degree in 29 months. B.S. obtainable. G.I. approved. Start September, February, Dorms, campus. High school graduate or equivalent. Catalog.

VALPARAISO TECHNICAL INSTITUTE
DEPARTMENT PE, VALPARAISO, INDIANA

Transistor Topics

(Continued from page 76)

lever switch. The supply voltage is not critical; it may range from 6 to 12 volts, and can be made up of series-connected flashlight cells. Although any standard-size speakers can be used, the units chosen should have high-impedance voice coils; Ronald used 130-ohm speakers in his model.

The intercom circuit can be assembled on a small metal chassis, on a Masonite breadboard, or on an etched circuit board, as preferred. Although layout is not critical, good wiring practice should be followed. Signal leads should be kept short and direct.

Educational Kit. Norelco has introduced a new "Electronic Educational" kit which offers an exceptionally broad range of experimental projects. The basic kit, Model EE20, sells for \$19.95, and can be used for assembling such circuits as an electronic organ, phono amplifier, intercom, p.a. amplifier, code oscillator, radio receiver, burglar alarm, acoustic relay, rain indicator, time switch, light meter and automatic night light. "Foolproof" pictorial layout and wiring templates are furnished for each circuit, with the actual wiring done on a prepunched breadboard-like base. Major components are mounted on the board using split rivets, while spring-type connectors are used for wiring, eliminating the need for hand tools and soldering.

Smaller versions of the basic kit are available. With the Model EE8 "Starter Kit," selling for \$13.95, you can assemble up to eight different circuits; the Model EE 8/20 "Add-On Kit," at \$9.95, permits the assembly of up to 15 additional circuits when used with the Model EE8. No batteries are furnished, but a 96-page instruction manual



is included with each version in addition to the circuit templates.

The Norelco kits are offered through local electronics parts distributors and are distributed nationally by Herman H. Smith, Inc. (Brooklyn 10, N. Y.).

—Lou

Predicted Receiving Conditions

(Continued from page 78)

number of hours during which DX is possible on 16 meters. Many of the world's broadcasters will transmit in this band, and activity will be greatest during the morning hours, peaking between 1200 and 1400 GMT, 8-10 a.m. EDST. Egypt will be on 17,785 kc. from 8 a.m. to 4 p.m. EDST. *Radio Peking*, on 17,780 kc., beginning at 9 p.m. EDST, is another interesting possibility; once again, however, East Coast listeners will have to log this one early.

19 Meters. This will be the best band for DX for the longest period of time. It will also be the most crowded. Reception should be possible from early morning to late at night, and the band may be open around the clock some days, with one part of the world or another being heard at any given hour. Vatican City and Poland will both be on 15,120 kc., an indication of the congestion in the 15-mc. band, and Ethiopia is expected to be back on 15,410 kc. around 10 a.m. EDST. Relays of the BBC from Cyprus on 15,260 kc. at 0900-1800 GMT and from Malaya on 15,350 kc. at 0900-1200 GMT could provide interesting listening.

25 Meters. The 25-meter band should be open around the clock in one part of the world or another during much of the sum-

mer, especially during June and July. It will be very crowded, particularly in the late afternoons and early evenings, when most of the Europeans will be making heavy use of it. The *Voice of America* broadcasts from Greenville on 11,960 kc. should be of interest; the transmitter power is 500 kw.—as high as any short-wave transmitter in the world—and the VOA should be heard through most of the country, except within several hundred miles of the Greenville plant itself, from 7 p.m. to midnight, EDST. East Germany will be operating on 11,765 kc. at 1100-1400 GMT, 7-10 a.m. EDST; although absorption at these hours will be high, reception is likely at least on several days during the summer.

31 Meters. This band, too, should be open for DX 24 hours a day. Reception will be optimum during the late afternoon and evening hours; daytime propagation will be limited by high noise and heavy absorption. Tokyo will be on 9740 kc. during the day and early evening, with best reception in the morning from 8 to 10 a.m. EDST. Mali, on 9745 kc. between 1200 and 1400 GMT, is another good catch; but since absorption will be high at this time, regular reception is not feasible.

41 and 49 Meters. Good DX should be possible in these bands beginning in the afternoon and continuing all night long until several hours after sunrise, local time. Although all channels in both bands will be occupied during the evening hours, crowding will not be as severe as it has been.

Standard Broadcast and Long-Wave Bands. High noise levels and absorption during the summer months will permit only fair DX in these bands. Toward the end of August, a seasonal improvement should begin to take place, but until then DX will not be nearly as good as it has been during recent months.

—50—

25-50 mc
37 WATTS
FCC TYPE ACCEPTED



Power-Packed! Engineered for Rugged Business Use!

FM-40

SONAR BUSINESS RADIO

Excellent performance and dependability provided by the experience and design ability that has made Sonar the leader in business radio. Greater range—Voice-Power designed circuitry • Compact and lightweight • Easily installed in smallest vehicles • Smartly styled for office use • Noise free squelch for crisp communication • Accessory plug for Sonar Call, Selective Calling, H.P. Linear Amplifier • 12 VDC & 117 VAC • Size: 4 3/4" H x 9 1/2" x 11 1/4" L • Wt.: 10 lbs.

SONAR RADIO CORP. 73 Wortman Ave., Brooklyn 7, N. Y.
Please send me complete information on Business Radio FM-40

Name _____ Dept. 386
Address _____
City _____ State _____

complete 1 pr. of Crystals, Power Mike, Brackets, & 2 power cables **\$289.50**

CIRCLE NO. 30 ON READER SERVICE PAGE



AUDIO VENDOR

- The original endless loop tape magazine in a new plastic re-usable pack for easy storage. 3 3/8" reel available in 3, 5, 8, 12 and 15 minute standard timings at 3 3/4 ips. Fits most standard reel recorders. At your dealers.

Cousino

ELECTRONICS CORPORATION
DEPT. PE
1941 FRANKLIN AVE. • TOLEDO, OHIO 43624

CIRCLE NO. 5 ON READER SERVICE PAGE

FREE! NEW CAREER GUIDE TO Success in ELECTRONICS



Automation, Math — Basic or Advanced
Wide choice of new Home Study Programs to prepare you for well paying career or advancement in present job. Choose Service, Broadcasting, Industrial, Automation. We assist you in choosing best program . . . save time and money. Tuition refund surety. Since 1931. Write today —
CENTRAL TECHNICAL INSTITUTE
Dept. 01055, 1644 Wyandotte St. • Kansas City, Mo. 64108

SAY YOU SAW

IT IN

POPULAR ELECTRONICS

EARN Electronics Engineering DEGREE

You can earn an A.S.E.E. degree at home. College level HOME STUDY courses taught so you can understand them. Continue your education, earn more in the highly paid electronics industry. Missiles, computers, transistors, automation, complete electronics. Over 27,000 graduates now employed. Resident school available at our Chicago campus — Founded 1934. Send for free catalog.
AMERICAN INSTITUTE OF ENGINEERING & TECHNOLOGY
1137 West Fullerton Parkway, Chicago 14, Ill.

On the Citizens Band

(Continued from page 82)

tress call which asked that anyone hearing the call notify the U. S. Coast Guard. CB'ers receiving the message got in touch with a Medicine Hat ham operator who in turn notified the authorities. The Coast Guard quickly located the vessel and was able to give aid.

The Waukesha County CB Club, Oconomowoc, Wis., reports that two sinking CB'ers were rescued last winter when their car threatened to take them below icy waters. The men were ice fishing, and as they drove over a spring-fed area on the lake, the ice gave way. CB-equipped, the men called for help as the car sank. Their lives were undoubtedly saved by Citizens Band radio.

And *The Monitor*, newsmonthly of the Lapeer County CB'ers, Lapeer, Mich., took a well-deserved poke at just the sort of thing we mentioned in last month's column. Lapeer CB'ers, like thousands of others around the country, are fed up with the generalized misinformation being poured out to the public regarding Citizens Band Radio. In answer to an article published in a national publication which referred to CB'ers as "sinister operators," the Michiganites offered the following record of emergency assists from their files last year.

October. CB-equipped gasoline supply truck involved in property damage accident. Truck was struck from behind, rolled into ditch. Driver, unhurt, contacted Lapeer CB'er requesting assistance. County Sheriff was notified and asked to send car to scene. Wife of driver was notified, and wrecker requested. Sheriff's car, the wrecker, and the driver's wife arrived within a matter of minutes.

November. Personal injury accident reported on a little-used gravel road. CB'er arrived to find small car overturned in ditch. Driver and two small children taken to farmhouse. Doctor's office notified that accident victims were being taken to office for exam.

One Lapeer County CB'er took part in all of the following assists:

January. Personal injury accident; reported to KDC0762; put out flares and stood by until deputies arrived on scene.

March. Personal injury accident reported to KDC0762 as a relay from KHH2113.

May. Fire reported and request for traffic control; two CB units used . . . Grass fire reported by 19Q1027. Used farm sprayer (radio-controlled) to put out blaze with-

A SPECIAL ANNOUNCEMENT FROM THE PUBLISHER

During the past few months, we have completely converted our subscription service department at 434 South Wabash Avenue in Chicago into an ultramodern Univac III computer operation at Portland Place in Boulder, Colorado.

You may already have noticed the change in your address tape, which is now being run at the rate of 135,000 names and addresses per hour. The first letter in the code line indicates the magazine. The next four digits indicate the month and year that your subscription expires. For example, 0567 means your last copy will be the May, 1967, issue; or 1166 means your last copy will be the November, 1966, issue. All other code numbers are meaningless except to the computer.

This important change for all Ziff-Davis publications was necessary to enable us to give our constantly growing subscription lists the most efficient, sophisticated, and reliable type of subscription fulfillment possible. However, as much as we have tried for absolute perfection, I am sure you will appreciate that in any conversion of this magnitude some errors will occur; but every precaution has been taken to hold them to a minimum. Should you experience any problem with your subscription service, please do not hesitate to advise us at once. The proper address is: POPULAR ELECTRONICS, Portland Place, Boulder, Colorado 80301.

P. T. HEFFERNAN
Publisher

out need for fire department—a \$125 savings to the taxpayers.

June. Personal injury accident reported by telephone and relayed by CB to KDC-0762 . . . Tractor accident; called off welding job as being closest to scene. Girl injured by tractor wheel; CB'er on scene within four minutes . . . Called out to tractor fire. Fire extinguished before fire department arrived . . . Barn fire; two CB'ers used for traffic and another to control small grass fires. Fire trucks protected other buildings.

July. Storm crippled home owner's power transformer. CB relay and landline call to electric company solved problem . . . Personal injury accident reported via CB radio . . . Barn fire; CB'ers relayed information, controlled traffic, also hauled water, in radio-controlled vehicles.

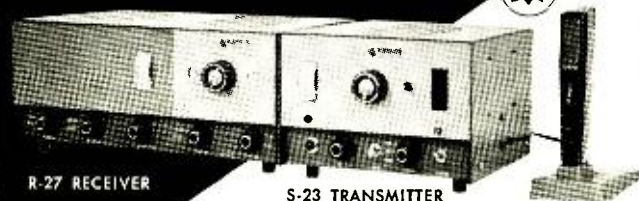
August. Petty thief apprehended by use of CB radio . . . Accident reported by 19A-8479 to 19B0655, relayed to KDC0762.

September. Storm knocked tree across highway; removed by CB'er; report made that no further assistance was needed.

CD-CB Exercise RACOM II. Nassau County Civil Defense, Zone 2 Headquarters, in North Hempstead, L.I., N.Y., conducted a Fallout Shelter Radiological Communications drill (RACOM) last January. Over 40 mobile CB'ers attended three briefing sessions on the exercise and participated in it. Six community CD Control Centers located in Westbury, Mineola, Williston Park, New Hyde Park, Port Washington, and Roslyn, had established Citizens Band Radio base stations in their Control Centers.

Between 8:30 and 9 on the morning of the drill, each Community Control roll-called its volunteer CB mobiles and synchronized time. Beginning at 9 a.m. sharp and until 10:30 a.m., radiological data from 104 fallout shelters traveled via CB radio from volunteer mobiles stationed at shelters to

**WHY A BROWNING EAGLE
CB BASE STATION?**



R-27 RECEIVER

S-23 TRANSMITTER

CONTACT FRANCHISE DIVISION FOR INFORMATION
ON AVAILABLE SERVICE CENTER AREAS

Here's Why!

R-27 RECEIVER • RF gain control • Selectivity switch • Cascode nuvistor front end • 12 tuned I.F. coils

S-23 TRANSMITTER • Compression amplifier • Clipper-filter stage • Built-in SWR meter • 23 channels

Also, Browning Drake: compact all-channel mobile rig. For new, colored CB catalog, write:



browning
LABORATORIES, INC.
Dept. PE-11, Union Ave.
Laconia, N. H., 03246

CIRCLE NO. 2 ON READER SERVICE PAGE

**ALL
NEW!**

**148
PAGES**



The most up-to-date guide available today to the world of Radio Communications

4 BIG SECTIONS Here is an information-packed "encyclopedia" covering the four major branches of specialized radio communications—

CITIZENS RADIO SERVICE **SHORT WAVE LISTENING**
AMATEUR RADIO **BUSINESS RADIO SERVICE**

Complete with charts, tables and illustrations this all-new work brings you exclusive information on such vital subjects as obtaining your license, establishing your CB station, CB ethics—practice and procedure. SWL and station reporting, CB clubs, Ham license application procedures, learning the code, typical business radio installations, and much more—every major area of the field is covered by a leading authority and presents a wide range of material—from basic fundamentals for the beginner through exclusive up-to-the-minute data and techniques essential for those in advanced communications.

EXTRA! FOR THE FIRST TIME TWO EXCLUSIVE DIRECTORIES

- ★ Complete directory of all new citizens band equipment
- ★ Complete specifications on every new 1965 SWL Receiver and every new 1965 CB Transceiver

Only \$1.00

FILL IN, DETACH AND MAIL THIS COUPON TODAY!

ZIFF-DAVIS SERVICE DIVISION, Dept. CH
589 Broadway, New York, N.Y. 10012

Please send my copy of the 1965 COMMUNICATIONS HANDBOOK. My dollar (plus 15¢ for shipping and handling; 25¢ outside U.S.A.) is enclosed.

name please print

address PE-55

city state zip code

the nearest Community CD Control, where the data was computed and plotted. By 10:30 a.m., one message from each of the 104 shelters had reached a Community Control Center. Radio communications from the Zone 2 Headquarters to the Community Control Center is via 2-meter radio (RACES) operated by licensed amateur operators.

Deputy County Director A. E. Falk later said, "The Citizens Banders who participated in this drill have shown their ability to operate on critical timing schedules, transmit and receive radiological data accurately. They have demonstrated a telephone back-up system of communications from fallout shelters where many of our citizens would find haven in nuclear attack. They have also indicated a desire to be trained as radiological monitors and assigned to shelters."

Mr. Falk further stated, "Due to the enthusiasm displayed by these participants, we have established a Pilot Evaluation Program to further study CB radio in conjunction with Civil Defense, with headquarters and training centers."

Citizens Band licensees who are interested in this program should contact Mr. Falk at Zone 2 Headquarters, Nassau County Civil Defense, 220 Plandome Rd., Manhasset, N. Y.

I'll CB'ing you!

—Matt, KHC2060

Across the Ham Bands

(Continued from page 80)

mail in their scores after the contests are over. This is unfortunate, because putting on a successful contest takes a lot of work, and it is largely by the number of scores submitted that the sponsor decides whether or not to repeat a contest.

The fault is not entirely that of the participants, however. While the rules of most amateur contests are simple enough, some sponsors seem to sit up nights trying to make the submission of a score as difficult as filling out an income tax form, and it just isn't worth the effort to the operator who knows his score has no chance of winning, anyway.

If you like a contest, let the sponsor know by sending in your score—big or small. But if you think the rules for submitting a score are too complicated, tell the sponsor so and simply submit a checklist of your contest contacts. You won't win,

but the sponsor will get the "message." On the other hand, if you like the scoring rules, let the sponsor know that by following them.

Notes from Club Bulletins. In the Indiana *MARS Bulletin*, Thelma, W9JYO/A9JYO, reports delivering a radiogram that had been garbled in transmission from a soldier stationed in Germany to a young woman in Indiana. The message so confused the addressee that she called the soldier via transatlantic telephone to find out what he was talking about. He then obtained leave from the Army and flew to Indiana, and they got married. At last report, the newlyweds were living in Germany. When all else fails, try a radiogram.

Time and Time Signals. Hams who have trouble reconciling local time with Greenwich Mean Time (GMT) and times in other parts of the world must have smiled understandingly at the news that the late Winston Churchill had the same trouble. During World War II, he constantly forgot that it was five hours earlier in Washington than in London and kept waking up President Franklin D. Roosevelt long before dawn with his transatlantic telephone calls. Finally, a special clock with an extra hand indicating Washington time was installed in Churchill's office. Wonder how many hams have added a GMT hand to their 24-hour clocks?

When most U. S. hams think of time signals and standard frequencies, WWV on 2.5, 5, 10, and 15 mc. naturally comes to mind. Equally accurate is Canada's Dominion Observatory Station CHU, which transmits continuously on 3330, 7335, and 14,670 kc. Every minute around the clock, a voice announcement of the correct Eastern Standard Time is made in French and English, with the second ticks in between. While many ham-band-only receivers will not cover WWV's frequencies or two of CHU's frequencies, virtually all of them will tune in CHU's 7335-kc. signal at the top of the 7-mc. band.

News and Views

Dennis Mungham, VE3ASO, 23 Hartfield Rd., Irlington, Ontario, Canada, runs 750 watts on 11 meters, and does it legally, because Canadian hams are still authorized to operate on that band. He also operates on 160, 80, 40, 20, 15, and 10 meters with the same transmitter and a National NC-109 receiver. Dennis rates England on 80 meters as his best "low-band" DX, although he has 47 states and lots of other DX logged. On 2 meters, 15 watts into a surplus BC-522 transmitter feeding into an 8-element beam 60' high has pushed VE3ASO's signal out 1100 miles. Still going up, Dennis also has a 420-mc. transceiver. He is open for skeds on any of the bands mentioned. . . . **Glenn Gustafson, WN1CYG**, 54 Stockman St., Springfield, Mass., keeps his Johnson

LATEST SAMS BOOKS FOR EVERYONE IN ELECTRONICS



USE THIS HANDY ORDER FORM

- Short-Wave Listeners Guide.** Invaluable for the short-wave hobbyist. Complete listings for over 300 short-wave stations by country, call letters, frequency, power, and broadcast time. Order **5LG-1**, only. . . \$1.25
- Transistor Ignition Systems Handbook.** Clearly explains principles, installation, tune-up, and maintenance of these new transistor systems which are revolutionizing the auto industry. Order **ISG-1**, only. . . \$2.50
- Citizens Band Radio Handbook.** New enlarged edition. Covers latest CB equipment and circuits, antenna systems, fixed and mobile installations, maintenance and repairs, FCC rules, etc. Order **CBH-2**, only. . . \$2.95
- How To Read Schematic Diagrams.** Not only shows you how to read and interpret diagrams, but analyzes each component, its construction, and its circuit purpose and use. Order **RSD-1**, only. . . . \$1.50
- ABC's of Computers.** Explains in simple terms how computers work and what they do. Covers analog and digital types; describes circuitry, memory devices, programming, etc. Order **ABC-1**, only. . . . \$1.95
- Second-Class Radiotelephone License Handbook.** Complete study course for elements I, II and III of the FCC exams. Helps you earn the license you need to repair communications equipment, including 2-way mobile radio. Order **QAN-1**, only. . . . \$3.95
- Color TV Servicing Made Easy.** Full explanation of color principles, circuitry, setup adjustments, and servicing of all color TV sets. Takes the mystery out of servicing color TV. Order **CSL-1**, only. . . . \$2.95
- 101 Ways to Use Your VOM & VTVM.** Shows you how to get the most from these popular instruments, how to make required connections, how to test properly, how to evaluate results. Order **TEM-3**, only. . . . \$2.00
- TV Servicing Guide.** Tells you how to apply proper troubleshooting procedures based on analysis of symptoms, illustrated by picture tube photos. Packed with troubleshooting and servicing hints. Order **SGS-1**, only. . . . \$2.00
- Electronic Gadgets for Your Car.** Practical projects for building a tachometer, transistorized battery checker and charger, spare-tire alarm, and other automotive electronic devices. Order **CAR-1**, only. . . . \$2.95
- Scope Waveform Analysis.** Practical, clearly explained data on the best ways to use a scope, how to properly obtain waveforms, and how to interpret what they mean. Order **SWM-1**, only. . . . \$2.95



FREE Sams Book List

Complete descriptions of more than 300 important books covering every phase of electronics. Send for it today.

HOWARD W. SAMS & CO., INC.

Order from any Electronic Parts Distributor or mail to Howard W. Sams & Co., Inc., Dept. PE-5, 4300 W. 62nd St., Indianapolis 6, Ind.

Send books checked above. \$_____ enclosed.

Send FREE Booklist. Send Photofact Index.

Name _____

Address _____

City _____ Zone _____ State _____

SOLE IMPORTERS IN CANADA: A. C. Simmonds & Sons, Ltd., Toronto 7

CIRCLE NO. 28 ON READER SERVICE PAGE

NOW PERSONAL TV LISTENING



You Can Enjoy TV... Or Ignore It

With the

TELEX

TV LISTENER

Enjoy television in private without disturbing others. Full rich sound through a comfortable, lightweight individual earphone. Others don't hear a thing. Keeps house quiet and peaceful during noisy Westerns and children's programs. Ideal for late night viewing after family is asleep. Switch sound on or off, and control volume remotely from your chair. 15 ft. listener cord and 4 ft. Earset® cord. Tune down commercials. Perfect for the hard of hearing, motels, institutions. With extra Earset® two can listen. See your local dealer.

A Product of Sound Research



TELEX/Acoustic Products

COMMUNICATIONS ACCESSORIES

3054 Excelsior Blvd. • Minneapolis 16, Minn.

CIRCLE NO. 45 ON READER SERVICE PAGE

Hallicrafters

performance standards
for just \$99.95



new CB-7

six-channel CB transceiver

- New all-electronic push-to-talk circuitry.
- Compact new size—just 12" x 5" x 7".
- Nothing else to buy—110V. AC or 12V. DC operation.
- Accessories available: S-meter; Noise Eliminator; Receiver Tuning; Encoder/Decoder.
- 100% modulation, sensitivity 1 µv.

Write for complete specifications today!

hallicrafters

Dept. 4, 5th & Kostner Aves.,
Chicago, Ill., 60624



Export: Hallicrafters Int'l. Div. Canada: Gould Sales Co. Montreal, P. Q.

CIRCLE NO. 10 ON READER SERVICE PAGE

"Ranger" transmitter and Heath HR-20 receiver on 40 meters. With them and a 40-meter dipole antenna, he has worked Puerto Rico, Canada, and 40 states . . . **Gary Davis, WN5JYM**, 814 Alice St., Jennings, La., proves that perseverance pays off. He tried for four months to make a contact on 40 meters with his Heathkit DX-60 transmitter and Hallicrafters S-38B receiver before the first one came through. Then, after getting "that first olive out of the bottle," he made over 60 contacts in the next three weeks and is still going strong! It would be interesting and instructive to find out what Gary is doing now that he wasn't doing when he wasn't making contacts. His equipment is still the same.

Bruce Crocker, WN7ANL, 2515 S.W. Timberline Drive, Portland, Ore., has worked 32 states and 5 countries in his six months as a Novice. By the time this item reaches your mailbox, Bruce will be a "General," and his call-sign will be WA7ANL, but his equipment will still include a Heathkit DX-40 transmitter and a National NC-270 receiver . . . **Steve Gorenbein, WB6MIO**, 1740 Haynes St., Van Nuys, Calif., uses two receivers—a Gonsset GR-21R and a Hallicrafters S-40—to keep up with his Heathkit DX-60 transmitter, which feeds a home-brew amplifier. With the help of an 80-through-10 meter vertical antenna and a rotary, 15-meter dipole, Steve has racked up 11 states and 15 countries . . . **Ray Martin, WA0DZI**, and his Dad, W0CTQ, 7523 Pawnee, Prairie Village, Kan., operate their stations jointly. Among the gear available is a Johnson 6N2, a Heathkit "Twoer," a Hallicrafters HT-40, and a couple of other transmitters. The receiver is a Hammarlund HQ-110C, and two of their antennas are a 5-element beam for 6 meters and a 10-element beam for 2 meters. Ray has worked nine states on 6 and 2 meters, and Dad isn't talking.

Although **Chuck, 5H3JR**, (L. Charles Tardiff, W.F., St. Charles Parish, Ibindo Nyambiti, Mwanza, Tanzania, Africa) specified that his new quad antenna was to be shipped from New York by boat, the supplier shipped it by air freight to the wrong address (at a cost of over \$200.00). But the antenna finally reached Father Chuck's mission. It and its new 60' pipe mast were almost in position when one of the guy ropes snagged in a tree. Seconds later, a dream, months of work, and \$300 were a tangled mess of wire and splintered bamboo. Still want to be a rare DX station thousands of miles from anywhere? But the story has a happy ending. A number of Father Chuck's ham friends bought him a new quad, and Dave, W2SNM, his QSL manager, personally supervised its packing and addressing. Dave then took the crate down to the docks and saw that it was put on the right ship.

Mike Czuhajewski, WN8MCQ, RFD #3, Paw Paw, Mich., has combined the doubtful advantages of low power, a poor antenna, and a very simple receiver into an impressive record. His AMECO AC-1 transmitter runs 15 watts and feeds a 63' piece of wire, 18' high and surrounded by trees, as an antenna; he receives on a Knight-Kit "Span Master." Forty-seven contacts in six states on 80 meters with such equipment is a record to be proud of. But Mike is less happy over his QSL returns—about one card received for every three sent . . . **Frederick Holzapfel, WA4REJ**, 6970 8th Rd., Memphis, Tenn., has worked 17 states with his Heathkit "Sixer." Shows what five watts into a Hy-Gain 8-el beam 30' high can do. Now that Rickey's Clegg "99-cr" is on the way, he is installing the "Sixer" in his automobile.

You can take the first step toward getting your "News and Views" or picture in this column by mailing them to: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Ind. 46401. We would also like to be put on the mailing list to receive your radio club paper. 73.

Herb, W9EGQ

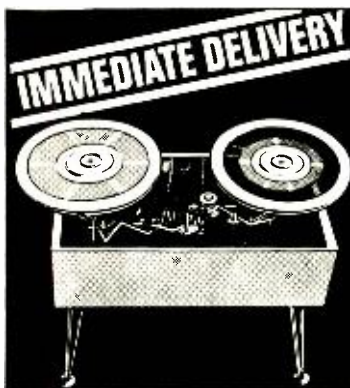
POPULAR ELECTRONICS

SHORT-WAVE MONITOR CERTIFICATE APPLICATION

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

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

(Please Print)	(Do not fill out)
Name	
Street, City and Zone	
State and Zip	
Receivers in use Make	Model
Make	Model
Age	Occupation
Ham/CB call -letter assignment(s)	
I listen mostly to SW Broadcast Homs CB BCB VHF VLF	
I use the following antennas	
I have QSL cards and countries verified. Check if subscriber to P.E.	
Signature	Date



IMMEDIATE DELIVERY

TAPE T.V. PICTURES AT HOME NOW ! VIDEO RECORDER KIT only \$392 complete

The amazing V.K.R. 500 is the world's first low-price television tape recorder for immediate delivery! Its ingenious design in kit form allows easy assembly for the engineer and enthusiast alike. Suitable for 525 line system, the V.K.R. 500 has entirely transistorised circuits using silicon transistors on single printed circuit board, and may be used for recording from your own ITV camera or 'off the air' television programmes. A special feature is the employment of N.I.S.R. (Non Integrating Sync. Regeneration) for really stable operation. The V.K.R. 500 is the machine you've been waiting for. **ORDER NOW!**

Running time up to 30 minutes approx. on standard 1/4" magnetic tape

WESGROVE ELECTRICS LIMITED

Nash House, New Street, Worcester, England.

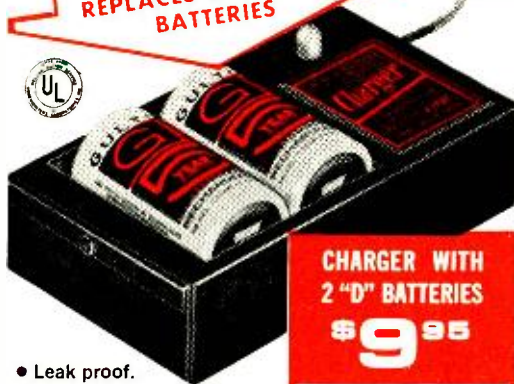
Telephone: Worcester 25848

CIRCLE NO. 32 ON READER SERVICE PAGE

Guaranteed Five Years*

RECHARGEABLE BATTERIES

SENSATIONAL NEW
NICKEL CADMIUM-
REPLACES ORDINARY
BATTERIES



CHARGER WITH
2 "D" BATTERIES
\$9.95

*** FIVE YEAR GUARANTEE**
"Within five years after
purchase, this battery will
be replaced without charge
due to any defect in materials
or workmanship."

- Leak proof.
- Power output remains constant; does not fade away like other batteries.
- Will outlast most toys and appliances.
- Cannot overcharge.

Never throw batteries away again—Pays for itself in an amazingly short time.

For use in toys, flashlights, portable radios, phonographs, tape recorders, appliances and other battery operated products.

"C" batteries and additional "D" batteries available—see coupon.

CONSUMER SERVICE COMPANY
160 Mercer Street, New York, N. Y. 10012

Enclosed is \$..... Please send the following:

- Chargers and 2 "D" batteries at 9.95 plus 75c for postage and handling.
- Boxes of 2 "C" batteries (with charger adapter) at 4.98.
- Boxes of 2 "D" batteries at 5.98
- Chargers without batteries at 5.98 plus 75c for postage and handling.
(N. Y. C. residents please add 4% sales tax.)
Foreign orders \$1.15 additional.

Name..... (PLEASE PRINT) PE 25

Address.....

City..... State..... Zip Code.....

Sorry—No charges or C.O.D. orders.

Short-Wave Report

(Continued from page 69)

stations in the 1500-1700 kc range. Several reporters have heard, with regularity, the following beacons: SOG, 1640 kc., Sogamoso, Colombia; TBU, 1695 kc., Tibu, Colombia; CGW, 1745 kc., Cartago, Colombia; and PLT, 1750 kc., Plato, Colombia. Another good one is RAB, 1613 kc., Rabinal, Guatemala. Remember, all beacon station ID's are given in Morse code.

A Monitor in New England reports hearing the BBC in Droitwich, England, on 200 kc. at 2155 with light music, and R. Luxembourg on 233 kc. in French at 0035-0045 but with QRM from aero beacon SQT in Squantum, Maine. Going in the opposite direction, stateside medium-wave stations being heard in England recently include WCAU, WEGP, WOR, WHDH, WBAL, WHN, WINS, WKBW, KYW, WCKY, WNEW, and WBT, as well as the Canadian CBA, CBM, and CBN.

Current Station Reports

The following is a resume of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Eastern Standard and the 24-hour system is used. Reports should be sent to SHORT-WAVE REPORT, P.O. Box 333, Cherry Hill, N.J., 08031, in time to reach your Short-Wave Editor by the fifth of each month; be sure to include your WPE identification, and the make and model number of your receiver. We regret that we are unable to use all of the reports received each month, due to space limitations, but we are grateful to everyone who contributes to this column.

Albania—European reports list R. Kukesi, Kukesi, as being heard at 1300-1500, with news from Tirana at 1300 and 1400; the frequency varies from 6570 to 6690 kc. R. Shkodra, Shkoder, signs off at 0930 and is heard again from 1400 to 1430 on 8215 kc.

Angola—As listed last month, the station on 11,685 kc. is definitely R. Dinnanga, Dundo. The schedule reads: 1300-1430 weekdays, and 0600-0730 Sundays. There are conflicting reports, however. It was believed that the 11,685-kc. channel replaced 9612 kc., but a QSL just in shows this schedule to be valid for CR6RR, 11,700 kc.; CR6RG, 4770 kc.; and CR6RI, 9612 kc.

Bermuda In the Utility category is VRT, heard giving a voice ID as Victor, Romeo, Tango, and calling the Queen Elizabeth at 1515 on 13,140 kc. This was followed by a test transmission period.

Bolivia—R. Sunui Oveko, Potosi, has moved from 5755 kc. to 5821 kc., where it has been noted with many talks (in Spanish) related to Miners' Unions. S/off time is irregular, at 2100 or later. Do not confuse this station with a Peruvian on 5818 kc.

British Honduras—R. Belize is being heard on both coasts evenings to 2300 s/off on 3300 kc. The complete schedule is: 0700-1030, 1300-1400, and 1730-2300 (Sundays at 0700-1400 and 1730-0000). The medium-wave outlet on 834 kc. is also strong at times in the east. They have commercials, and newscasts from London and the VOA, as well as Eng.-transcribed programs from R. Nederland.

British Virgin Islands—Radio New York World-wide's press sheet reports that a medium-wave station is to be constructed in Rodetown. It will operate on 780 kc. with 10-kw. power and will be known as ZBVI.

Bulgaria—The latest schedule from R. Sofia lists the Eng. xmsns to N.A. and Great Britain as being only on 6070 kc. The schedule reads: to N.A. at 1900-1930, 1930-2000 and 2300-2330; to England at 1430-1500 and 1630-1700.

Cambodia—Phnom-Penh is noted very weakly on 9695 kc. at 0815-0845 with local music and talks. They may have an Eng. newscast at 0800.

Canary Islands—Radio Nacional de Espana es las Islas Canarias, Santa Cruz de Tenerife. is good at 1900 s/on in Spanish, but quickly fades and is unreadable after 1930. The frequency is 11,800 kc.

Congo (East)—Leopoldville, 9623 kc., is heard at 1745 with news in French, at 1756 with an ID, an anthem, then s/off. Elisabethville is noted on 11,885 kc. to 1530 s/off with programs in French and African languages.

Costa Rica—A new station is TIJCD. R. Atenas. Atenas, 6205 kc., heard to 2100 s/off; they announce as being on 6150 kc. R. Relej, San Jose, formerly on 6205 kc., has moved up to 6215 kc. and is generally good around 1900.

Ecuador—Station HCEH3, R. Progreso, Loja, has moved again, this time from 4753 kc. to 4706 kc., and is audible from 1900 to past 0000 with Latin American pop tunes and lengthy listeners' request programs. Station HCXZL, R. Nacional, Quito, recently returned to the air on 4939 kc. with the usual Latin American programs and very few commercials; it is heard best around 2200. Station HCOT1, R. Saracay, Santo Domingo de los Colorados, has moved down to 3401 kc. and fades in around 1900 with Ecuadorian music; s/off time is after 2300.

Gibraltar—As listed last month, MLU2 operates c.w. on 11,655 kc. In addition to the time listed previously, look for it around 1424 with a CQ running marker; from 1430 to 1450 s/off they issue weather messages. There may be QRM from YND, Nicaragua, and/or TGB, Guatemala.

Haiti—Evidently inactive for some time, R. Commerce, Port-au-Prince, is again being heard irregularly at 1115-1130 and at 1430-1630 on 9480 kc. They may give an alternate ID as Voice of Haiti. Most of the programs are in French.

Honduras—Newly heard is HRRZ, R. Tegucigalpa, Tegucigalpa, 4960 kc. At 2155 they have "Fiesta Mexicana," and at 2200 they s/off with a clear taped copy of the call-sign and name, and a theme believed to be "Nom Dominicar" or something similar. Other details are not known at press time.

Hungary—Budapest has been found on 7295 kc. with Eng. at 1930 that runs to 2000 s/off.

Indonesia—R. Republik Indonesia operates in Indonesian to Europe and Middle East areas at 1300-1400 on 9865 and 11,715 kc.; in Eng. to Australia, New Zealand, and Pacific areas at 0600-0700, and to S.E. India, Pakistan, Japan, and the West Coast of N.A. at 0930-1630, all on 9865 and 11,795 kc.

Japan—A recent QSL from Nihon Shortwave B/C Co., Ltd., lists their stations as JOZ, 3925 kc.; JOZ2, 6055 kc.; JOZ3, 9595 kc.; JOZ4 and JOZ5, 3945 kc.; and JOZ6, 7230 kc. All of these stations are in Tokyo except JOZ4 which is in Sapporo. Medium-wave stations observed on the West Coast

SHORT-WAVE ABBREVIATIONS

B/C—Broadcasting	QRM—Station interference
CQ—General call	QSL—Verification
c.w.—Morse code	R.—Radio
Eng.—English	s/off—Sign-off
ID—Identification	s/on—Sign-on
kc.—Kilocycles	VOA—Voice of America
kw.—Kilowatts	xmsn—Transmission
N.A.—North America	xmtr—Transmitter

NEW! SCR CAPACITIVE DISCHARGE FURY XII ELECTRONIC AUTO IGNITION SYSTEM



- All Components Pre-tested
- 8 Amp Silicon Contr'd. Rectifier
- All Motorola Semiconductors
- Mylar Capacitors Throughout
- 2 Microfarad Storage Capacitors

Designed for quality—engineered for reliability! 5½" L. 3¼" H. 3K" D. ALL-DIODE TRIGGERING for proven reliability. All advantages of capacitive discharge PLUS solid state electronics! Provides SUPERIOR COLD STARTING ABILITY. Install in 10 minutes! In KIT form or FULLY ASSEMBLED. ORDER TODAY AND SAVE BIG MONEY!

FURY XII DLX. KIT SHOWN \$39.95
FURY XII DLX. MODEL—ASSEMBLED 69.95
MK Standard Model Kit 29.95
MK Standard Model Assembled 49.95

- MICRO-KITS CO., DEPT. PS465 P.O. BOX 495,
15547 So. Garfield Ave., Paramount, Calif. 90723
- ENCL. \$39.95 for FURY XII DELUXE KIT
 - ENCL. \$69.95 for ASSEMBLED FURY XII
 - ENCL. \$29.95 for MK STANDARD KIT
 - ENCL. \$49.95 for ASSEMBLED MK SYSTEM
 - PLEASE send FREE LITERATURE

NAME _____
ADDRESS _____
CITY _____ STATE _____

CIRCLE NO. 39 ON READER SERVICE PAGE



LOOK! A NEW ELECTRONICS SLIDE RULE WITH COMPLETE INSTRUCTION COURSE

Professional 10" all-metal Electronics Slide Rule. Designed specifically for technicians, engineers, students, hobbyists. Has special scales not found on any other rule. Enables you to solve electronics problems quickly, accurately. Made to our rigid specs by Pickett, Inc. Slide Rule plus four lesson AUTO-PROGRAMMED Instruction Course with grading service, and top-grain leather carrying case all for \$14.95. Satisfaction warranted or your money back. Cleveland Institute of Electronics, Dept. PE-108, 1776 E. 17th St., Cleveland, Ohio 44114.

SEND COUPON TODAY!

Cleveland Institute of Electronics
1776 E. 17th St., DEPT. PE-108, CLEVELAND, OHIO 44114

- Send Electronics Slide Rule with Instruction Course and leather case, I'm enclosing \$14.95.
- Send descriptive brochure only . . . without obligation.

NAME _____
ADDRESS _____ COUNTY _____
CITY _____ STATE _____ ZIP _____

CIRCLE NO. 3 ON READER SERVICE PAGE

include Far East Network stations in Iwakuni, 1550 kc., at 0310-0401 (Sundays), and in Itazuke, 1550 kc., at 0403-0430.

Korea (North)—The newest schedule from *R. Pyongyang* has Eng. to Africa at 1300-1400 only on 7580 kc. and at 1400-1500 only on 6540 kc. Other Eng. xmsns go to Latin America at 2200-2300 on 9750 and 15,240 kc., and to S.E. Asia at 0700-0800 on 7580 and 9750 kc.

Martinique—*R. Martinique* is being noted on 3315 kc. around 0500 with talks in French and music.

Mozambique—Station CR7BF, Lourenco Marques, is now on 11,780 kc., and has been heard from 2300 with musical requests and commercials, from 0000 with news, and from 0015 with the Leslie Sullivan show, all in English.

Netherlands—*R. Nederland*, Hilversum, has a Dutch xmsn on 15,180 kc. with classical music at 0930-0950, and news in Eng. at 1220. S/off time is at 1230 after a five-minute "Spotlight."

Netherland Antilles—Station PJB, Bonaire, reportedly has a burned-out power transformer that has caused a temporary closing of some short-wave services. Recent loggings include xmsns on 5980 kc. at 2100-0430 and on 6130 kc. at 2230-2300, both in English. This station has been noted lately giving their time as 4 hours behind GMT rather than the usual 4½ hours.

Another good catch for the c.w. boys is PJT, Curacao, on 12,800 kc. (although it is listed for 12,295 kc.). Station PJT operates with 3-kw. power into a rhombic antenna.

New Guinea—Rarely heard is VL9CD, *R. Wewak*, on 3335 kc., operating with 250 watts. West Coasters might look for it around 0455-0500 with music, then Eng. news.

Nicaragua—A previous listing of R590 (Mexico)

on 5965 kc. was in error; the station is YNWW, the only short-wave outlet for the Nicaraguan Sports Network. The chief station in this network is YNRD, *Quinientos Noventa Punto*, 590 kc., Managua. They feature many sporting events, especially baseball, after which there is an Esso newscast. The s/off runs from 0100 to 0130.

Pakistan—Karachi has Eng. news at dictation speed at 0835-0850 on 11,672, 15,100 (or 15,095 kc.), 17,765 and 21,590 kc. Other reports indicate that this broadcast may also be given on 9810 kc. A report from the West Coast lists the station as being heard on 7010 kc. at 1036-1045 but with a nearly unreadable signal.

Peru—Station OAXTR, *R. San Jose*, Indiana (Dept. de Oresto), 4825 kc., opened during mid-1964 and may be operated by a mission in the Amazonian jungle. They feature "Escuelas Radiofonicas" (following the pattern of *R. Sutatenza*) and much indigenous music. Present closing is around 2200. Frequent ID's are given but there is QRM from Ashkabad on the same channel.

Philippines—A new B/C facility of the VOA is being built in the northern Philippines. Called "Project Bamboo," it will consist of ten 250-kw. short-wave xmt's which will provide greater coverage of the Chinese mainland, the Asian portion of the Soviet Union, and S. & S.E. Asia.

Switzerland—Berne now uses 6080 kc., dual to 6120 and 9535 kc., for the 2015-2145 xmsn to N.A. The West Coast xmsn continues to be heard at 1000-1130 on 15,305 kc.

The Swiss state-controlled TV network is now carrying commercials for the first time in its 12 years of being. This is expected to bring in an extra 17 million francs (about \$4 million) rev-nue.

Syria—The latest schedule from Damascus is:

DX Country Awards Presented

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

Seventy-Five Countries Verified

Bill Holscher (WPEØATE), Webster Groves, Mo.

Fifty Countries Verified

Vincent Yucas, Jr. (WPE1FJA), S. Boston, Mass.
Robert A. Howell (WPE8GXG), E. Lansing, Mich.

Twenty-Five Countries Verified

Gene E. Beard (WPE8HX1), Columbus, Ohio
P. Kilroy (WPE3FOB), Washington, D. C.
Donald David (WPE1ESU), Hinsdale, Mass.
Robert Quade (WPE2LLB), Rochester, N. Y.
Stephen Dionne (WPE2LOU), Binghamton, N. Y.
Clifford Nadiger (WPE6CAK), San Jose, Calif.
James Moore (WPE4GOI), Nashville, Tenn.
Ray Salvo (WPE6DEM), Hayward, Calif.
Henry Brown, Jr. (WPE1EXZ), Falmouth, Mass.
Charles Quinley, Jr. (WPE4HBU), S. Pittsburg, Tenn.
Richard Clinard (WPE4GNV), Madison, Tenn.
Bill Lee (WPE3FGU), Bethlehem, Pa.
Earl Stick, Jr. (WPE3FZY), Lebanon, Pa.
Clarence Mills (WPE6EMO), W. Covina, Calif.
David Cuevas (WPE6EPU), S. San Gabriel, Calif.
Jack Pleska (WPE3EUN), Simpson, Pa.
Michael Busse (SV1PE1E), Athen-Psuhicon, Greece

Steve Tharp (WPE2LQK), Grand Island, N. Y.
Bob Dirkse (WPE8HEQ), Galesburg, Mich.
Hector Borrero (KP4PE1G), Bayamon, Puerto Rico
David Smith (WPE1GBC), Everett, Mass.
Jerry Headen (WPE4HQL), Winston-Salem, N. C.
George E. Hall (WPE2KOR), Saddle Brook, N. J.
Barry L. Jones (VE3PE1ZP), Willowdale, Ont., Canada
Frederick Galdo (WPE2LLN), Riverside, N. J.
John H. Allen (WPEØDXW), Pueblo, Colo.
Richard G. Sears (WPE1FNM), Cambridge, Mass.
Rick Malchetske (WPE9HBT), Menasha, Wis.
Robert I. Cate (WPE1FXM), Dover, N. H.
Ray Gregory (WPE5DD5), San Antonio, Texas
N. W. Thompson (WPE2MQN), Richmond Hill, N. Y.
Donald Lee (WPE3EVB), Lebanon, Pa.
Alfred J. Reyer, Jr. (WPE6FUX), Fallbrook, Calif.
Michael Brass (WPE1EYD), Framingham, Mass.
Gene Carlson (WPE9HAM), Andover, Ill.
Robert R. Collins (WPE4GOO), Santa Ana, Calif.
Ronald Brown (WPE3FNR), Baltimore, Md.
Kenneth Weaver (WPE3DUB), Allentown, Pa.
Foster Cooperstein (WPE1GCF), New Bedford, Mass.
Charles W. Maier (WPE3FXJ), Baltimore, Md.
Winfried Wandrei (VE7PE8W), Burnaby, B. C., Canada
David Chaffin (WPE4HJZ), Chattanooga, Tenn.
Mary Pollock (WPE4BPQ), Hickory, N. C.

SHORT-WAVE CONTRIBUTORS

Clifford Stott (WPE1FXQ), W. Springfield, Mass.
 Bill Smith (WPE1FZ), Uxbridge, Mass.
 David Smith (WPE1GBC), Everett, Mass.
 Charles Territo, Jr. (WPE2FX), Paterson, N. J.
 Alan Raylesberg (WPE2MKW), Bayside, N. Y.
 Bernie Greene (WPE2MNY), Brooklyn, N. Y.
 Doug Lamerson (WPE2MNA), Richmond Hill, N. Y.
 Charles Coombe (WPE2MOB), Trenton, N. J.
 Larry Bennett (WPE2NEU), Forest Hills, N. Y.
 Bertram Podall (WPE2NIC), Briarwood, N. Y.
 Robert Nagle (WPE3DIN), Alencon, Pa.
 Marshall Salt (WPE3ERC), Reading, Pa.
 Kenneth Stern (WPE3FDZ), Philadelphia, Pa.
 Mark Budinger (WPE3GGR), Ingomar, Pa.
 Grady Ferguson (WPE4BC), Charlotte, N. C.
 Chuck Edwards (WPE4BKK), Fort Lauderdale, Fla.
 Bruce Churchill (WPE4EVD), Virginia Beach, Va.
 David Bal'ew (WPE4IGQ), Nashville, Tenn.
 Bob Scott (WPE4HIX), Kingsport, Tenn.
 Aldridge Salisbury (WPE4HLD), Falls Church, Va.
 Louis Morales (WPE4HLR), Miami, Fla.
 Bobby Conder (WPE4HQT), Winston-Salem, N. C.
 Jim Cumbie (WPE5AC), Dallas, Texas
 Jack Keene (WPE5BMP), Houston, Texas
 Shaler Hanisch (WPE6BMP), Hartford, Conn.
 Dave Brown (WPE6EMH), Woodland Hills, Calif.
 Gary Scrimgeour (WPE6EYS), La Jolla, Calif.
 Bruce Bumm (WPE6FPB), Seaside, Calif.
 Robert Sabin (WPE6DB), Wilmington, Ohio
 Harry Moulbray (WPE6EVO), Akron, Ohio
 Ray Fansler (WPE6CQC), Fairfield, Iowa
 Jerry Tom (WPE6GKM), South Bend, Ind.
 Darwin Hansen (WPE6BYQ), Belmont, Iowa
 Cecil Waugh, Jr. (WPE6CKU), St. Joseph, Mo.
 Steve Smay (WPE6EAW), Springfield, Mo.
 Joe Kasser (G2PE5S), London, England
 Jack Perolo (PY2PEIC), Sao Paulo, Brazil
 Robert Jones (VE3PE2H), Belleville, Ont., Canada
 Richard Langley (VE3PE2CA), Scarborough, Ont., Canada
 David Bennett (VE7PE1R), Richmond, B. C., Canada
 Leo Alster, Rahway, N. J.
 George Bednarik, Jr., Petoskey, Mich.
 Jerry Brennan, Redwood City, Calif.
 Don Brewer, Cedar Rapids, Iowa
 William Campbell, Canandaigua, N. Y.
 Jose Carriazo, Jr., Chicago, Ill.
 Daniel Ferguson, Cocoa, Fla.
 Wayne Moyer, Dayton, Ohio
 Joe Piechuta, Meriden, Conn.
 Radio New York Worldwide, New York, N. Y.
 Sweden Calling DX'ers Bulletin, Stockholm, Sweden

French and Eng. at 0000-0230 on 7390 kc. and at 1100-1400 on 15,165 kc.; Hebrew, German, and Yugoslavian at 0900-1000 on 9555 kc.; Turkish at 1000-1100 on 7390 kc.; Arabic, Spanish, and Portuguese at 1830-2100 on 11,915, 15,190, and 17,865 kc. There is a special program of literature and classical music at 1400-1630 on 9555 kc. The Arabic schedule reads: 2300-1800 on 6165 kc.; 2300-0230 and 0500-0900 on 17,865 kc.; 1400-1630 and 1700-1800 on 9555 kc.; and 0000-0500 and 0900-1700 on 7145 kc.

U.S.S.R.—Referring back to our January listing, *R. Yerevan* is, in fact, a bona-fide station. We've just seen their QSL card and program schedule which was sent by registered mail. However, it would seem that "Yerevan," in addition to being a real place, is also a hypothetical place to which all jokes against the Russian regime can be credited.

Venezuela—Station YVOC, *R. Ecos del Torbes*, San Cristobal, 4981 kc., has returned to the air and is heard best from 1830.

Vietnam (North)—Hanoi has a new schedule: Eng. at 1900-1930 and French at 1730-1800 on 9760, 11,760 and 15,100 kc.; Eng. at 2330-2345, 0500-0530, 0830-0900 and 1030-1100 and French at 2315-2330, 0600-0630 and 0900-0930 on 9840 and 11,840 kc.

Windward Islands—Grenada is noted on 2420 kc. around 2100 with a musical period followed by a newscast that seems to be a relay. There is severe QRM at times from a Brazilian on the same frequency.

SEND POPULAR ELECTRONICS REGULARLY EACH MONTH, FOR:



SUBSCRIPTION OFFER

SAVING UNDER SINGLE-COPY PRICE

- 3 Years \$10 YOU SAVE \$2.60
 - 2 Years \$7 YOU SAVE \$1.40
 - 1 Year \$4 YOU SAVE .20
- New Renewal Extension

name _____ please print

address _____

city _____ state _____ zip code _____

- Bonus!**
- Payment enclosed. (We will add 2 EXTRA ISSUES at no extra cost, for each year of your order!)
 - Bill me. I'll pass up the bonus. _____

initial

Foreign Postage: Canada & Pan-Am countries, add .50 per year; all other foreign countries add \$1 per year.

Mail to: POPULAR ELECTRONICS
 Dept. 0151, Portland Place, Boulder, Colo. 80301

WORLD'S FINEST-SOURED SOLDER
ERSIN MULTICORE
5-CORE SOLDER
 BUY IT AT RADIO-TV PARTS STORES
 EASY DISPENSER ONLY 50c

ELECTRONICS
COYNE ELECTRONICS INSTITUTE

A quarter million dollars worth of equipment. Non-Profit Institute—Est. 1899. Courses: Electronics • Electricity • TV-Radio • F.C.C. • Electronics Engineering Technology. Mail coupon or write for FREE BOOK, "Your Opportunities in Electronics." No Salesman will call.

COYNE ELECTRONICS INSTITUTE Educ. Serv. Dept. 55-M
 1501 W. Congress Parkway, Chicago, Ill. 60607

NAME _____ PHONE _____
 ADDRESS _____ AGE _____
 CITY _____ STATE _____

ELECTRONICS MARKET PLACE

COMMERCIAL RATE: For firms or individuals offering commercial products or services. 75¢ per word (including name and address). Minimum order \$7.50. Payment must accompany copy except when ads are placed by accredited advertising agencies. Frequency discount: 5% for 6 months; 10% for 12 months paid in advance.
READER RATE: For individuals with a personal item to buy or sell. 45¢ per word (including name and address). No Minimum! Payment must accompany copy.

GENERAL INFORMATION: First word in all ads set in bold caps at no extra charge. Additional words may be set in bold caps at 10¢ extra per word. All copy subject to publisher's approval. Closing Date: 1st of the 2nd preceding month (for example, March issue closes January 1st). Send order and remittance to: Hal Cymes, POPULAR ELECTRONICS, One Park Avenue, New York, New York 10016.

FOR SALE

FREE! Giant bargain catalog on transistors, diodes, rectifiers, components, valuable parts, equipment. Poly Paks, P.O. Box 942, Lynnfield, Mass.

GOVERNMENT Surplus Receivers, Transmitters, Sniperscopes, Radios, Parts, Picture Catalog 20¢. Meshna, Nahant, Mass.

DIAGRAMS for repairing Radios \$1.00. Television \$2.50. Give make model. Diagram Service, Box 1151 PE, Manchester, Connecticut 06042.

ROCKETS: Ideal for miniature transmitter tests. New illustrated catalog, 25¢. Single and multistage kits, cones, engines, launchers, trackers, technical information, etc. Fast service. Estes Industries, Penrose 18, Colorado.

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."

CANADIANS—GIANT Surplus Bargain Packed Catalogs. Electronics, Hi-Fi, Shortwave, Amateur, Citizens Radio. Rush \$1.00 (Refunded). ETCO, Dept. Z., Box 741, Montreal, CANADA.

TV CAMERAS, transmitters, converters, etc. Lowest factory prices. Catalog 10¢. Vanguard, 190-48 99th Ave., Hollis, N.Y. 11423.

WEBBER Labs. Transistorized converter kit \$5.00. Two models using car radio 30-50Mc or 100-200Mc, one Mc spread. Easily constructed. Webber, 40 Morris, Lynn, Mass.

JAPAN & Hong Kong Electronics Directory. Products, components, supplies. 50 firms—just \$1.00. Ippano Kaisha Ltd., Box 6266, Spokane, Washington 99207.

CANADIANS, TRANSISTORS AND PARTS. Free catalogue contains reference data on 300 transistors. J. & J. Electronics, Box 1437, Winnipeg, Manitoba.

CB QSL-WPE-SWL cards—Attractive 2 & 3 colors, glossy white. Call records books, Plastic card holders, Warning, Police, Gag, Call letter signs, Plastic badges, Maps, etc. Send 25¢ (refundable) for catalog No. 107. WOODY, 2611 Shenandoah, St. Louis, Mo. 63104.

CB-WPE-QSL CARDS. New "FROSTALEEN" Paper. 16 SAMPLES, 25¢. Dick, W8VXK, 1996P N, M-18 Gladwin, Michigan 48624.

COMPONENTS? Kits? Hardware? For catalogue write Trans-Vu-Pacs, Box 267, Chelsea, Mass. 02150.

NEW MAGNETIC DEVICE—Engineers, Inventors, Experimenters, Hobbies. Latest Theory in Basic Magnetism. Create new Products by Experimenting with the Magnetic Ladder Acceleration Solenoid using D.C. Plans \$1.00. Jesse Costa, Box 26, Waquoit, Mass. 02570.

\$1.00 DELIVERS Plastic Packets for 60 QSL's. TEPABCO, Brown Blvd., Gallatin, Tennessee.

TRANSISTORIZED CONVERTER 26-200 MC. Receive signal from 26 to 200 MC (1 MC spread), on broadcast band using car radio, crystal control or tuneable (1 MC spread). Kit \$11.00 pp. Wired \$20.00 pp. Webber Labs, 40 E Morris St., Lynn, Mass.

ELECTRONIC "GOODIES"—Bonanza surprise package, \$1.00 ppd. Guaranteed satisfaction. **DART ELECTRONICS,** Box 214, Jericho, N.Y.

DIAGRAMS—Television \$2.50. **RADIO 1919 to 1955** \$1.00 each. Give Model. Diagrams, Box 55, Williamsport, Pa. 17704.

ANSWER YOUR HOME PHONE FROM YOUR CAR! This complete unit connects to your present C-B Radio and will allow you to make and receive phone calls from your car, operating through your base station. Comes with dial, handset, and base. Nothing else to buy. Can be connected to any CB rig in minutes. \$29.95 PP. **MONEY REFUNDED IN 10 DAYS WITHOUT QUESTION IF NOT COMPLETELY SATISFIED.** Eastern Electronics, Dept. PE-5, 1511 Sheridan Ave., N.Y., N.Y. 10457.

QSL'S \$1.75/100 up. Catalogue-samples 10¢. Longbrook, Box 393-Y, Quakertown, N.J. 08868.

TRANSISTOR Ignition. "Operation Pickup" described June 1963 **POPULAR ELECTRONICS.** Complete kit guaranteed components. Now \$13.95 Postpaid. **NEW MODEL T-1A** including **DELCO** transistor, **MALLORY** coil. Kit \$16.95. Wired, \$18.95. Specify automobile. **ELECTROMART,** Box 2680, Milwaukee, Wisconsin. 53214.

NEW Supersensitive transistor locators detect buried gold, silver, coins. Kits, assembled models. \$19.95 up. Underwater models available. Free catalog. Relco-A33, Box 10563, Houston 18, Texas.

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.

INVESTIGATORS—Electronic surveillance devices. Price breakthrough on ultra miniature professional devices. Free details. Trol Electronics-PE, 342 Madison Avenue, New York, N.Y.

INVESTIGATORS, FREE BROCHURE, LATEST SUBMINIATURE ELECTRONIC SURVEILLANCE EQUIPMENT. **ACE ELECTRONICS,** 11500-L NW 7TH AVE., MIAMI 50, FLA.

CITIZEN BANDERS! Get base station Performance with your mobile units. No modifications or soldering necessary. Proven performance. Send for free details or send (\$15.00) to: T. Francis, 15 Park Row, N.Y. 38, N.Y.

ACHTUNG! Das machine is nicht fur Gerfingerpoken und mittengraben. Is easy schnappen der Springenwerk. blowenfusen und poppercorken mit spitzensparken. Ist nicht fur gewerken by das Dummkopfen. Das rubbernecken sightseeren kepen hands in das pockets. Relaxen und watch das Blinkenlights. This attractive. engraved metal plaque only \$2.00 each. ppd. Southwest Agents, Dept. P, 8331 Hwy. 80 West, Fort Worth, Texas 76116.

WALKIE-TALKIE. Construct 2"x1"x1/2" transistorized, long range, 100 milliwatt marvel for \$10. Plans, **FREE GIFT,** \$2.00. Baker Electronics, R.R. 1, Greencastle, Ind.

LASER: Hobbyists, experimenters, amateur scientists. Build your own coherent-light optical laser. Complete instructions, schematic diagrams and parts list. \$6.00. Same as above, diode laser. \$3.00. Technical Writers Group, Box 5501, State College Station, Raleigh, N.C.

CB CARDS—Economy line. Some low as \$1.50 hundred. Send 10¢ for samples. Signal, Adams County, Manchester, Ohio.

REVERBERATOR (Echo) UNIT—Build your own. Complete plans, schematic parts list—\$3.00. Use with automobile radio, home radio, or record player. Technical Writers Group, Box 5501, State College Station, Raleigh, N.C.

DYNA-PAK—completely transistorized unit; used as signal generator, voltage monitor, continuity tester, code oscillator, code monitor and other uses. \$2.98. Deltronic Labs, Box 128, Horsham, Pa.

10 DISTANCE Crystal set plans—25¢, 20 different—50¢. Includes data sheets, catalog. Laboratories, 1131-L Valota, Redwood City, Calif.

AMAZING NEW electronic miracle transforms your TV room into a Stereophonic Theatre! Free details and Free Gift! Consolidated Acoustics, 1302C Washington, Hoboken, N.J.

BUY Appliances, Cameras, Watches, etc. at factory prices plus 10%! Free Details! Cam Company, 436-11 Bloomfield Ave. Verona, N.J. 07044.

ELECTRONIC Ignition Kits, Components. Free Diagrams. Anderson Engineering, Epsom, New Hampshire 03239.

COMPASS KIT Three inches diameter with disk magnetizers, One Dollar. Magneto, 617-C Seventh Street, San Francisco, Calif. 94103.

NAMEPLATES, Decals and Signs of All Kinds. Seton, New Haven 15, Conn.

BUILD TV Camera Cheaper Than Ever! Send 10¢ for Details. ATV Research, Box 396, South Sioux City, Nebr. 68776.

DIGITAL CIRCUITS: Set-reset **FLIP-FLOPS** for operation up to 1,000,000 pulses per second, **PULSE GENERATORS, FULL ADDERS, and LOGIC GATES.** All circuits fully transistorized and mounted on plug-in printed circuit boards. A connector is provided with each unit. Rugged wide temperature range industrial units available. Type FF-1A flip-flop and connector for 10,000 pps operation: \$3.87. Postage paid. Send for free literature giving detailed specifications of all circuits. **KOMTRON**, Box 275, Little Falls, N.J. 07424.

NEED RESISTORS? Factory fresh, **NAME BRAND**, 1/2 watt, 10% standard carbon resistors. Any regular value from 10 ohms to 2.2 megohms, \$.05 each! Postpaid. Any quantity assorted. Minimum order \$1.00 **TEPCO**, Box 508, Tulsa, Okla., Tenn.

HEAR AIRCRAFT, TOWER, WEATHER. 9 Transistor AM-FM portable receiver converts to VHF aircraft band. \$26.50. **BUILD TINY, ULTRA SENSITIVE FM WIRELESS MIKE.** Wired board, parts, and instructions. \$12.50. Free details. Transco, Box 13482 North County Branch, St. Louis, Mo. 63138.

SAFGUARD PRIVACY! New instrument detects electronic 'bugs', wire-tapping and snooping devices. Free information. Dee Equipment, Box 7263-E7, Houston 8, Texas.

QSL-CB-SWL (Letters)—Cards Printed; Samples 10¢. **MARTIN**, 828-C Schuylkill Avenue, Reading, Pa.

110VAC 60cy from car generator. Powers lights, refrigerator, transmitter, receiver, etc. Simple, easy to convert. Plans \$2.00. Tedco, P.O. Box 12098, Houston, Texas 77017.

TELEPHONE Voice Switch: (LS-500). Actuates automatically and unattended any tape or wire recorder. Pictorial installation instructions included. \$23.75. Postpaid USA, **WJS Electronics**, 1525 No. Hudson, Hollywood, Calif.

RESISTORS, NEWEST TYPE METAL-FILM, COPPER CIRCUIT BOARD, CAPACITORS, TERMINAL BLOCKS, FREE CATALOG, FARNSWORTH ELECTRONIC COMPONENTS, 88 Berkeley, Rochester, New York 14607.

INVESTIGATORS, keep in step with advancements in the art of electronics for the professional. Send \$1.00 for equipment brochure. **WJS Electronics**, 1525 North Hudson, Hollywood, California 90028.

FREE catalog: Wholesale Electronic parts and equipment. Royal, Box 2591, El Cajon, Calif.

DETECTIVES! Free brochures! Electronic intelligence devices for your needs and budget. **SILMAR ELECTRONICS**, 3476 N.W. 7th Street, Miami, Fla. 33126.

GOVERNMENT SURPLUS AS-81 DIRECTION FINDER ADAPTER

New \$29.95



Marine type tunes 2.1 to 8.5 mc. Connects to antenna input of any receiver, in frequency range making a manual rotatable loop direction finder. Requires 12 V. D.C. Size of unit 7 x 24 x 9". Shock mfg. Shipped in original box with spares & leads. Wt. 60 lbs.

NICKEL CADMIUM BATTERY CELLS

79¢ ea.



Special purchase allows this bargain. Shipped as received from the Government, not cleaned or checked and may have cracked cases. All types are 1.25 V. per cell. Instructions for filling & care included.

4-6 Amp. Hr., 6" H x 2" W x 1/2" D. Plastic case. Wt. 6 oz. ea. \$7.90 for 10
6-10 Amp. Hr., 4 1/2" H x 2 1/2" W x 3/4" D. Plastic case. Wt. 8 oz. ea. \$12.00 for 10
30 Amp. Hr., 9" H x 3" W x 1 1/4" D. Metal case. Wt. ea. 2 3/4" lb. \$20.00 for 10

The above cells carry no guarantee by us but we can supply new and tested used cells—send for list.

RECEIVER-TRANSMITTER RT-11A/APN-12—\$7.95

160-230 mc with vernier tuning of osc. Turret 8 channel tuner motor driven with gear head type motor. Complete with following tubes: 2C26A, 51R4G1, 2X2, 8-6A07, 2-6SL7GT, 2-6AK5, 9002 6E5, and 6H6. (tubes alone worth more than our price). Also has built-in speaker cage blower and other parts. Used. Ship. wt. approx. 50 lbs. Size 11 3/4" x 12 1/2" x 12". \$7.95

12 V. DC to 24 V. DC AMPLIDYNE—Used \$7.95

Model 5AA31XJBA. Input 28 V., output 60 V. @ 8.8 amp.; however, works satisfactorily from 12-24 V. Size 5 3/4" dia. x 12" long. Wt. 28 lbs. Used but good.

SYNCHROS—New—79¢ ea.

A pair of either of these connected together gives the equivalent of a flexible shaft—turn one & other changes position accordingly.

1. Type 241G1—79¢. Wire rotors of a pair in series for use on 110 V. 60 cycle intermittent osc. Ideal for wind or rotor direction indicators.
2. High torque type—heavy brass constructed—\$2.95 ea. Shallow to illustration. Serry 7830 synchro transmitter designed for communications use on 60 cycle 110 volts. Size 4 1/4" dia. x 7" L. Shaft size 1/4" dia. 1 1/4" L.
3. C78218—Navy type 5 synchro transmitter. Size 3 3/4" dia. 5 1/2" L. Wt. approx. 5 lbs. New, in cans. \$2.99 ea.



MOBILE ANTENNA—\$1.99

AN80A rooftop mount antenna with co-ax connector for RG/8U—mounts thru 3/4" hole porcelain insulator with rubber weather seal. Ant. length is 5 1/2". Can be used for CB work on all bands by changing element to correct length. Ship. wt. 1 lb.



DRY DISC RECTIFIERS—New

1. 24 V. DC from AC 60 cycle, selenium—79¢ ea. Full wave type, size 1 1/4" dia. x 5 3/4" L. Wt. 8 oz.
2. 110 V. DC at 110 V. 60 cycle full wave type—copper oxide. Size 3 3/4" x 5 7/8" x 1 1/2". Wt. 5 1/2 lbs. \$1.98 ea.

HANDSETS—\$1.99

Telephone type with carbon mike & magnet rec. elements. Ideal for CB. Ship. wt. 2 lb.



DYNAMOTORS: \$10/per hundred lbs.

DM 36: 28 V., in. 220 V., 80 Ma out, used, wt. ea. 4 lb.
DM 40: 12 V., in. 172 V., 138 Ma out, used, wt. ea. 6 lb.
DM 055028: 27 V., in. 220 V., 80 Ma out, New, wt. ea. 3 lb.

Orders less than \$10 must have \$1.00 additional to accompany them to cover packing and handling.

ESSE RADIO COMPANY

368 S. Meridian St.

Indianapolis, Indiana 46225

CIRCLE NO. 43 ON READER SERVICE PAGE

CALIBRATED TIME-BASE. 1-second through 50-micro-seconds plug-in horizontal input ANY kit-oscilloscope/pulse-risetime & frequency measurements. \$24.95 kit. Stanford Audiology, Box 906, Palo Alto, Calif.

UNUSUAL ELECTRICAL devices. Free catalog. Wells, 15845 Simonds. Granada Hills, Calif.

WE SELL CONSTRUCTION PLANS: \$50 TV Camera, \$40 Telephone Answering Machine, \$50 Ultrasonic Dish-washer, \$15 Bell System type Speakerphone, Phone-vision, Private Eye Tail Transmitter, \$75 Electron Micro-scope, \$10 Legal Telephone Connector, \$15 Automatic Telephone Dialer, Dial Telephone Exchange, Electronic Tranquilizer, Transistorized Teletype, Morse Code Copier, Police Radar Detector plus Legal Jammer, Telephone Extension in your car, TV Recorder, 3D TV Converter. **FREE** Super Hobby Catalog. **COLOR** TV Converter, completely electronic; No mechanical gadgets, costs about \$35. All plans \$4.75 each. Don Britton Enterprises, 7906 Santa Monica Blvd., Hollywood, Calif. 90046.

BUILD your own Transistor Ignition System. All Transistor Ignition Coils, \$6.97. "Transistor Trio" \$10.00. Hall Engineering, 2241 N.W. 33, Oklahoma City, Okla. 73112.

TV CAMERA Under \$40.00—Completely Transistorized space age flying spot scanner—Schematics, Photographs, Plans—\$3.00. Free Science Project Catalog—Beck, 777 Ruth Drive, Newbury Park, Calif. 91320.

SPECIAL SALE: CLEGG VHF INTERCEPTER RECEIVER FOR 6 And 2 Meters—\$3.50. For Information Write: Gary Basile, 93 Westside Ave., Haverstraw, New York.

TRANSISTORS—Miniature Electronic Parts. Send for free Catalog. Electronic Control Design Company. P. O. Box 1432K, Plainfield, N.J.

TRANSISTOR Ignition Coils 400:1 Special \$3.95. Two Delco Transistor Cascade Amplifier (15 Amp) in Anodized Aluminum Heatsink, Below Parts cost at \$5.95. 4/10-6/10 80 watt Ballast Resistors, 69 Cents. 6/10 Volt 20 Amp Load Relay with fuse, 99 cents. Complete Kit for 6-12 Volt Negative Ground, \$9.95 postpaid. Orders under \$5.00 Add 50 cents postage. Closeout, All New Merchandise, Supply Limited. Electronic Liquidators, BOX 1946, Grand Junction, Colorado.

AUTO REVERBERATION UNITS wholesale. Signal Systems, 31160 Eight Mile, Farmington, Mich. 48024.

ELECTRONIC SURVEILLANCE EQUIPMENT, investigators, hobbyists. Free catalog. Fudalla, 448 Spadinaroad, Toronto 10, Ont., Canada.

VOICE OPERATED TRANSMIT module. Ultra sensitive. All transistor. Guaranteed. \$14.95. Maynard Electronics, Box 5100, Fresno, Calif.

AUTOMATIC PHONE PATCH and voice operated transmit module. 10 transistors, 2 diodes. Guaranteed. \$24.95. Maynard Electronics. Box 5100, Fresno, Calif.

EPOXY TRANSISTOR IGNITION COILS \$6.25 postpaid. 400:1 Highest quality. Other ignition parts and circuits available. Send for free list. Send check or money order to: Instantspark, Dept. PE, P. O. Box 5144 Sherman Oaks, Calif.

SWL—Pull in those weak stations, increase selectivity. Antenna system complete with coupler. Minimum space required. \$18.95 complete. George Keller, 2855 Ivanhoe Rd., Bethlehem, Penna. 18017.

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.

WANTED—RCA Radio, Model 4-X-661 Series, Ted Witkowski, 2213 6th St., Mpls., Minn. 55418.

ARC-27, ARC-34, ARC-38, ARC-44, ARC-52 ARC-55, ARC-73, ARC-84, RT-220c/ARN-21, APN-22, R-540/ARN-14c, ARN-18, ARN-59, 51X-2/17L-7, 17L-4, RT-68/GRC. Test Sets With ARM, UPM, URM, SG, Prefixes. Top Dollar Paid. Selp Electronics, Drawer 1782D-PE, Ellenton, Fla. 33532.

SHORTWAVE LISTENING

SW LISTENERS GUIDE, easy to use, English programming. **DOUBLES LISTENING PLEASURE.** \$2.00. SWL Guide, 218 Gifford, Syracuse 2, N.Y.

HIGH FIDELITY

"LOW, Low quotes: all components and recorders. HiFi, Roslyn 9, Penna."

Hi-Fi Components, Tape Recorders, at guaranteed "We Will Not Be Undersold" prices. 15-day money-back guarantee. Two-year warranty. No Catalog. Quotations Free. Hi-Fidelity Center, 1797 (P) 1st Avenue, New York, N. Y. 10028.

FREE! Send for money saving stereo catalog #P5E and lowest quotations on your individual component, tape recorder, or system requirements. Electronic Values, Inc., 200 W. 20th St., New York, N.Y. 10011.

MC GEE Radio Company. Big 1965 176 Page Catalog Sent Free. America's Best Values. HiFi—Amplifiers—Speakers—Electronic Parts. 1901 McGee Street, Dept. PE, Kansas City 8, Missouri.

TUBES

BEFORE You Buy Receiving Tubes, Transistors, Diodes, Electronic Components and Accessories . . . send for 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., 469-E Jericho Turnpike, Mineola, N. Y. 11502.

TUBE Headquarters of the World! Free Catalog (tubes, electronic equipment) write! Barry, 512 Broadway, N.Y.C. 12.

RADIO & T.V. Tubes—33¢ each. Send for free list. Cornell, 4213 University, San Diego, California 92105.

HAM AND CB EQUIPMENT

FREE ECHO C.B. Catalog. Write Echo Communications, Inc., Dept. PE, Box 43, Cedarburg, Wisc. 53012.

CBER'S, HAMS, SWL'S! Clipper-filter kit, \$10.99, wired \$14.99. GW-10, GW-11, GW-12 Preselector kits \$8.99, wired \$11.99. Free catalog. **HOLSTROM ASSOCIATES**, P. O. Box 8640-E, Sacramento, Calif. 95822.

BARGAIN! Used transmitters, receivers, test equipment offered in "The Ham Trader". Next 12 interesting issues \$1.00. Single copy 10¢. Brand, WA9MBJ, publisher. Sycamore, Ill.

DO-IT-YOURSELF

TRANSISTORIZED All Band Radio Kit, Transistor and Tube Included \$3.00. To Box 131, Temple City, Calif.

HELP WANTED

EARN CASH Commissions plus free gifts. Sell match-book advertising. Sales kit furnished. Matchcorp., Dept. MD-55, Chicago 60632.

LONG NEEDED INVENTION. Man to contact service stations. Huge profits. Cyclo Mfg., 3816 Dahlia, Dept. 128, Denver 1, Colo.

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.

BEFORE Renting Stereo Tapes try us. Postpaid both ways—no deposit—immediate delivery. Quality—Dependability—Service—Satisfaction—prevail here. If you've been dissatisfied in the past, your initial order will prove this is no idle boast. Free Catalog. Gold Coast Tape Library, Box 2262, Palm Village Station, Hialeah, Fla 33012.

RENT Stereo Tapes—over 2,500 different—all major labels—free brochure. Stereo—Parti, 1616-PE Terrace Way, Santa Rosa, California.

TAPE-MATES MAKES AVAILABLE TO YOU—ALL 4-TRACK STEREO TAPES—ALL LABELS—POSTPAID TO YOUR DOOR—AT TREMENDOUS SAVINGS. FOR FREE BROCHURE WRITE TAPE-MATES CLUB, 5280—P. W. PICO BLVD., LOS ANGELES, CALIF. 90019.

STEREO TAPE. Save up to 60% (no membership fees). We discount recorders, batteries, accessories. We mail prerecorded tape, prepaid, anywhere that United States rates prevail. Free 60 page catalog. Saxitone, 1776 Columbia Road, Washington, D.C. 20009.

RENT 4-TRACK STEREO TAPES—Narrow it down, it has to be TRIMOR—Goodbye to partial satisfaction—Service and Dependability our keynote—**ALL LABELS and TITLES**—No Deposit—Postpaid both ways. (48 states)—**FREE BROCHURE and TAPE CATALOG.** TRIMOR Company P. O. Box 748, Flushing, N.Y. 11352.

TAPE RECORDER BARGAINS. Brand new, latest models, \$10.00 above cost. Arkay Sales, 22-03 Riverside Ave., Medford, Mass. 02155.

TAPE transport, Recording studio quality. Build yourself for fraction of cost. Detailed plans \$5.00. Pepke Laboratories, 309-B West 19 Street. N.Y., N.Y. 10011.

REPAIRS AND SERVICES

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.

TRANSISTOR radio repair. \$4.50 each. Guaranteed 90 days. Returned COD. TRANSERVICO, Box 1022P, Bloomington, Indiana 47402.

EQUIPMENT

FREE electronics catalog. Tremendous bargains. Electrolabs, Department C-641D, Hewlett, New York 11557.

REMAILING SERVICE

25¢ T. CANASE, 3 Irving Street, Waterbury, Conn.

PLANS AND KITS

14 WEATHER Instrument Plans \$1.00. Saco, Box 2513B, South Bend, Indiana.

PRINTED Circuit Kit—complete two copper clad boards 2½ x 5, etch tray, etchant, etching resist, layout grids, cleaning pad, instructions. \$2.98. Deltronix Labs. Box 123, Horsham, Pa.

SOLAR Powered Radio \$3.95, Dinde Radio \$1.50, Voice Transmitter \$4.95. LECTRONIX-PE, Box 42, Madison Heights, Michigan 48071.

May, 1965

NATION-WIDE TUBE CO.

024	6AN8	6D4	6X4	12A4
1A7	6AQ5	6J5	7A5	12AU7
1B3	6AU4	6J6	7A7	12AX7
1H5	6AU6	6J6	7B6	12BA6
1K3	6AV5	6SA7	7RR	12BE6
116	6AV6	6SC7	7C5	12BH7
1W5	6AW5	6SF7	7E6	12BY7
1R5	6AX4	6SG7	7F7	12C5
155	6BG6	6SH7	7Q7	12CA5
6C5	1U4	6SJ7	7Y4	12L6
1X2	6BE6			12R5
2CW4	6BH6			12SA7
2D54	6BK7			12SQ7
2D4	6BL7			12SK7
3B26	6BN6			12SQ7
3D76	6BQ5			12W6
3V4	6BQ6			12X6
4RQ7	6BQ7			18F46
5AT8	6C4	6SK7	8AW8	22DE4
5J6	6C6	6SL7	8CQ7	25L6
5U4	6C6	6SN7	9AU7	25Z6
6Y3	6C67	6SQ7	10DE7	32L7
6X7	6C7	6S7	11C7	50A5
6AB4	6C7	6S7	12AD6	70C5
6AC7	6D4	6W6	12AF6	50L6
6AC5	6D6	6W6	12AT7	11L7
6AH4	6D6	6W6	12AV6	6X3
6AL5	6D6			
6AM8	6D6			

FREE POSTAGE
ON ALL ORDERS!
No Hidden Costs!

Winter Specials 25c each
No. 100000 quantity
6AU6, 6AX4, 6SN7,
6W6, 6Y3, 6K6, 12AU7
SPRING SPECIALS 25c
EACH. Fresh stock
available. Console type
Tubes: clockers—5R11—
C-Test-M's—Morro—
Calex's—good con-
dition—\$39.95. FOB.
Harrison, N. J.

TERMS: Free Postage In
USA on prepaid orders. Add
50¢ for handling on orders
under \$5. Send 25¢ deposit
on COD orders. Send approx.
postage on Canadian & foreign
orders.
Money refunded in 5 days
if not completely satisfied.
Tubes are new, used or seconds
are so marked.

Send for special details on self-service
tube testers and CRT Prices. Dept. PE-5

NATION WIDE TUBE CO.

406 HARRISON AVENUE, HARRISON, NEW JERSEY HU 4-9848

CIRCLE NO. 23 ON READER SERVICE PAGE

ENJOY TV & stop commercials. Easy to build. Details \$2.00. R.A.F., 8614 Joseph, St. Louis, Mo. 63144.

CONSTRUCT EXCITING COMPUTER GAMES. Catalogue. Monti, 219-A Tinton, Eatontown, N.J.

MASS PRODUCE YOUR OWN CIRCUITS. Silk screen process kit \$9.95. Maynard Electronics, Box 5100, Fresno, Calif.

"ULTRA MINIATURE TRANSMITTER", Under 2" long. Plans—\$2.00. Electronics, Box 262, Peter Stuyvesant Station, N.Y., N.Y. 10009.

MOVIE FILMS

COLLECTORS' ITEMS 8mm Color Films—**ROARING 64 INDY 500—188'**, \$11.95. **NBA BASKETBALL ACTION—200'**, \$16.95. **'65 ROSE PARADE—200'**, \$16.95. **'65 ROSE BOWL** (Michigan/Oregon State)—200', \$18.95. All films ppd. **SPORTLIGHT FILMS**, 20-PE North Wacker Dr., Chicago, Ill. 60606.

GOVERNMENT SURPLUS

JEEPS \$64.50 . . . **Boats** \$6.18 . . . **Typewriters** \$4.15 . . . **Airplanes, Electronics Equipment, 100,000 Bargains** Typically Like These Direct From Government in Your Area. For Complete Directory and Surplus Catalog Send Only \$1.00. Surplus Service, Box 820-J, Holland, Mich.

"GOVERNMENT SELLS"—Surplus Electronics; Oscilloscopes; Transceivers; Test Equipment; Radar; Walkie-Talkies; Boats; Jeeps; Aircrafts; Misc.—Send For—"U.S. Depot Directory-Procedure"—\$1.00—Service, Box 425 ZE, Nanuet, N.Y.

GOVERNMENT Surplus. Complete Sales Directory \$1.00. Surplus Publications, Box 45781E, Los Angeles 45, Calif.

JEEPS — \$62.50, TRANSMITTERS — \$6.18, Typewriters \$4.15, Walkie-Talkies, Oscilloscopes, Multimeters. Typical Surplus Prices. Exciting Details Free. Enterprises, Box 402-B10, Jamaica 30, New York.

PATENTS

INVENTIONS; Ideas developed for Cash/Royalty sales. Raymond Lee, 1606G Bush Building, New York City 36.

INSTRUCTION

LEARN While Asleep, hypnotize with your recorder, phonograph. Astonishing details, sensational catalog free! Sleep-Learning Association, Box 24-ZD, Olympia, Wash. 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! Cook's School of Electronics, Craigmont, Idaho 83523.

REI First Class Radio Telephone License in (5) weeks Guaranteed. Tuition \$295.00. Job placement free. Radio Engineering Institute, 1336 Main Street, Sarasota, Fla.

ELECTRONICS—F.C.C. License Training—Correspondence, or resident classes. Free details. Write: Dept. 3, Grantham Schools, 1505 N. Western, Hollywood, Calif. 90027.

HEALTH, Success, Self-culture Courses. Homestudy, Psychology, Metaphysics, Bible, Philosophy. Write, **INSTITUTE OF METAPHYSICS**, 1250 Indiana Street, Birmingham, Alabama 35224.

BE YOUR Own Television Repairman! Instruction Book, \$1.25—Build your own Radio-Telescope! Instruction Book, \$3.00 (Satisfaction Guaranteed) Abrilz, K2BDB, Westhampton Beach, New York 11978.

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 Earn Extra Money at Home." Castolite, Dept. 108-E, Woodstock, Illinois.

PRINTING

BOOK Printing. Lowest cost. Paperbacks or hard covers. Catalog free. Addams Press, 30 West Washington, Chicago, Ill. 60602.

INVENTIONS WANTED

INVENTIONS wanted. Patented; unpatented. Global Marketing Service, 2420-P 77th, Oakland 5, Calif.

PATENT Searches including Maximum speed, full airmail report and closest patent copies, \$6.00. Quality searches expertly administered. Complete secrecy guaranteed. Free Invention Protection forms and "Patent Information." Financial assistance available. Write Dept. 9, Washington Patent Office Search Bureau, 1426 G Street, N.W., Washington 4, D.C.

INVENTORS! Don't sell your invention, patented or unpatented, until you receive our offer. Eagle Development Company, Dept. P, 79 Wall Street, N.Y. 5, N.Y.

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.

INVENTORS! Sell your invention for cash or royalties! Our client manufacturers eagerly seek new items. Patented. Unpatented. Financial assistance if needed. 25 years proven performance. For free information, write Dept. 20, Gilbert Adams, Invention Broker, 80 Wall St., New York 5, N.Y.

INVENTORS! Outright cash sale or royalties for your inventions. Patented. Unpatented. Active demand from our client manufacturers. Financial assistance available. Write Dept. 35, United States Invention Brokerage, 78 Wall Street, New York 5, N.Y.

MUSIC

POEMS wanted for songs and records. Send poems, Crown Music, 49-RB West 32, New York 1.

SONG ideas wanted. Write with Professional Songwriters. Share royalties. Songwriters' Associates, 236 West 55th Street, New York 10019-V.

AUTHORS' SERVICES

AUTHORS! Learn how to have your book published, promoted, distributed. **FREE** booklet "ZD," Vantage, 120 West 31 St., New York 1.

PUBLISH your book! Join our successful authors; publicity advertising promotion, beautiful books. All subjects invited. Send for free appraisals and detailed booklet. Carlton Press, Dept. ZDQ, 84 Fifth Avenue, N.Y.C. 11.

REAL ESTATE

FLORIDA Water Wonderland—Homesites, Cottagesites, Mobilesites, Established area. \$390 full price, \$5.00 month. Swimming, fishing, boating. Write, Lake Weir, 38bf, Silver Springs, Fla. Ad 6-1070 (F-1)

FREE!—ALL NEW! SPRING CATALOG Thousands of properties described, photos galore—Land, farms, homes, businesses—recreation, retirement. 472 offices coast-to-coast, "World's Largest." Mail Free! **STROUT REALTY**, 50-ZD East 42nd St., N.Y. 17, N.Y.

FREE! NEW illustrated Summer catalog! Top values coast to coast! Farms, Ranches, Homes, Businesses, Waterfront, Recreation, Retirement properties. **United Farm Agency**, 612-B West 47th St., Kansas City, Mo. 64112. PLaza 3-5212.

GOVERNMENT LAND. Complete Sales Directory \$1.00. Land Publications, Box 45781E, Los Angeles 45, Calif.

ELECTRONICS

BUILD SOLAR Powered Transistorized Citizens Band Transmitter for under \$6.00. Plans \$1.00. Electronic Plans, Box 262, Peter Stuyvesant Station, N.Y., N.Y. 10009.

HYPNOTISM

FREE Hypnotism, Self-Hypnosis, Sleep Learning Catalog! Drawer H400, Ruidoso, New Mexico 88345.

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.

RECORDS

DISCOUNT Records, All Labels—Free List. Write Cliff House, Box 42-P, Utica, N.Y.

DISCOUNTS on all LP's. Free details. Citadel Record Club, 545 Fifth Ave., Dept. 22, New York 17, N.Y.

PHOTOGRAPHY—FILM, EQUIPMENT, SERVICES

MEDICAL Film—Adults Only—"Childbirth"—1 reel 8mm. \$7.50—16mm \$14.95. International-E, Greenvale, L.I., New York.

SCIENCE Bargains—Request Free Giant Catalog "CJ"—148 pages—Astronomical Telescopes, Microscopes, Lenses, Binoculars, Kits, Parts. War surplus bargains. Edmund Scientific Co., Barrington, New Jersey.

FREE illustrated photographic bargain book. Central Camera Co., Dept. 45-E 230 So. Wabash, Chicago, Ill.

EDUCATIONAL OPPORTUNITIES

LEARN While Asleep. Remarkable, Scientific, 92% Effective. Details Free. ASR Foundation, Box 7021, Dept. e.g., Lexington, Kentucky.

MONEY Back Guarantee—C.I.S.T.—The World Wide Institute of Home Study—34 Global centres—260 courses—Engineering, Electronic, Academic and Commercial—send for your Free 100 page copy of 'Career Opportunities' today—No salesman will call. C.I.S.T., 634 Garden City Building, 263 Adelaide St. W., Toronto, Canada.

PHOTOGRAPHS

PHOTOGRAPHS and transparencies wanted, to \$500.00 each. Valuable information free—Write Intraphoto-PE, Box 74607, Hollywood 90004.

BUSINESS OPPORTUNITIES

INVESTIGATE Accidents—Earn \$750 to \$1,400 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-5, 6801 Hillcrest, Dallas 5, Texas.

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 workshops and industrial. Send \$1.00 (refundable) for equipment guide, formulas, operating data, catalog. HBS Equipment Division 90, 3445 Union Pacific Ave., Los Angeles 23, California.

HIGH Weekly Earnings! Address—mail letters featuring real merchandise. Receive \$10 with every order—keep \$8 profit. Supplies furnished. Free particulars. Modern Merchandising, Box 357, Oceanside, New York.

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.

FREE Book "990 Successful, Little-Known Businesses." Work home! Plymouth 845Y, Brooklyn 4, N.Y.

SELL CB EQUIPMENT—Dealerships available to aggressive people who can sell Citizens Band Radio full or part time. Knox Electronic, Dept 194, Galesburg, Ill. 61401.

100,000 PRODUCTS Wholesale! Write Today! Wholesalers, 1265-PP Broadway, New York 1, N.Y.

BIG MONEY. Learn Electric Appliance Repairing at home in your spare time. How automatic washer-dryers, refrigerators, and all kinds of appliances work, how to find what's wrong, using the Christy Electronic Trouble Tracer. How to fix them. We show you how to get business, what to charge, how to buy parts wholesale. Make \$5-\$6 per hour by operating your own fix-it shop in your kitchen or basement. No previous experience or training required. Enroll now—pay later from earnings. Send for FREE BOOK. CHRISTY TRADES SCHOOL Inc., 3214 W. Lawrence Ave., Dept. A-2314, Chicago, Ill. 60625.

BUY Appliances, Cameras, Watches, etc. at factory prices plus 10%! Free details! Cam Company, 436-10 Bloomfield Ave., Verona, N.J. 07044.

THIS IS IT! SPARETIME PROFITS WITH ABSOLUTELY NO DOOR-TO-DOOR SOLICITING. SEND 50¢ FOR DETAILS ON 3 GREAT NEW PLANS. FAN-TAM, BOX 161-C, BROOKLYN 3, N.Y.

DISC-JOCKEY (\$20,000/year) free details. Box 3364, Anaheim, Calif.

MANUFACTURERS' REPRESENTATIVE IN PHILADELPHIA, PENNSYLVANIA AREA DESIRES EITHER DISTRIBUTORSHIP OR DEALERSHIP OF NEW ELECTRONIC PRODUCTS. BARCLAY ASSOCIATES, 207 BARCLAY BUILDING, BALA-CYNWYD, PA. 19004.

PIANO Tuning learned quickly at home. Tremendous field! Musical knowledge unnecessary. Information free. Empire School of Piano Tuning. Dept. PE, Box 327, Shendoah Station, Miami, Florida 33145. (Founded 1935.)

RAISE money fast—easy proven sources—free particulars. Advisor, Box 48337-ZD2, Los Angeles 90048.

COINS

5 ROLLS Unsold Buffalo Nickels. \$14.50. Lists. Ace, Jamesburg, N.J.

LINCOLNS 50 Different Plus Uncirculated Kennedy Half \$2.50. Mickey, Box 82, Brooklyn 11229.

STAMPS

SURPRISE COLLECTION! Exotic mint British Colonials, absolutely free with approvals. VIKING, Great Neck 50, N.Y.

DOUBLE BONUS

BONUS #1 FREE

FREE POLY PAK WORTH \$25

BONUS #2 FREE

\$1 FREE: YOUR CHOICE OF ANY \$1 POLY PAK LISTED BELOW FREE

BOTH FREE WITH \$10 ORDERS

GERMANIUM DIODES HOBBY SPECIAL 100 for \$1

- 50 COILS & CHOKES \$1
rf, lf, osc, peaking, etc.
- 10 ELECTROLYTICS \$1
various types, for general use
- 30 HOBBY TRANSISTRS \$1
40 types, Handy shop, ass't.
- 60 CERAMIC COND'RS \$1
144 types, 10 to 100 pf
- 50 TERMINAL STRIPS \$1
1 to 8 bags, wide assortment
- 60 INSULTD RES'TRS \$1
1/2, 1, 2W, Carbons, 5% too
- 30 POWER RESIS'TRS \$1
2 to 100W, for work shops
- 10 LITTLE FLYTICS \$1
For transp. kits, 10 to 100 pf
- 15 PNP TRANSISTORS \$1
CK722, 2N107, asst. cases.

- 10 RCA PLUG-IN JACK SETS \$1
For amps, tuners, recorders
- 5 2N107 TRANSISTRS \$1
40 pages, A shop must.
- 40 DISC CONDENSERS \$1
25000 to 2500 pf, to 5KV
- 40 PREC'SN RES'TRS \$1
1/2, 1, 2W, asst. 1% values
- 75 HALF WATERS \$1
resistors, asst. 1/2, 1W
- 10 CK722 TRANS'TRS \$1
Raytheon, pop. audio.
- 15 NPN TRANSISTORS \$1
2N170, 2N345, 2N410, etc.
- 4 TRANSFORMERS \$1
Type for Lab. or Projects
- 100 PRINTED CIRCUIT \$1
parts, Hobby & trial work

3-TRANSISTOR AMPLIFIER SALE

- Only 3"x2"x1 1/2"
- Printed circuit \$1.00
- Wired.
- \$25 SURPRISE PAK* \$1
Pop. assortment audio parts
- 60 TUBULAR COND'RS \$1
20 values, 1000 to 2 mfd
- 10 VOLUME CONTROLS \$1
3 types, duals too, to 1 meg
- 10 POWER RECTIF'RS \$1
4 amp. stud. 50 to 400V
- 10 TRANSISTOR SOCKETS \$1
PNP, NPN & submini projects
- 10 TINY RECTIFIERS \$1
1/2, german. 1A, 50-400V

HOBBY SPECIAL TRANSISTORS 2 95
RF, IF, Audio Power, Untested

POLY PAKS
TERMS: include postage, avg. wt. per pak 1 lb.

10C GIANT PARTS CATALOG
P.O. Box 942E
So. Lynnfield, Mass.

CIRCLE NO. 24 ON READER SERVICE PAGE

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. Get a better job & earn more! Send only \$2.00 for expert, complete Resume Writing Instructions. J. Ross, 80-34 Kent St., Jamaica 32, N.Y., Dept. PE.

OVERSEAS—Foreign Employment. Permanent. High paying. All occupations. Transportation. Household resettlement. Sixth successful year furnishing immediate, direct placement. Fast service. Global Employers, Box 286-W, Oroville, Calif.

BOOKS

BOOKS 15¢: electronics, electrobiology. List free. Electroc cosmic, Clayton R2-1, Ga. 30525.

ELECTRICAL Accessories, Controllers—12,500 Listings in German Export-Import Directory. \$5.95. Burke Associates, Manchester, Mass. 01944.

BOOKS For Everyone. Catalogs 15¢. Myers Book Service, Marquand, Mo.

REPAIR your own Television Set. Manual Written by Electronic Technicians \$1.98. Keystone Electronics, 5539 Lansdowne Ave., Phila. 31, Pa.

MAGAZINES

FASCINATING New Magazine For Book Collectors! Information Free. TBA, Webster 37, New York.

PERSONALS

INVESTIGATORS, FREE BROCHURE, LATEST SUBMINIATURE ELECTRONIC SURVEILLANCE EQUIPMENT. ACE ELECTRONICS, 11500-K NW 7TH AVE., MIAMI 50, FLA.

MISCELLANEOUS

HYPNOTIZE secretly, cleverly, one glance . . . or money-back. \$2. Elton's, Box 18223-PE2, Indianapolis, Indiana, 46218.

DEEPLY in debt? Clear credit—quick relief. Write Advisor, Box 48337-ZD1, Los Angeles 90048.

SELF-HYPNOSIS in one evening or pay nothing. Full instructions only \$2.00. Elton's, Box 18223-PE3, Indianapolis, Indiana 46218.

SELF-HELP IDEAS, Guaranteed. Free Details. Reddy, 713 East First, Auburn, Indiana 46706.

BEERS, PEACH BRANDY, WINES—Strongest Formulas, \$2.00. (Complete brew supplies—hydrometers catalog 10¢)—Research Enterprises, 29-D Samoset Rd., Woburn, Mass

RUBBER Stamps, Business Cards, Labels, Free Literature. Vargo's, 4119 Buechner Ave., Cleveland, Ohio 44109.

FREE beautiful song to all music-lovers. Send names, addresses. Nurdyke, 6000-3 Sunset, Hollywood, Calif. 90028.

BEER, ALE, WINES! Powerful Methods! Secrets! Illustrated Booklet, \$2.00. (Supplies catalog 10¢). Interstate Products. Box 1-VF3, Pelham, New Hampshire.

STAMMER—Stutter—No More. (Dr. Young.) Write: Gaucho, Box 9309-E8, Chicago 90.

20 CHILD EDUCATIONAL PROJECTS—Interesting, fun. Children 4-14 can make from common items. Simple instructions. Color illustrated. \$1.00. Satisfaction guaranteed. ED-U-KATE, Dept. WAS-2, Box 5781, Midwest City, Okla.

FREE Muscle Building Information. Guaranteed. Milton Birkland, Birch Hills, Saskatchewan.

BEERS, Wines, Ciders. Fifteen Delicious Home Recipes, One Dollar. Royal Company, Champlain, N.Y.

POPULAR ELECTRONICS

May 1965

ADVERTISERS INDEX

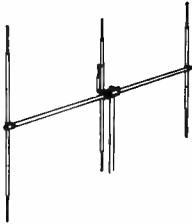
READER SERVICE NO.	ADVERTISER	PAGE NO.
	American Institute of Engineering & Technology	98
1	Antenna Specialists Co., The	34
41	B&K/Mark	87
44	B&K Manufacturing Co	89
2	Browning Laboratories, Inc	99
	Capitol Radio Engineering Institute, The	8, 9
	Central Technical Institute	98
	Cleveland Institute of Electronics	5
3	Cleveland Institute of Electronics	105
4	Columbia Products Company	6
35	Conar	12
5	Cousino Electronics Corporation	98
	Coyne Electronics Institute	107
37	Delta Products	93
	DeVry Technical Institute	3
33	EICO Electronic Instrument Co., Inc	26
6	Edmund Scientific Co	94
43	Esse Radio Company	109
7	Finney Company, The	FOURTH COVER
8	Fisher Radio Corporation	23
9	G C Electronics	4
	Grantham School of Electronics	94
10	Hallcrafters	102
11	Heath Company	84, 85
12	Hy-Gain Electronics Corporation	20
13	International Crystal Mfg. Co. Inc	25
40	JFD Electronics Corporation	28
14	Jerrold Electronics	1
15	Johnson Company, E.F.	29
16	KLH Research and Development Corporation	31
34	Kinematrix, Inc	95
17	Kuhn Electronics Inc	96
18	LTV University	10
19	Lafayette Radio Electronics	83
36	Metrotek Electronics, Inc	91
39	Micro-Kits Co	105
42	Miller Company, J.W.	88
20	Milwaukee School of Engineering	32
	Mission Liquidators	96
21	Mosley Electronics, Inc	THIRD COVER
22	Multi-Elmac Company	95
	Multicore Sales Corp	107
23	Nation-Wide Tube Co	111
	National Radio Institute	SECOND COVER
	National Technical Schools	7
24	Poly Paks	113
25	Progressive "Edu-Kits" Inc	27
26	RCA Electronic Components and Devices	11
	RCA Institutes, Inc	16, 17, 18, 19
27	Radio Shack	13
38	Raytheon Mfg. Co	30
28	Sams & Co., Inc., Howard W	101
29	Scott, Inc., H.H.	21
30	Sonar Radio Corp	97
45	Telex/Acoustic Products	102
31	Turner Microphone Company, The	14
46	U. S. Army	33
	Valparaiso Technical Institute	96
32	Wesgrove Electric Limited	103

CLASSIFIED ADVERTISING 108, 109, 110, 111, 112, 113, 114.

MOSLEY DEPENDABLE CB ANTENNAS

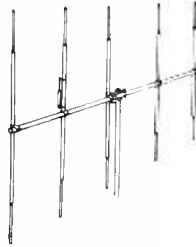
Mosley Shakes CB World, Scotch- Master Beams Boost Performance

The outstanding Scotch-Master line includes the popular A-311-S, just one of the outstanding antenna values to appear on the two-way communication market in many years..



perfect for economy minded CB'ers who want the utmost in dependable communications. This 3-element beam is an impressive, lightweight and extremely durable antenna incorporating features such as a 12' boom, 18' 8 1/2" element length, yet weighs just 12 1/2 lbs. Performance of the Mosley A-311-S is just what the CB'er needs, 8db forward gain, 20 db front-to-back and a standing wave ratio of 1.5/1 over the entire band. This antenna is designed and produced in the true Mosley tradition recognized by engineers and amateur radio operators as "The Antenna Standard Of Quality." The remarkable A-311-S has a 65 lb vertical wind load and just 35 lbs horizontally. It offers a uni-directional radiation pattern and a feed point impedance of 52 ohms. The Low Low price is only \$35.00.

Another quality Scotch-Master beam by Mosley, a leader in the communication field, is the A-511-S...a Big Brother to the A-311-S. The



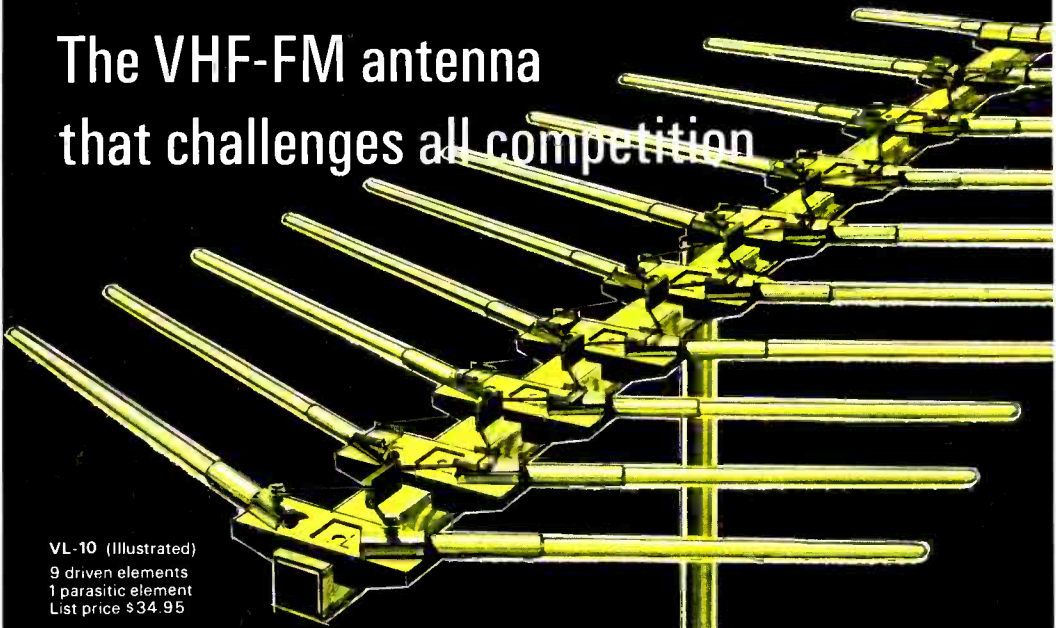
A-511-S has 2 more elements than the A-311-S plus an additional 1.5 db. forward gain. Specifically, the A-511-S has 5 elements which are wide spaced, a forward gain of 9.5 db. and weight of 16 1/2 pounds. The boom length is 12 feet more than the A-311-S...24 feet. The maximum element extends 18' 8 1/4". This beam gives Top Performance due to a front-to-back ratio of 20 db. and a standing wave ratio of 1.5/1 or less over full bandwidth. The Mosley A-511-S is a sturdy, durable antenna with a vertical wind load of 112 lbs. and a horizontal wind load of 62 lbs. It offers a uni-directional radiation pattern and a feed point impedance of 52 ohms. The A-511-S is just another of the many superior antennas by Mosley. The very reasonable price of this outstanding beam is only \$55.00.

Mosley has a wide variety of other CB antennas including a Standard line, Deluxe line and the All-New Devant. For complete information write Code PE-1, Mosley Electronics, Inc., 4610 N. Lindbergh Blvd., Bridgeton, Missouri, 63044

Mosley Electronics Inc. 4610 N. Lindbergh Blvd. - Bridgeton, Mo. 63044



The VHF-FM antenna
that challenges all competition







VL-10 (Illustrated)
9 driven elements
1 parasitic element
List price \$34.95

NEW FINCO *Swept Element*
"COLOR-VE-LOG"
VHF-FM ANTENNA

Finco's Color Ve-Log challenges all competition on color or black and white reception and stands behind this challenge with a "Guarantee of Supremacy". The swept element design assures the finest in brilliant color and sharply defined black and white television reception – as well as superb FM monaural and stereo quality. FINCO precision-engineered features make these advanced-design antennas indispensable to good home sight-and-sound systems. And, of course, they carry the famous unconditional guarantee from the leading manufacturer in the field – FINCO. Promote the Color Ve-Log Antennas with pride, sell them with confidence, and profit handsomely.

Featuring Finco's Exclusive Gold Corodizing

 <p>VL-5 5 element VHF-FM 5 driven elements List price \$16.95</p>	 <p>VL-7 7 element VHF-FM 7 driven elements List price \$23.95</p>	 <p>VL-15 15 element VHF-FM 9 driven elements 6 parasitic elements List price \$46.95</p>	 <p>VL-18 18 element VHF-FM 9 driven elements 9 parasitic elements List price \$54.50</p>
---	---	--	---

The FINNEY Company • 34 W. Interstate Street • Bedford, Ohio

Write for color brochure #20-307, Dept. PE

CIRCLE NO. 7 ON READER SERVICE PAGE