BUILD TICKLE STICK FOR PARTY FUN

POPULAR ELECTRONICS

FEBRUARY 1966

35 CENTS

SPECIAL REPORT

ELECTRONICS HOME STUDY

Can you get a good job?

What does it cost? What schools?

Home study vs. Resident school

Other benefits? How much time?

(starting on page 41)
Thousands Who Gained Through NRI

9 TRAINING KITS
EXCITING, FAST

Articles of NRI graduates, Industrial Electronics and Radio
fuges and others. Training men to
electronics has been
ry. NRI pioneered
home instruction,
ing equipment fur
proved way
train. With NRI
etter position with
ve on to greater
matter how much
have,

Make $3 to $5 An Hour in Spare Time
You don’t have to wait until you get an NRI diploma to start
ing. As many others have done, you can be making $3 to $5
hour in your spare-time as you train, fixing radios and TV
sets for friends and neighbors. You learn how to install, main-
tain 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 special-
ized 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 equip-
ment. 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 every-
thing 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 Achieve-
ment 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.

MAIL POSTAGE-FREE CARD NOW

PICK YOUR FIELD
FROM NRI’S SPECIALIZED INSTRUCTION PLANS

1 TELEVISION-RADIO SERVICING
Complete training from basic fundamentals of
electronics 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 compre-
ensive training plan that teaches you the funda-
mentals, 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 thor-
ough background in fundamental Electronic
principles, advance to required subjects cov-
ering equipment and procedures.

5 MATH FOR ELECTRONICS
A brief course for engineers and technicians who
need a quick review of the essential mathe-
matics used in industry, communications, in
government jobs. Basic arithmetic review, short-
cut formulas, modern digital number system,
much, much more.

6 BASIC ELECTRONICS
A concise course to teach modern Electronics
terminology and components. A wealth of prac-
tical, useful information to help you better un-
derstand the field, to give you some technical
knowledge. For anyone who wants basic under-
standing of Radio-TV Electronics.

7 ELECTRONICS FOR AUTOMATION
This course is not for beginners. Offered for
men with some fundamental knowledge of Elec-
tronics who want better understanding of Auto-
mation 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 in-
dicators, radar, sonar, other equipment used on
commercial ships and thousands of pleasure
boats. Prepares you for a First Class FCC Li-
cense with Radar Endorsement.

10 MOBILE COMMUNICATIONS*
Learn to install and maintain mobile equipment
and associated base stations. Covers trans-
mitters and receivers used by police and fire de-
partments, public utilities, construction projects,
taxi, 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.

AmericanRadioHistory.Com
WHERE YOU TRAIN IS AS IMPORTANT AS YOUR DECISION TO TRAIN

At NRI you are backed by 50 Years of leadership in home-study training for Electronics • Automation • TV • Radio

Fifty years ago, a school teacher named James E. Smith started giving extra instruction to four of his students in the “mysterious” new field of radio. From that small beginning, National Radio Institute has grown to be America’s largest home-study school in the many fields of Electronics. Nearly three-quarters of a million students have enrolled over the years. This vast experience is behind NRI’s meaningful, interesting, easy-to-understand methods of training; methods that make Electronics a practical subject for almost anyone to learn no matter how much or how little formal education he has.

But experience is only the base upon which NRI is built. Today there is a staff of more than 150 dedicated people working with you as a “class” of one, keeping training material up-to-the-minute, providing consultation services as you train, advising you about new developments in Electronics, even helping you with job placement when you’re ready. Ask men whose judgment you respect about NRI training. And send for the catalog we offer. Read about opportunities in Electronics, about new developments, about NRI itself and the variety of training plans open to you at reasonable cost. Mail the postage-free card today.

JOIN MEN LIKE THESE—TRAIN FOR SUCCESS WITH NRI

“I went into my own business six months after finishing the NRI Radio-TV Servicing Course. It makes my family of six a good living. We repair any TV or Radio. I would not take anything for my training with NRI. It is the finest.”

DON HOUSE, Lubbock, Texas

“Many thanks to NRI for the Electronics training I received. I hold a first class FCC License and am employed as a studio and master control engineer/technician with KXJB-TV.”

RONALD L. WOOD, Fargo, N.D.

“I am a Senior Engineering Aide at Litton Systems, in charge of checkout of magnetic recording devices for our computers. Without the help of NRI I would probably still be working in a factory at a lower standard of living.”

DAVID F. CONRAD, Reseda, Calif.

“NRI training enabled me to land a very good job as Electronic Technician with the Post Office Dept. I also have a very profitable spare-time business fixing Radios and TV.”

NORMAN RALSTON, Cincinnati, Ohio
Special Feature

Project CHOOSE .................................................. Ken Gilmore 41

Part 2: Correspondence Schools

Electronic Construction Projects

Reverb for Your Car .............................................. Daniel Meyer 50
Solid-State Tachometer for CD or Transistor Ignition Systems .......................... Murray Gellman 54
Dwell Meter Adapter ............................................ David H. Bozarth 58
Meet the Mini-Organ .............................................. William S. Gohl 70
The Tickle Stick .................................................. Fairis S. Burt 82

Communications

Satellite Activity Report ........................................ 38
On the Citizens Band: ALERT CB'ers Battle "Betsy" .......................... Matt P. Spinello, KHC2060 73
Short-Wave Listening: Monitor Certificate Applications and DX Awards .......................... Hank Bennett, W2PNA 75
English-Language Broadcasts to North America .......................... Robert Legge 76
Amateur Radio: A Safety Belt May Save Your Life .......................... Herb S. Brier, W9EGQ 77
DX States Awards Presented ................................ 114

Other Features and New Developments

Electromaze Puzzle .............................................. Robert C. Radford 59
Zero-Beating the News ......................................... 64
Parts Profiles ..................................................... Don Lancaster 66
There's One in Every Crowd .................................... Buz Holland, WA4YKK 69
Four-Letter Quiz .................................................. Robert P. Balin 72
Solid State ........................................................ Lou Garner 79

Departments

Letters from Our Readers ........................................ 6
Out of Tune ........................................................ 12
Tips & Techniques .............................................. 14
Reader Service Page ........................................... 15
New Products ..................................................... 22
Operation Assist .................................................. 30
Electronics Library .............................................. 90
New Literature .................................................... 91
Ham Hobby Clearinghouse ..................................... 94

Copyright © 1966 by ZIFF-DAVIS PUBLISHING COMPANY. All rights reserved.

POPULAR ELECTRONICS is published monthly by Ziff-Davis Publishing Company at 307 North Michigan Avenue, Chicago, Illinois 60601. February, 1966. Volume 24, Number 2. (Ziff-Davis also publishes Skiing, Flying, Business/Commercial Aviation, Popular Boating, Car and Driver, Popular Photography, Hi-Fi Stereo Review, Electronics World, Modern Bride, Skiing Trade News and Skiing Area News.) One year subscription rate for U.S., U.S. Possessions and Canada, $4.00; all other Foreign $5.00. (Schedule for payment in foreign currencies may be found elsewhere in this issue.) Second class postage paid at Chicago, Illinois, and at additional mailing offices. Authorized as second class mail by the Post Office Department, Ottawa, Canada, and for payment of postage in cash.

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

AmericanRadioHistory.Com
**Prepare at Home**

Whether you want to prepare for a good-paying new job or for advancement in Electronics with your present employer, DeVry Tech offers specialized educational programs designed to meet your needs. You set up your own HOME LABORATORY and work over 300 construction and test procedures to develop on-the-job type skills. You build a quality Transistorized Meter, a 5-inch Oscilloscope and a special Design Console. DeVry also includes modern "programmed" texts, instructive motion pictures, Consultation Service. Effective? Yes!

**Resident School**

If you prefer you may get all of your training in DeVry's U.S. or Canadian resident schools under the close guidance of friendly, experienced instructors. You work with a wide variety of commercial equipment similar to that actually used in industry as you prepare in our laboratories for a technician's job in Communications, Microwaves, Radio-Television, Automation, Radar, Computers, or other branch of Electronics. DeVry even provides part-time job placement service to those who wish to earn extra money while attending day or evening classes.

**Placement Service**

Meet W. E. Bartz, who has helped thousands of DeVry men toward exciting, profitable careers in Electronics. When YOU complete your program, he will help you too. As Placement Manager in touch with business and industry across the nation, Bartz knows the employer demand for DeVry-trained men. He has cooperated in placing our graduates with thousands of firms!

Men 18-45, start preparing NOW for this vast opportunity field. Soon you should be ready for DeVry's valuable employment help!

MAIL COUPON TODAY!

No Advanced Education or Previous Technical Experience Needed to Get Started

Your ambition and desire to succeed are more important DeVry guides you every step of the way toward success.

**DeVry Technical Institute**

Send coupon for these two factual booklets NOW! Included details on how to prepare for a career in Electronics. I am interested in the following opportunity fields (check one or more):

- Space & Missile Electronics
- Communications
- Television and Radio
- Computers
- Microwaves
- Broadcasting
- Radar
- Industrial Electronics
- Automation Electronics
- Electronic Control

Name: ___________________________ Age: ______

Address: ____________________________ Apt.: ______

City: __________________ State: ______ Zip Code: ______

Check here if you are over 16 years of age.

DeVRY TECHNICAL INSTITUTE
4141 Belmont Avenue, Chicago, Illinois 60641 Dept. PE-7-W

February, 1966

Accredited Member of National Home Study Council
TWO TRIGGER POSITIONS

GIVE HIGH AND LOW HEAT

(Only Weller Soldering Guns have it)

This exclusive Dual Heat feature permits instant switching to either of two soldering temperatures. There's low heat for most of your electronic soldering, yet high heat is immediately available when you need it.

Weller guns also reach full soldering temperature up to 40% faster than other guns. They deliver more heat per rated watt, resulting in the greatest soldering efficiency.

This is why professionals insist on Weller. Be sure you do, too.

Weller Dual Heat Guns and Kits come in wattage ranges from 100 to 325, priced from $6.95 to $12.95 list.

WELLER ELECTRIC CORP., EASTON, PA.

In Canada: Ontario • In England: Horsham, Sussex.
WORLD LEADER IN SOLDERING TECHNOLOGY
CIRCLE NO. 43 ON READER SERVICE PAGE
Let I.C.S. equip you for success in radio-TV-electronics—
with professional equipment!

Brand-new "Electronic Laboratory," now being offered for the first time, can help you land in this big money-making field—FAST!

Here's your opportunity for you to turn spare time into cold cash, or begin a whole new career—in a field where the rewards have never been greater. And you don't need previous experience to do it!

International Correspondence Schools has just developed a new I.C.S. Electronic Laboratory you can construct in your own home. Includes series of training kits, plus the new I.C.S. VTVM—the professional quality vacuum tube voltmeter shown here. With it comes complete course instruction combining all the fundamentals with practical knowledge you can apply at once. And best of all, you build your own professional test instrument!

I.C.S. instruction gets you going with equipment you can really use!

A famous manufacturer of nationally known electronic testing equipment worked closely with I.C.S. to develop the Electronic Laboratory and the VTVM itself. Everything you get is geared to increase your skill and knowledge step by step. Until finally, you've completed a precision testing unit you can use for practically any kind of experimentation, design or servicing work.

Here's how I.C.S. instruction works. You begin with basic study lessons. Texts are clearly worded and easy to follow. At the same time, you "act out" what you learn with simple experiments. Then, in 3 easy stages, you assemble your own precision testing unit. Throughout, your instructor gives you expert, professional help. You learn at home, in spare time, as fast as ability permits.

Coupon brings full details on your future in this fast-growing field!

Make up your mind right now to find out how I.C.S. training in Radio-TV-Electronics can pay off for you. See how it can help you cash in on the tremendous demand for men skilled in installation, maintenance and servicing of radios, TV sets, hi-fis, computers, automation systems and a host of other space-age devices. Clip and mail the coupon below. You'll receive 3 valuable free booklets—including sample lesson. They'll show how you can land in this big-money field fast!

Coupon brings 3 valuable FREE booklets.
MAIL IT TODAY!

INTERNATIONAL CORRESPONDENCE SCHOOLS

Dept. 1673, Scranton, Penna. 18515

(If you are in Canada: I.C.S. Canadian, Ltd.)

Please rush me your new 64-page booklet "Electronics School" which answers the most often-asked questions about preparing for an electronics career. Also send me "How to Succeed," and a sample lesson. I have indicated my field of interest below.

☐ Electronic Fundamentals ☐ Hi-Fi/Stereo & Sound Systems ☐ Electronic Principles for Automation ☐ Industrial Electronics Engineering ☐ Professional Help
☐ Electronic Instrumentation ☐ General Electronics ☐ Industrial Electronics ☐ Telephony ☐ Full Employment
☐ Computer Fundamentals ☐ Transistor Circuits ☐ Semiconductor- ☐ FCC Radiotelephone Licenses ☐ Other (please specify)
☐ Radio-TV Servicing ☐ Electronics Technician

Name________________________________________ Age______

Address________________________________________

City________________________ State________ Zip Code____

Occupation________________________ Employed by________

Working Hours____ A.M. to____ P.M. Convenient payment plans Training Programs for Industry

☐ I am a member of U.S. Armed Forces. Send me facts about special low rates.

February, 1966

CIRCLE NO. 19 ON READER SERVICE PAGE
HAMS' QSL "P's & Q's" SHOWING

What's wrong with the hams of today? In the past few months, I have sent out 30 to 40 reception reports to hams with requests for letters of verification or QSL cards; only 12 responded. I know four other SWL's who have had similar results. When I become a ham, I don't think that I will disregard a request for a verification.

GARY HERRON, WPESIQN
Fraser, Mich.

While listening in on 20 meters, I heard a group of old guys hollering on side bands about the SWL being no good to anyone, and how they wouldn't answer an SWL's card. One old fellow, when he could get his breath, said he didn't have any QSL cards anyway. I have just passed the exams for my General Class ham ticket, and plan to get back on the air. I feel that ham radio operators and SWL's have pretty much the same interests, and can see no reason for a ham not to respond to an SWL.

FERDINANDO O. MARTINO, Sr., WPE6EPZ
Sacramento, Calif.

Many times SWL reports to amateur radio operators are not given due consideration by their recipients. While not all reports are worthy of verification by hams, I'm sure when a ham receives a self-addressed, stamped envelope from me he should at least have the courtesy to return my card with the reason for the rejection. I would really appreciate finding out any mistakes I have made in making out a helpful report. After spending $5 and receiving only 10 verifications from 50 reports, I am a little discouraged.

STEVE SMAY, WPE6EAW
Springfield, Mo.

With reference to the letter from Jon Puerner (September, 1965), I have also received a QSL which came a year later, almost to the day, but this QSL came from a ham in Burlington, Iowa. So be patient, hams and SWL's, for you may also receive your QSL's from Ghana and Iowa in the near future.

MICHAEL McFARLANE, WA9JZL
South Bend, Ind.

STEREO AMPLIFIER SOUNDS OFF

I built the “Two-Compactron Stereo Amplifier” (July, 1965), and am more than...
Only Courier gives you a 23-channel transistor CB rig for $169 and can guarantee it for 10 years!

What do you do for an encore after introducing the industry's finest 23-channel transistorized CB rig for the unheard price of $169? Tag it with a 10 year guarantee!


You can see the Courier TR-23S at your nearest Courier dealer. Or use the coupon for all the data on the amazing Courier TR-23S—the CB rig with the ten year guarantee.

Yes! I'd like to know all about the $169 Courier TR-23S with the 10 year guarantee!

Name __________________________________________

Address _________________________________________

City ______________________ County ______ State ______

CIRCLE NO. 9 ON READER SERVICE PAGE
LETTERS  (Continued from page 6)

pleased with the results. I built it with two modifications: (1) I installed a jeweled pilot lamp fixture with a No. 47 bulb and connected it to the filament leads; and (2) I built the power supply into the changer base, partly for the sake of economy, but mainly to eliminate the clutter of extra connections. The entire unit is concealed in a louvered-front closet, with a "muffin" fan for ventilation. I am driving two 8-inch speakers, and I must say, at far more than room-filling volume!

BILL FOROTSTON Newentot, La.

Good work, Bill, but it looks to us as if that monster in the go-cart at the left has his thumbs in his ears.

D.C.-OPERATED FLUORESCENT LIGHT

Congratulations to Ben Richards for a fine construction project, "D.C.-Operated Fluorescent Light" (July, 1965). I used non-polarized type capacitors for C1 and C8, made by P.R. Mallory & Co., and installed C5 to take care of any power supply transients. Capacitor C3 can be used with or without L1. Not having a 6-watt lamp immediately available, I tried a 15-watt lamp. The light worked without any apparent ill effect.

R. L. GASTON, W5JUS Austin, Texas

Thank you for an exceptionally useful construction project—it works fine. The article suggests that a fuse should be placed in the circuit to protect the transistors against application of excessive or wrong polarity voltage, and also states that the fuse may not act quickly enough. Part of the problem can be solved by placing a 500-ma. silicon diode in series with the switch, the cathode side towards the brown lead of the transformer. This will prevent damage from an improperly connected battery.

JACK WERTHMAN Kansas City, Mo.

THE 51ST STATE

In the "Amateur Radio" column (November, 1965, p. 93), Garry Shandling, WATBKG, claims more states in the union than Uncle...
SPECIAL OFFER from the famous Gernsback Electronics Book Club, an affiliate of RADIO-ELECTRONICS Magazine. For 10 years the Club has helped men in electronics get ahead and stay ahead in this fast-changing field. See how it can help you...

You are invited to accept—at a mere fraction of the original price—an electronics guide that answers every question you’ve ever had on fixing transistor radios and printed circuits. We make this extraordinary offer to demonstrate just one of the many advantages you will enjoy as a member of the famous Gernsback Electronics Book Club.

Here is a complete, self-training course by expert Leonard C. Lane. It tells you all you want to know, including specific servicing methods and techniques. You get practical, down-to-earth guidance you can use at once to spot trouble in the audio section, pinpoint speaker and earphone circuit defects, check distortion in the audio amplifier, locate frontend troubles, eliminate printed-circuit board pitfalls, and work more effectively with the signal generator vtm, scope and isolation probe.

NOTHING IS LEFT OUT. This giant 2-volume guide treats every area—much of it original, unavailable anywhere else in book form. Hundreds of illustrations and schematics practically turn equipment inside out for you to examine. You get practical tips to save shop time, to lessen servicing trial and error, to find and fix any trouble with professional know-how.

Learn more, earn more! Every other month the Club’s News Bulletin will tell you about a significant new self-teaching book on color TV or radio servicing, test instruments, transistors, hobby projects, stereo, tape recording, industrial electronics, appliance repair, communications, or on some other area of vital interest to you. Each is a working tool designed to help you learn the subject quickly and easily.

Big cash savings! As a member, you alone decide whether you want a particular book or not. You get 2 books now for 99¢ and need take only 4 more within a year. And the Club saves you up to 30% off retail prices on the books you take!

FREE reference service! What’s more, our staff agrees to answer for you personally, any specific electronics questions of your choice. You’re entitled to 3 questions for every book purchased—an extraordinary membership benefit!

Send no money now mail coupon for free trial

You risk nothing, now or ever, by mailing the coupon above. You will receive these 2 skill-building handbooks for free examination. If not pleased, return books in 10 days and forget the matter. Otherwise, start your membership and discover how the Club will help you build your know-how, boost your income, and get more fun out of electronics!

Gernsback Library, Electronics Book Club Dept. C, 154 West 14th Street New York, N.Y. 10011

February, 1966
3.5 watt output. This new solid state 6-channel mobile CB transceiver delivers the most talk power you can get from a 5-watt transmitter—3.5 watts at 100% modulation.

Outstanding mobile performance—Unique double conversion receiver, with noise limiting, provides excellent reception of even weak, distant signals.

All silicon transistor design, plus lifetime guaranteed glass-fiber circuit boards, combine to offer unmatched reliability, minimum current drain, and smallest possible size.

Write for Bulletin Pace I, and the name of your nearest Pace dealer.

From the makers of the famous PACE 5000

Pace Communications Corp.
24049 Frampton Ave., Harbor City, Calif. 90710
Telephone (213) 325-8444

CIRCLE NO. 45 ON READER SERVICE PAGE

LETTERS

(Continued from page 8)

Sam—a total of 51. I would also like to say that the “Unique 99% Speaker Enclosure,” (same issue) works wonderfully.

Neil Stern
Bronx, N. Y.

Neil, with transistors taking over, it’s quite possible Garry found a “Solid State,” or else his computer broke down.

FM BLOCKBUSTER

Down the block from me, about ¼ of a mile, is FM Radio Station KMAX. It comes through beautifully on an FM radio. It also comes through great on the speakers of my tape recorder, and on Channel 3 of my TV set. I should have stayed in New York.

Paul J. Yudell
Sierra Madre, Calif.

Paul, did you tell them you were from New York? You can still outwit them though. Simply place a low-pass filter in series with

the first audio amplifier in the tape recorder, and in your TV set. All it consists of is a 10,000-ohm ½-watt resistor and a 50-pf. capacitor connected as shown. By the way, how long is a block in Sierra Madre?

CAMPER’S SPECIAL NOT DOWN THE DRAIN

I was sorry to learn that reader D. McDaniel (Letters, December, 1965, “Camper’s Special Down the Drain,”) couldn’t find a 2N3053 transistor in California’s Bay Area. We are the Transitron distributor in the midwest and stock Transitron’s 2N3053 @ $1.24. We also have a type 2N3945 @ $1.25 which is a direct substitute for the RCA 2N3053. In San Francisco, the distributor is Fortune Electronics, 3400 Georgia Ave. N.W.

Dick Dreher
Engineering Services Co.
Kansas City, Mo.

Dick, thanks for your help. Quite a few readers have problems getting the parts for our projects. Although it is a trend to blame the magazine and/or the project designer, the manufacturers—and in some instances the stores themselves—are at fault. The manufacturers must cut through the jungle of diode and transistor type numbers. No store
Get with the new PRECISE Green line for truly new design and decor in test instruments. These unique units have color dynamic front panels featuring easy-on-the-eyes Green to aid readability and accuracy. New functional design and layout make operation fast and foolproof. Inside, they’re on line with sophisticated circuitry checked out for reliability. So when it comes to test instruments, take the best course. Swing with PRECISE scopes, VTVMs, power supplies, signal generators, tube testers, decade boxes and probes.

MODEL 636
AF SINE SQUARE GENERATOR — 20 cps to 200 kc in four ranges. Less than 0.25% sine wave distortion at 10 v rms into 600 ohms load.

MODEL 780
CONTINUOUSLY VARIABLE REGULATED VOLTAGE SUPPLY — Regulated dc output from 0 to +400 v at 150 ma, and 0 to –150 v bias. Also provides unregulated ac. Meters for voltage and current.

MODEL 905
VACUUM TUBE VOLTOMETER — Comes with assembled dc/ac-ohms probe. Direct reading of p-p voltages. Separate ac low voltage scale. Low 0.5 vdc range for transistor circuit measurements.

Get them from your local distributor.

PRECISE ELECTRONICS
Division of Designatronics Inc., Mineola, L. I., N.Y.
LETTERS  (Continued from page 10)

can be expected to stock the thousands of semiconductors that the EIA has approved. And what is sold in one store may not be available anywhere else in the city. Substitutions take time to find and, in nine cases out of ten, the store doesn't want to look them up.

EXPERIMENTERS CAN TALK, TOO

I wish to express my appreciation to you. During the last school year, I entered an essay contest run by the National Science Teachers of America and sponsored by the Ford Motor Company. The title of my essay was, "A Transceiver." It was based on a previous project of mine. I won a Regional Award, and a Silver Plaque. Most of my electronics knowledge comes from articles that I have read in your magazine.

JEFF SIEGEL
New York, N.Y.

DIODE ARTICLES Praised

Your Fall 1965 Edition of Electronic Experimenter's Handbook requests comments in regard to articles like "The Fabulous Diodes." This article by Louis Garner Jr. is excellent and a very good reference—keep 'em coming. However, my vote for the most engrossing and thought-provoking article goes to Charles Fair's "Using Silicon Diodes" in your July, 1965 issue; it shows actual applications. Also, I was very much impressed with the article by Charles Pirollo, "The Neon Lamp Wonder" (April, 1965), and am completely fascinated by the construction project "Super-Sens" (November, 1965). By the way, I look forward to "Transistor Topics" each month. I am a mechanical engineer, and am just getting my feet wet in electronics.

JOHN A. BRADSHAW
Hillsdale, N.J.

Thank you for your comments, John. It looks like you would have us mix the same brew as we have been doing right along, that is, put more Popular Electronics articles into the Electronic Experimenter's Handbook. The 1966 Spring Edition of this handbook is scheduled to go on sale February 17. Look for it. Incidentally, we changed the name of "Transistor Topics" to "Solid State" to more nearly reflect this state-of-the-art activity.

OUT OF TUNE

Super-X Pulse Power Pack (December, 1965, page 42). The value of resistor R13 is given in the Parts List as 330,000 ohms. It should read 330 ohms. All other references to R13 are correct.

INSTANT EMERGENCY COMMUNICATIONS WITH PEARCE-SIMPSON'S SENTRY $99.90

6 Channel Transistorized CB Two-Way Radio

Ultra-compact and featuring an all transistor power supply and receiver, the Sentry is ideal for mobile operation. It takes no more current to operate than a dashboard clock and transmits a powerful signal even when car battery is so low it will not turn over the engine.

The Sentry, designed for the Highway Emergency Locating Plan (H.E.L.P.) puts the stranded motorist in touch with thousands of H.E.L.P. monitors along the nation's highways.

Pearce-Simpson, Inc. P. O. Box 800—Bayshore Annex, Miami, Florida 33152

Please send full information and model specifications.

Name
Address
City State

CIRCLE NO. 28 ON READER SERVICE PAGE
for brilliant 82-channel TV performance—COLOR or black & white, plus FM/Stereo

INSTALL THE NEW...

JFD® LPV COLOR LOG PERIODIC TV ANTENNA

Now you can enjoy the best reception ever on any VHF, UHF or FM/Stereo station—from one antenna, using one down-lead—with the patented new JFD COLOR LPV Log Periodic.

Why cripple your reception with inefficient antenna "hodge-podges?" Choose a powerful space-age JFD LPV... see and hear the spectacular difference!

DON'T BE MISLED BY IMITATIONS—NO OTHER ANTENNA WORKS LIKE THE JFD LPV BECAUSE...

- Only the LPV is designed according to the original log periodic patented design of the University of Illinois Antenna Research Laboratories.
- Only the LPV combines frequency-independent design with capacitor-coupled electronic dipoles for...
- Higher, more uniform gain and narrower directivity on channels 2 to 83—and FM.

SEE YOUR JFD LPV DEALER TODAY!

JFD ELECTRONICS CORPORATION • 1462 62nd Street • Brooklyn, N. Y. 11219
world's largest manufacturer of TV & FM antennas

CIRCLE NO. 49 ON READER SERVICE PAGE
"GIMMICK" CAPACITOR INCREASES BANDWIDTH OF UHF TV BOOSTER

A variable frequency amplifier, such as the Blonder-Tongue UTB-1 UHF booster, can be easily modified to provide a frequency range from 440 to 910 mc., instead of 470 to 890 mc., to take in part of the UHF radio ham band and other services. Solder a 0.47-pf. capacitor or "gimmick" across the output resonant tank, and cut the capacitor leads as short as possible—they should be no longer than ¼ inch. Now connect the capacitor across the two tabs sticking out from the center wafer on the bottom of the chassis.

—Ken Greenberg

COPPER TUBING MAKES HANDY KNOB BUSHING

Should you find yourself in need of a control knob for a ¼"-diameter shaft, but only have ½" types on hand, you can use a piece of copper tubing as a bushing to bring the knob opening down to size or the diameter of the shaft up to size, depending on the way you look at it. Cut a short length of ¼" copper tubing, slit it so that it fits around the ⅛" shaft, slip the tubing over the shaft, and then fit the knob into place.

—Homer L. Davidson

ADD CHANNELS TO YOUR CB TRANSCEIVER

You can add a switch and a few crystal sockets to your CB transceiver to get more channels—if the unit is not already able to receive all of them. The number of channels is limited only by the type of switch you (Continued on page 20)

THE TURNER TRANSISTORIZED

WITH VARIABLE OUTPUT LEVEL

Now, from Turner comes the very finest base station microphone ever designed. The 43 features a two transistor pre-amp with volume control to give you up to 50 times the output level you now have. Yes, just dial your desired signal for maximum modulation all the time — every time. You can work close or far away from this microphone, or change the output for a big or little voice.

Eventually, all sets lose some of their initial power. Turner's 43 puts the zip back into your set and keeps it up to full strength at all times!

The 43 has tailored frequency response of 300-3500 c.p.s. for best and clearest voice transmissions with knocked down local noise interference. Exclusive touch-to-talk or lock on-off switching — the 43 works with all tube or transistor sets regardless of switching requirements or type.

Ask your dealer about the new 43.

THE TURNER MICROPHONE COMPANY
946 17th Street N.E., Cedar Rapids, Iowa
Available in Canada.
Export: Ad Auriemo, Inc., 85 Broad Street, New York 4, N.Y.

LIST PRICE
$49.50

VOLUME CONTROL
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

Mail the coupon to the address indicated below. Please use this address only for Product Service requests.

3

NAME (Print clearly)

ADDRESS

CITY STATE ZIP CODE

VOID AFTER MARCH 31, 1966

February, 1966
"Get more education or get out of electronics ... that's my advice."
Ask any man who really knows the electronics industry. Opportunities are few for men without advanced technical education. If you stay on that level, you'll never make much money. And you'll be among the first to go in a layoff.

But, if you supplement your experience with more education in electronics, you can become a specialist. You'll enjoy good income and excellent security. You won't have to worry about automation or advances in technology putting you out of a job.

How can you get the additional education you must have to protect your future—and the future of those who depend on you? Going back to school isn't easy for a man with a job and family obligations.

CREI Home Study Programs offer you a practical way to get more education without going back to school. You study at home, at your own pace, on your own schedule. And you study with the assurance that what you learn can be applied on the job immediately to make you worth more money to your employer.

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, airmail postpaid card or write: CREI, Dept. 1202D, 3224 Sixteenth Street, N.W., Washington, D.C. 20010

Founded 1921
Accredited Member of The National Home Study Council

NOW! TWO NEW PROGRAMS!
• Industrial Electronics for Automation
• Computer Processing Systems

February, 1966
in perfect tune for every C-B application

but really quite flat

Flat indeed... but in silhouette only with under-dash downroom compressed to a mere inch and a half...

But sharp too and design-slanted strictly for vehicular operation, with slimline styling and a bold new natural woodgrain trim, a fitting complement to any modern car. The TWR-7 is also rugged and functional, equally at home on truck or motorcycle.

Today, any mobile unit must be solid-state—for exceptionally low battery drain—for a very real and important reduction in equipment size. The TWR-7 goes far beyond mere transistorization—uses only silicon planar transistors—introduces a unique, double-sided ground plane construction for lowest silhouette and highest circuit isolation. Ground plane boards are copper surfaced epoxy fiberglass, have plated through holes. Ruggedness and durability are dominant in TWR-7—quality is evident everywhere. The price is music to the ears of the discerning buyer... 129.95

5 watts • 5 channels with tip-touch selector and direct channel readout.

Write for attractive full-color brochure

RAYTHEON COMPANY
213 E. Grand Ave., So. San Francisco, Calif. 94080
CIRCLE NO. 46 ON READER SERVICE PAGE

TIPS (Continued from page 14)

use and the total number of channels allowed. While the diagram shows only a 3-position switch and 3 crystal sockets for simplicity of illustration, an assembly consisting of a 2-gang, 11-position ceramic switch and 11 crystal sockets with appropriate crystals can be plugged into a crystal socket in your transceiver. Mount the new sockets and switch on an aluminum panel, and orient them to obtain the shortest possible leads.

—Morris Moses

DON'T BE A SOREHEAD
—CUSHION THOSE PHONES

Headbands used with conventional type earphones can become quite uncomfortable pressing against the skull, even after short periods of time. An easy way to eliminate this discomfort is to cushion the band with some inexpensive foam rubber or plastic. Just cut a 12"-long strip of the soft material, wrap it around the headband, and tape or cement the end. You can also make a foam cushion for each of the ear pieces, but be sure to cut an opening in the center so as not to obstruct the sound.

—Art Trauffer

TUBE ANODE MAKES MINIATURE SOLDER POT

Want an easy-to-make solder pot to use for tinning stranded wire? Locate a burned-out high-voltage rectifier tube such as a 1B3; break the glass and remove the cup-shaped anode. Then remove the ¼" tip from a heavy-duty soldering iron and insert the anode cap. Allow the iron to heat sufficiently, and feed solder into the newly fashioned cup until it's about three-quarters full.—Jan B. Rosenbaum
BUIL D 20 RADIO CIRCUITS AT HOME with the New Improved PROGRESSIVE RADIO "EDU-KIT"®

A Practical Home Radio Course

Now Includes
* 12 RECEIVERS
* 3 TRANSMITTERS
* VOLTAGE WAVE GENERATOR
* SIGNAL TRACER
* AMPLIFIER
* INJECTION INJECTOR
* CODE OSCILLATOR

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 training. You will learn 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 wire. 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 IF amplifiers, Cathode, Plate and Fouler rectifiers, different modulation equipment. You will learn the various practical methods of trouble shooting, using the Progressive Signal Tracer, Progressive Signal Injector. Progressive Oscilloscope. The "EDU-KIT" is the product of many years of research and teaching experience. "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 electronics science. Whether you are interested in electronics as a hobby, as a career or for advancement, you want an interesting hobby, a well paying job, a profession or a vocation, you will find the "EDU-KIT" a worthwhile 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" is designed carefully, step by step, so that you cannot help but become an "Electronic Master." The "EDU-KIT" allows you to teach yourself at your own rate. No instructional help is necessary.

PROGRESSIVE TEACHING METHOD

The progressive teaching method of the "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 complete background in radio, electronics theory and practice, at the time of the day that suits you, at your own pace. Then, when you are ready, you build a simple radio. With this radio you learn to construct, build and operate a simple receiver. After you have become an expert in this field, then you build a more complex radio. With this radio you will learn how to practically troubleshoot. Then you build a more advanced radio, learn more advanced theory, and practice more advanced troubleshooting. Therefore, in a practical and progressive manner, at your own pace, you will find yourself constructing, building, troubleshooting and teaching, as a professional Radio Technician. Included in the "EDU-KIT" course are Receiver, Transmitter, Code Oscillator, Signal Tracer, Professional Radio Generator and Signal Injector, Circuit materials, Printed Circuitry, Bottles, manuals, "breadboard" experiments, genuine radio circuits, constructed by means of professional work. The "EDU-KIT" is not only a means of rapid instruction how to build and operate radio circuits, but as a "Printed Circuit Magazine" it gives you the latest developments in AC and DC house current circuits.

YOU WILL BE COMPLETE AS A PROFESSIONAL

You will receive all parts and instructions necessary to build twenty different radio and electronics circuits, each guaranteed to operate. Our Kit contains tubes, tube sockets, variable, electronic, ceramic, and other dielectric condensers, resistors, tie strips, hardware, tubing, punched metal chassis, instruction Manuals, hook-up wire, solder, instruction manuals, hook-up wire, solder, instruction manuals. In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, instruction manuals. You also receive a useful set of tools, a pair of "EDU-KIT" Pliers and Wire Strippers, a pair of "EDU-KIT" Soldering Iron and "EDU-KIT" Soldering Wick. The "EDU-KIT" also includes Code Instructions and the Progressive Code Oscillator. In addition to F.C.C. Radio Amateur License instructions, 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 CIRCUITY

At no increase in price, the "EDU-KIT" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique serving instrument that can detect many Radio and TV troubles. This revolutionary technique of radio construction is now becoming popular in all forms of radio and TV sets. A Printed Circuit is a special insulated chassis on which has been deposited a conductive material which takes the place of the usual wiring. The various parts are merely plugged in and soldered to terminals. Printed Circuitry is the basis of modern Automation Electronics. A knowledge of Printed Circuitry is a necessity today for anyone interested in Electronics.

UNCONDITIONAL MONEY-BACK GUARANTEE

ORDER FROM AD-RECEIVE FREE BONUS RADIO & TV PARTS JACKET WORTH $15

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>Send &quot;EDU-KIT&quot; postpaid. I enclose full payment of $26.95.</td>
</tr>
<tr>
<td>☐</td>
<td>Send &quot;EDU-KIT&quot; C.O.D. I will pay $26.95 plus postage.</td>
</tr>
<tr>
<td>☐</td>
<td>Rush me FREE descriptive literature concerning &quot;EDU-KIT.&quot;</td>
</tr>
</tbody>
</table>

Name:

Address:

PROGRESSIVE "EDU-KITS" INC.

1186 Broadway, Dept. 635D, Hewlett, N. Y. 11557

FREE EXTRAS

* SET OF TOOLS
  * SOLDERING IRON
  * ELECTRONICS TESTER
  * PLIERS-CUTTERS
  * VALUABLE DISCOUNT CARD
  * TESTER INSTRUCTION MANUAL
  * MATH FIDELITY QUIZZES
  * TELEVISION BOOK
  * RADIO TROUBLE-SHOOTING BOOK
  * MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE | FCC AMATEUR LICENSE TRAINING | PRINTED CIRCUITRY |

SERVICING LESSONS

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

FROM OUR MAIL BAG

J. Staton, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired many sets in my part-time job. I got the "EDU-KIT" and paid for it, but I found your ad and sent for your Kit."

Ben Valerio, P. O. Box 21, Magna, Utah, states: "I am an electronics hobbyist and have had some experience repairing radios. The "EDU-KIT" paid for itself. I was ready to spend $25 or $30, but I found your ad and sent for your Kit."

Robert L. Shuff, 1534 Monroe Ave., Huntington, N. Y., writes: "I thought I would drop a line to say that I received the "EDU-KIT," and was really amazed that such a bargain could be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The trouble-shooting Tester that is supplied with the Kit is really swell, and finds the trouble in no time."

February, 1966

CIRCLE NO. 31 ON READER SERVICE PAGE

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

TRANSISTORIZED ELECTRONIC KEYER
How's your code speed these days? The all-transistor circuitry of the Heathkit HD-10 electronic keyer provides optional transmitting speed ranges of 10 to 20 or 15 to 60 wpm. There are no relays that will stick and require cleaning, or that will chatter and punch holes in CW characters. A built-in sidetone generator and speaker with adjustable volume permits off-the-air practice, as well as monitoring of on-the-air transmissions. Circuit board construction is employed, and assembly time is about eight hours.

Circle No. 75 on Reader Service Page 15

SIX-STATION INTERCOM
The latest in intercoms from Lafayette Radio Electronics is a multi-purpose six-station unit, Model MPI-6. An all-master system incorporates up to six master stations, enabling three private conversations or a six-station conference to be held. A master-to-remote system enables the master station to communicate with up to five remotes either separately or in a six-station conference. The master unit has a five-station selector control, 3-way talk-listen-dictate switch, and volume control.

Circle No. 76 on Reader Service Page 15

ANTENNA SPLITTER/COMBINER
Currently available from JFD Electronics Corporation is the Model SC80 splitter/combiner—a high-efficiency signal-divider network. In the SC80, VHF signals on channels 2 to 13 are directed to one output, for connection to the VHF antenna terminals at the back of the TV receiver. Another output shunts UHF signals on channels 14 to 82 to the separate UHF antenna input at the rear of an all-channel TV receiver or UHF converter. A third output is exclusively for FM and FM stereo signals. This ruggedly housed device can also serve as an outdoor combiner when separate VHF, UHF, and FM antennas must be used. It eliminates the confusion of multiple downleads by matching the antennas to a single transmission line.

Circle No. 77 on Reader Service Page 15

SINGLE-CONVERSION AMATEUR RECEIVER
Excellent frequency stability and freedom from adjacent-channel cross-modulation are among the design features of Hamcrafters' newly released SX-146 receiver. It employs a single-conversion signal path and pre-mixed oscillator chain. A 2.1-kc., 6-section quartz crystal lattice filter provides maximum selectivity for SSB, and there are provisions for plug-in installation of a 0.5-kc. CW crystal filter and a 5.0-kc. AM crystal filter. Sensitivity of the SX-146 in the AM mode is less than 1 microvolt for 10 db S/N (30% modulation) and for SSB/CW is less than ½ microvolt for 20 db S/N. Transceive provisions are also included for operation with the HT-46 transmitter.

Circle No. 78 on Reader Service Page 15

MOBILE CB TRANSEIVER
Especially suitable for tight mobile installations, the "Pacer II" CB transceiver measures only 4 ¾" high, 11¾" wide, and 6¾" deep. A product of Metvotek Electronics, a subsidiary of Regency Electronics, the unit has 11-channel crystal-control transmit and receive, plus a 23-channel tunable receiver. Other features of the "Pacer II"—said to be more than have ever before been incorporated in such a low-cost transceiver—include an automatic noise limiter with "on-off" switch and a fully illuminated king-size S-meter which can be read from virtually any angle and from several feet away.

Circle No. 79 on Reader Service Page 15

TONE CONTROL FOR DYNAKIT PREAMPS
Dynakit owners can install a new TC-3X tone control modification kit in their present
If Fisher amplifiers are so special, how come anybody can build one?

Because Fisher's method of kit construction is rather special, too. With the exclusive Fisher StrataKit method, anybody, including your wife, can build an authentic Fisher stereo component that will be fully equal in performance and reliability to its laboratory-wired prototype.

No experience is necessary. Assembly takes place by simple, errorproof stages (Strata). Each stage corresponds to a separate fold-out page in the uniquely detailed instruction manual. Each stage is built from a separate packet of parts (StrataPack). Major parts come already mounted on the extra-heavy-gauge steel chassis. Wires are precut for every stage—which means every page. All work can be checked stage-by-stage and page-by-page, before proceeding to the next page.

The end result is one of the world's finest high-fidelity instruments. Like this Fisher KX-200 stereo control-amplifier. Its 80 watts (IHF) stereo power amplifier section will drive the least efficient speakers at extremely low distortion. Its preamplifier section provides a virtually unlimited range of input and control facilities. It even incorporates features like a laboratory-type d'Arsonval bias/balance meter and a power-derived third-speaker output with separate volume control.

If bought already assembled, an amplifier like this is easily worth $250. But it is all yours in the Fisher KX-200 StrataKit for $169.50. And that price is rather special, too.

FREE $1.50 VALUE! Send for The New Kit Builder's Manual, an illustrated guide to high fidelity kit construction, complete with detailed specifications of all Fisher StrataKits.

Fisher Radio Corporation
11-35 45th Road
Long Island City, N.Y. 11101

Name

Address

City State 102

The Fisher

February, 1966
PRODUCTS (Continued from page 22)

PAS-2 and PAS-3 preamplifiers to obtain the benefits of a tone control circuit that achieves the advantages of both switch-type and continuous control systems. According to Dynaco, the tone control provides for the removal of all frequency and phase discriminating networks from the circuit in the mechanically centered "flat" position, and at the same time maintains the infinite resolution capability of continuous controls.

Circle No. 80 on Reader Service Page 15

"RADIO ANALYST"

All the necessary functions needed to repair AM and FM auto and transistor radios are incorporated in B&K Manufacturing Company’s Model 970 "Radio Analyst." A solid-state instrument, it's complete with power supply, in-circuit and out-of-circuit transistor tester, r.f. and audio signal generators, and a rugged volt-ohm-milliampmeter. The Model 970 employs an in-circuit signal injection procedure that works on either power or signal type transistors, and reads good or bad directly on the built-in meter. The power supply provides 1½ to 12 volts for battery substitution, and a separately variable 1½ to 12 volts for bias.

Circle No. 81 on Reader Service Page 15

"SKIPPER" FAN MOUNTS WITHOUT HARDWARE

A small fan that delivers 100 cubic feet of cooling air per minute and requires no mounting screws has been introduced by Rotron Manufacturing Company. Although not specifically designed to cool hi-fi equipment, the "Skipper" produces minimum acoustical disturbance. Its 38-db (SIL) noise level makes it ideal for use in ham shacks, test areas, or rooms where quietness is required. The fan comes complete with plug and cord assembly, guards, boot to protect solder connections, and plates to give you a choice of mounting methods.

Circle No. 82 on Reader Service Page 15

SPEAKER SYSTEMS

Want to "build" your own hi-fi system? The six speakers in University Sound’s "Mustang" line make possible many combinations, ranging from a small bookshelf system to a huge multi-speaker system with multiple woofers and tweeters. Their physical design and shallow depth styling are said to be ideal for in-the-wall installation and built-in hi-fi/stereo systems. The "Mustangs" vary in size from a full-range 8" speaker to a 12" three-way extended range reproducer; a "Spherecon" tweeter is included.

Circle No. 83 on Reader Service Page 15

PUSH BUTTON MULTITESTER

Ten push buttons quickly select operating mode and range on the Olson Model TE-192 multimeter. The unit has a 30,000-ohm per volt sensitivity for a high degree of accuracy. Features include a 1-volt d.c. full-scale range for measuring critical biasing voltages in transistor circuits, and an "off" switch which damps meter movement for safety during transit. The d.c. voltage range goes from 0 to 1000 volts in six steps, the a.c. voltage range from 0 to 1000 volts in five steps. Capacitance is measured from 250 µf. to 0.02 µf., resistance from 0 to 10 megarhms in three steps, and inductance from 50 to 5000 h. The Model TE-192 operates on two penlight batteries.

Circle No. 84 on Reader Service Page 15

ELLIPICAL-STYLUS CARTRIDGE

Audio Dynamics has introduced a new cartridge with a minute moving system that is said to perform below the critical point of record groove yield, assuring true sound from the first playing. Called the ADC 10/E, the new cartridge has a "moving mass" (the weight or inertia of the total moving system) about one-third that of the best magnetic cartridge. Sensitivity of this "induced magnet" cartridge is 4 mv. at 5.5 cms/sec. recorded velocity, channel separation is 30 db from 50 to 10,000 cycles, and frequency response goes from 10 to 20,000 cycles, ±2 db. Tracking force range: ½ to 1 gram.

Circle No. 85 on Reader Service Page 15

UNIDIRECTIONAL MICROPHONE

The unidirectional pickup characteristics featured in the Shure Model 580 "Unidyne A" cardioid microphone are said to have been available heretofore only in much higher priced models. Feedback from speakers or other noise entering the rear of the microphone is eliminated or greatly reduced, voice...
The ideal base/mobile combination for CB radio

FOR BASE STATIONS where 117 V 60 cycle AC current is available...

The Low-Cost RCA Mark VIII and Mark NINE
- 9 crystal-controlled transmit and receive channels.
- Tunable receiver for reception of 23 C-B channels; dial marked in both channel numbers and frequency.
- Exceptionally good voice reproduction.
- Highly selective superheterodyne receiver with one RF and two IF amplifier stages.
- Electronic switching—no relay noise or chatter.
- Illuminated "working channel" feature.
- Light and compact—only 3½ inches high, weighs only 9 pounds with mike.
- Improved Automatic Noise Limiter.

Plus these EXTRA features in the Mark NINE
- Combination "S" Meter and relative RF Output Meter indicates the relative strength of incoming signal and Relative RF Output Meter indicates relative strength of signal being transmitted.
- Spotting Switch. Permits precise manual tuning of receiver without use of receiver crystals.
- External Speaker Jack. Lets you connect an external speaker to set, so that incoming calls can be heard in remote locations.

Mark VIII: $99.95*  
Mark NINE: $114.50*

FOR MOBILE UNITS where low power consumption is important...

The all-solid-state MARK 10
- All silicon transistors assure low power consumption, dependable communications at temperatures from -23° to 130° F.
- Compact, lightweight. Fits easily under dash of any car or truck. Only 3½" high, 5½" deep, 8¼" wide. Weighs less than 4½ pounds.
- 12 crystal-controlled transmit and receive channels with illuminated channel selector.
- Combination "S" Meter and relative RF Output Meter.
- Operates from 12-volts DC power source (positive or negative ground).
- Crystal-controlled double conversion, superheterodyne receiver provides frequency accuracies greater than 0.004%.
- Separate AGC amplifier eliminates blasting and overloading, minimizes fading.
- Six-stage IF bandpass filter for maximum selectivity without ringing.
- Low-distortion, series-type noise limiter with automatic threshold adjustment.
- Receiver power regulated for maximum stability.
- Acoustically designed cabinet with audio characteristics shaped for maximum intelligibility.
- External speaker jack (de-activates internal speaker).

Mark 10: $189.95*

*Optional distributor resale price.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.

The Most Trusted Name in Electronics
quality remains the same whether it is of high or low frequency, and boominess (echoing) is either eliminated or greatly reduced. The "Unidyne A" comes in two versions: a high impedance design for use with any high-gain, high-impedance amplifier, and a low-impedance design for use with any low-impedance amplifier. In addition, the high-impedance unit is available in matched pairs for stereo recording.

Circle No. 86 on Reader Service Page 15

**PRODUCTS (Continued from page 24)**

**PENCIL-STYLE SOLDERING IRON**

Weller Electric Corporation has introduced the SP-23 pencil-style soldering iron. This feather-weight 23-watt iron features a narrow, long-reach stainless steel barrel and a replaceable nickel-plated copper tip, and comes packaged in a hang-up style vinyl pouch. The same iron is available as part of an SP-23 K kit; also included in the kit are three soldering tips, five feet of 60/40 rosin-core solder, a handy soldering-aid tool, and complete soldering instructions.

Circle No. 87 on Reader Service Page 15

**DELUXE SHORT-WAVE RECEIVER**

There are five bands on the Heathkit GR-54 SWL receiver; three short-wave bands from 2 to 30 mc., a 550- to 1550-kc. AM broadcast band, and an 180- to 420-kc. aeronautical and radio navigation band. A comparatively low priced unit, the GR-54 boasts operating features usually found on units costing almost twice as much: SSB and CW reception, a built-in speaker, a transformer-operated power supply, and a built-in code practice monitor. A long-wire antenna kit is included.

Circle No. 88 on Reader Service Page 15

**LASER RODS**

Laser rods are now available for the home workshop. United Electronics Laboratories is marketing ruby rods of the same chromium concentration and crystallographic orientation as those most commonly used in the nation's largest research laboratories. Offered in two sizes—1.5" long by 0.150" in diameter, and 2.0" by 0.250"—they are sold with complete instructions for assembling the simple electrical components needed to fire the laser beam.

Circle No. 89 on Reader Service Page 15

XCELITE INC. • 20 BANK ST., ORCHARD PARK, N. Y.
Send Bulletin N365 on 99PS-60 and 99PS-40 sets.

<table>
<thead>
<tr>
<th>name</th>
<th>address</th>
<th>city</th>
<th>state &amp; zone</th>
</tr>
</thead>
</table>

**CIRCLE NO. 44 ON READER SERVICE PAGE**
Now—revolutionary, field-proven “scanner” antenna for 25-50 Mc.!

Rotate the beam, not the antenna. Instantaneous, positive control over your mobiles!

Scan control unit has Monitor (omni) position, indicator lights for direction-in-use.

CB’ERS ATTENTION!
You can have a “Professional Scanner” cut to operate on CB! Ask your distributor for details or write to us today.

the antenna specialists co.
Div. of ANZAC Industries, Inc.
12435 Euclid Ave., Cleveland, Ohio 44106
Export Div., 64-14 Woodside Ave., Woodside, N.Y. 11377

Omni-directional position, plus full-circle scan coverage.

Rotate beam electronically, instantly. No mechanical rotator needed.

6 db gain *, min. 18 db front-to-back ratio in beam mode.

Rugged aluminum construction. Stress-designed to withstand 100 m.p.h. winds.

Power rating: 500 watts.

Every unit individually tuned to your exact frequency, and receives mandatory system checkout.

* Ref., drooping ground plane

"Stripes of Quality"

February, 1966
"Couldn't have worked out better if I'd planned it."

"What are you going to be?" they kept asking me all through my senior year in high school.

"I didn't know. But I did know I wasn't going to take any old job or try for college until I had plans. And I didn't want to just hang around until I made up my mind.

"I talked to the other guys, my family...everyone. Then I talked to the Army Recruiting Sergeant. And that was the smartest thing I ever did. He didn't try to pressure me. He just answered my questions. With his help, I enlisted for training as a data processing equipment operator.

"It turned out I was a natural for it. Picked it up with the help of some of the best teachers I ever came across. And now I'm an expert in something that will mean good jobs the rest of my life."

An Army enlistment has been the turning point for many men. It can be for you. It can give you the chance to learn any one of over 300 skills, skills you can build your life on. You can travel to countries and places you might never see otherwise. And you'll be proud of what you're doing.

Look into what the Army has to offer. You'll find there's more for you in today's action.

Army
SCHEMATIC DIAGRAMS

Philco Model 40-190, code 121, circa 1931, Tunes 550-1500 kc., 1.5-3.5, 6-0-1.8 mc. Has 8 tubes. (Shirley Farrell, 10911-C Cusina Ave., South Gate, Calif. 90281)

Winegard Model RD-300 "Red-Head" TV-FM booster. (Norman Stuckler, Rock Port, Mo. 64452)

Federal "Orthosonic" Model A-10 receiver. Battery operated. Has 8 tubes. (Roger DeVries, 49 Ross Ave., Demarest, N.J. 07627)

Philco Model 39-35 receiver. Tunes BC. Has 10 tubes. (Earl F. Gustafson, 301 Prince Anne Rd., Virginia Beach, Va. 23452)

Gonset Model 3009 automatic tuner. Tunes FM on 30-40 mc. (Paul Brazil, 26 Prospect Ave., Norwalk, Conn. 06854)

Newtronics Model A-1 stereo amplifier. Fully transistorized. (Earl Morwitt, 4222 N. Ashland, Chicago, Ill. 60613)

National Radio Model DCBW3 receiver, circa 1930. Tunes 1.5-15 mc. Has type 36 and 37 tubes. (Thomas L. Greenwood, 2609 La Grande St., Huntsville, Ala. 35801)

Federal Model 894 signal generator. Weston Model 891 tube tester. (W. G. Komori, Box 23, Union, S.C. 29087)

RCA Model 8TK2 receiver, rating A. Tunes 510-1720 and 2300-22,000 kc. on three bands. (David Lake, Rt. 1, Box 85, Taft, Calif. 93268)

Precision VTVM, Series EV-10-S, circa 1953. (Charles Bien, 21433 N. California Ave., Chicago, Ill. 60647)

E. H. Scott "Philharmonic" receiver. (Henry Davis, 907 S. Third Ave., Maywood, Ill. 60153)

Eccofonic Model #109-B reverb. chamber. (William Russotto, 39 Morga St., Dorchester, Mass.)

TCS-12 surplus transmitter, made by Collins Radio. Tunes 2 to 18 mc. (Mike Johnston, 1610 S. Orange Blossom Trail, Orlando, Fla. 32805)

Majestic Model 70 receiver and power supply, circa 1927. (Norman J. Farrington, 1011 Adams St., LaCroise, Wis. 54601)

Grundig "Majestic" Model UKW receiver. Tunes AM, FM and a.w. Has 6 tubes. (Agustin Paredes, 1822 N. 36 St., Stone Park, Ill. 60165)


Meissner receiver, circa 1942. Tunes BC, a.w., and FM. Has 8 tubes. (Leonard Raphael, 519 E. 24 St., Brooklyn, N.Y. 11210)

February, 1966

(Continued on page 30)
DIAMONDS ARE NOT FOREVER

True, it's unfortunate...and unfortunately, it's true: the diamond tip of ANY high fidelity stylus eventually wears out. Some sooner, some later.

The new ultra-lightweight tracking force cartridges (1 or 2 grams) extend diamond tip life many times. But even they need periodic inspection. Depending upon the degree of wear, a worn stylus will (at the very least) appreciably accelerate audible record wear—or it can actually damage a record beyond redemption, in a single playing!

SHURE PERFORMANCE DEPENDS ON A GENUINE SHURE STYLUS

The superior performance of all Shure cartridges DEPENDS upon the Shure Stereo Dynetic Stylus Assembly. An inferior stylus replacement will audibly detract from and significantly reduce the cartridge's performance, and increase record wear. Obviously, if an imitation Shure Stereo Dynetic Stylus is used, we cannot guarantee that the cartridge will perform to published specifications. Accept no substitute. Look for this wording:

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

ASSIST (Continued from page 29)

Magnavox Model 38H receiver, ser. X59572, style CPAR 653, chassis #CR178. Tunes BC. (Daniel M. Bayles, 519 S. McKenzie St., Adrian, Mich. 49221)


Rogers receiver, ser. 8792, type 6R531. (Harvey Zabrisky, UKRM, ELBA, Yukon Territory, Canada)

DeForest "2" scope. (John Johnson, 4825 N. Glickman, Temple City, Calif.)

Hartrey Model 5320 receiver. Tuned 5-54 mc. and 48-54 mc. Has 8 tubes. (William Hyland, 16 Ridgewood St., Waterbury, Conn. 06710)

Stromberg-Carlson No. 330-5 receiver, ser. P28692(1). Tuned BC and S.W. Has 6 tubes. (Kit Pogorsky, 7109 3rd Ave., Brooklyn, N.Y. 11209)

Northern Radio Co. Model 1 variable master oscillator. (Charles Jokes, 1276 Benton St., Barberton, Ohio)

SPECIAL DATA OR PARTS

McMillan "Five." Two audio coupling transformers, 1" in diameter by 1½" high needed. (Fred Butterfield, 6 Second St., Brooklawn, N.J.)

Superior Model 600 tube tester. VOM and tube testing data needed. (Dave Bock, 58780 Rome Pl Rkt., Washington, Mich.)

A-C Electrical Mfg. Model A-C Dayton phono-set, circa 1924; tunes BC; has 5 201-A tubes. Schematic and source for tubes needed. (L. P. Card, 392 Lakeview Rd., Yorkton, Sask., Canada)

Crosley Model 11-122U receiver, ser. 2970262; has 5 tubes. Schematic, operating and alignment manual, and case needed. (James M. Baribals, 737 Atlantic Ave., Daly City, Calif. 94014)

Hallicrafters Model S-40-B receiver, circa 1954; tunes 540 kc. to 44 mc. on 4 bands; has 8 tubes. Tuning dial needed. (C. Miller, 10413 Munn, Houston, Texas 77029)

Atwater Kent horn with 6" base or smaller (any condition). Atwater Kent emblem for front panel, and 1"-diameter brown knob with arrow on top needed. (Paul Mundt, 911 E. Evergreen St., Santa Maria, Calif.)

Lear Model 6610PC or 6611PC or 6612PC receiver, phono combo, circa 1947; tunes 530 kc.-18 mc. on 3 bands. Audio amp section needed. (Robert LaRocca, 7205 18 Ave., Brooklyn, N.Y. 11204)

Erwood Model 4112 amplifier; has 7 tubes. Schematic and information on replacement power transformer needed. V-M "TRI-O-MATIC" record changer, circa 1950. Center spindle for 45 rpm and cartridge knob used to select needle needed. (Dennis C. Smith, 9201 Meyers Rd., Detroit, Mich. 48228)

Atwater Kent Model 20 receiver. Three short pin type 01A tubes needed. R27/ARC-5 surplus "Command" aircraft receiver; tunes 6-8-1 mc. Transformer #3558 (62 pf. per section) needed. (David Stefan, 2606 Angle Way, Rancho Cordova, Calif. 96870)

Acrosond Model T0-300 transformer, 6600 ohms p-p, for Milliard 550 circuit amplifier needed. (Thomas D. Greene, 175 Kensington Ave., Buffalo, N.Y. 14214)

Essex delay line, 0.6 microsecond delay, 1000-ohm impedance. All available data needed. (Louis Compoginis, 4520 Bailey Way, Sacramento, Calif. 95825)

GE Model X371 and X372 receiver; tunes BC and S.W.; has 11 tubes. Schematic and alignment data needed. (Frederico C. Po, 1572 Doroteo Jose, Sta. Cruz, Manila, Philippine Republic)

Philco receiver, chassis H 48576, circa 1934; tunes 550 kc. to 1700 kc. Schematic, coils, and #77 tubes needed. Majestic receiver, chassis 4810-E, ser. A-299537; tubes 560 kc. to 18.0 kc. on 2 bands; has 9 tubes. Schematic and alignment data needed. (Allen Holmes, 1620 Locust Way, Alderwood Manor, Wash. 98001)

Browne-Nobles NB-101 battery-operated broadcast tuner needed. (Henry V. Urban, 67 Poulten Ave., Buffalo, N.Y. 14215)


(Continued on page 32)
NEW from FINCO

BOOSTER-COUPLER
Model No. 65-1 List $29.95

ALL FINCO PRODUCTS ARE ENGINEERED FOR “COLOR”

The BOOSTER-COUPLER
"For Deluxe Home and Commercial Use"
Two tube, 4 set VHF-TV or (FM) Distribution Amplifier for home and small commercial distribution systems... with low loss splitters (FINCO #3001 or #3003) can feed 16 or more sets, depending on signal level and line length losses. FEATURES:
On-Off Switch
AC convenience receptacle
Ventilated perforated steel cabinet 6½" x 3½" x 3½" Metal enclosed to eliminate shock hazard
Easy access for tube servicing
Convenient, easy mounting... bracket and screws supplied
UL listed AC cord
117 Volts, 60 cycles
Attractive appearance with rugged commercial construction
No strip terminals
Minimum "snow" (very low noise figure)
100% test for all electronic characteristics

The CONVERTERS
"That challenge all competition"
FEATURES:
• Drift free fine tuning
• Post conversion signal amplification
• Solid state chassis — shockproof
• Convenient AC outlet on converter
• Exact input-output impedance match
• Lighted dial tuning
• Full color and black-white signal conversion
• High gain — low noise
• Conforms to FCC radiation specifications
• Easy installation — UL approved
• Instant warm-up — Operates at Channel 5 or 6
• A model for every reception area

Write for beautiful color brochures—Numbers 20-338 and 20-377

THE FINNEY COMPANY
34 West Interstate Street  Bedford, Ohio 44014  Dept. PE

CIRCLE NO. 13 ON READER SERVICE PAGE

February, 1966
The do-it-yourselfer's newest catalog

Here's your new catalog of quality electronic kits and assembled equipment...your shopping guide for TV set kits, transistor radios, voltmeters, scopes, tube testers, ham gear, PA systems, and a host of other carefully engineered products. Every item in the CONAR catalog is backed by no-loophole, money-back guarantee. It's not the biggest catalog, but once you shop its pages you'll agree it's among the best. For years of pleasurable performance, for fun and pride in assembly, mail the coupon. Discover why CONAR, a division of National Radio Institute, is just about the fastest growing name in the kit and equipment business.

CONAR

MAIL NOW!

3939 Wisconsin Avenue, Washington, D.C. 20016

Please send me your new catalog.

Name

Address

City.State.Z-code

CIRCLE NO. 6 ON READER SERVICE PAGE

ASSIST

(Continued from page 30)

Phillips Model CM50A receiver; tunes BC and s.w. to 22 mc. on 5 bands; has 5 tubes. Schematic and service info needed. (L. Swiderlak, Box 756, Timmins, Ontario, Canada.)

R-96/SR surplus receiver; tunes .125-12 mc.; has 11 tubes. Schematic, operating manual and parts info needed. (Larry Long, 45 South St., Holbrook, Mass. 02346)

Atwater Kent Model 33 receiver; has 6 tubes. Operating info, power and voltage specs, alignment data, schematic, parts list and source for parts needed. RCA "Radiola 60" receiver; has 9 tubes. Schematic and operating manual needed. (Carlton Mann, Box 314, Hanover, Ind. 47243)

Meissner "Analist" receiver; has 8 tubes and 4 relay control indicators. Operating instructions, schematic, and d.c. voltmeter needed. (Arnold Walter, 155 Bathurst Dr., Toronto, Ont., N.Y. 11151)

R-174/URR surplus receiver, ser. 665, made by Emerson Radio; tunes 4 bands, 1.5 to 19 mc. Source for 2 dual antenna transformers (T1 and T5) needed. (Orville Myers, Gen. Del. Boulder, Colo.)

Heathkit Model TS-2 sweep generator. Operating and assembly manual and marker tuning capacitor needed. (E. Gasior, 1752 Spruce Ct., S. Milwaukee, Wis.)

RCA "Radiola 18" receiver, circa 1928; tunes 550-18,000 kc.; has 7 tubes. Schematic and source for UX-171-A, UX-227, UX-280 and UX-226 tubes needed. (Ray Vallen, Jr., 2020 Whitmore St., Omaha, Neb.)

Atwater Kent Model 35 receiver, ser. 100126; has Model H horn type speaker. Schematic and source for parts needed. (Donald Goodie, 3018 Doane St., Orlando, Fla. 32809)

RT-18 ARCI surplus transceiver, ser. A4262. Operating manual needed. (David H. Lawrence, 603 Thompson St., Charleston, W. Va. 25311)

Philco Model 116-122 receiver, circa 1935; tunes longwave, BC, and s.w. Schematic, operating manual, and source for type 77 and other tubes in unit needed. (Larry Hughes, 1111 W. Flora St., Ontario, Calif. 91761)

Sherbrooke Model 1151-200 television set, ser. 59450. Schematic and parts source needed. (Fred Pfeffer, 625 Evergreen Ave., Pittsburgh, Pa. 15209)

RCA Model T-60 receiver; tunes BC and 5.6 to 20 mc.; has 5 tubes, tuning eye, push-button tuner. Schematic and parts source for parts needed. (S. Ordinetz, RFD #2, Chester Depot, Vt. 05141)

Greybar Model 330 or "Radiola 60" receiver, circa 1925. Power transformer needed. (F. Wood Sayles, 45 Petites Ave., Providence, R.I. 02909)

ASB-7 surplus receiver, CAY-16ACE. Technical manual and schematic needed. (John Charis, 218 Park St., Lawrence, Mass. 01844)

Sakura Model TR-4E volt-ohmmeter; 20,000 ohms per volt. Selector switch and wiring diagram needed. (Karl Radoy, 1834 N.E. 170, Seattle, Wash. 1955)

Aireon Model 1221A amplifier made for juice box; has 5 tubes. Schematic and operating voltage data needed. (Jonathan L. Bové, 34 South St., Hingham, Mass. 02043)

TRC-8 surplus receiver made by Eapy Co; tunes FM on 530-250 mc. TRC-8 surplus transmitter. AN/APR-4 surplus receiver; tunes 56-280 mc. Manuals needed. (John Rokita, 3701 Pleasant Dr., Sharon, Pa.)


RME Model 43 receiver; tunes 510 to 33,000 kc. on 6 bands; has 8 i-f tubes and 1 #50. Operating and servicing manual and meter needed. (Alc T. L. English, 1405 USAF Hospital, Box 83, A.P.O., New York, N.Y. 09406)

RD-142/JUN surplus recorder reproducer, made by Olympic Radio; has 2 channels, each using 4 heads and 2" tape. Heads, preferably mounted, and information on heads wanted. (E. W. Cox, 12905 Superior, E. Cleveland, Ohio 44112)

GE Model E 165 receiver; tunes 540 kc.-1700 kc., 1.7 mc.-6.0 mc., 6.0 mc.-18.0 mc. has 10 tubes. Schematic and service data needed. (C. Fred Mullins, 3258 Rebert Pike, Springfield, Ohio 45502)
MESSENGER “100”

new! Low cost—all solid-state CITIZENS RADIO TRANSCEIVER

Check the performance features — then take a look at the price tag! You won’t find a CB unit on the market that gives you as much value and reliability for your two-way radio dollar. The same highly competent engineering team that designed the famous Messenger III now brings you this low cost, compact, 5-channel transceiver for Mobile, Base or Portable field use! Delivers maximum power from legal input. High performance noise limiting for “whisper quiet” operation. Adjustable “squelch” control. Receiver is both sensitive and selective — unique speech compression circuit prevents overmodulation and delivers a crisp, clean signal without adjacent channel “splatter” . . . boosts average transmitted power for maximum readability at extended ranges.

ADVANCED CIRCUITRY FEATURES OF THE “100” INCLUDE:

- Narrow bandwidth receiver for excellent selectivity!
- High receiver sensitivity for maximum range!
- Unique speech compression circuit which prevents overmodulation and helps deliver a clean, crisp signal without adjacent channel "splatter"!

Three types of usage from one unit — Mobile, Base or Portable.

$129.95 NET (Mobile Unit)

See your Johnson distributor or write today for complete details!

E. F. JOHNSON COMPANY
2405 10th Ave. S.W. • Waseca, Minn. 56093

February, 1966

CIRCLE NO. 32 ON READER SERVICE PAGE
This important job (and its big salary) is reserved for a qualified electronics technician. It can be you!

It's a fact. There are thousands of jobs like this available right now for skilled electronics technicians. What's more, these men are going to be in even greater demand in the years ahead. But how about you? Where do you fit into the picture? Your opportunity will never be greater . . . so act now to take advantage of it. The first step? Learn electronic fundamentals . . . develop a practical understanding of transistors, troubleshooting techniques, pulse circuitry, micro-electronics, computers and many other exciting new developments. Prepare yourself now for a job with a bright future . . . unlimited opportunity . . . lasting security . . . and a steadily-increasing salary.

Over 15,500 ambitious men are using Cleveland Institute Electronics Training Programs as a stepping stone to the good jobs in electronics. Why not join them? You will learn at home, in your spare time, and tuition is remarkably low. Read the important information on the facing page. Then fill out the postage-free reply card and drop it in the mail today. Without obligation we'll send you all the details. But act now . . . and get your high-paying job just that much sooner.
How You Can Succeed In Electronics

... Select Your Future From Five Career Programs

The "right" course for your career

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

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

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

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

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

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

An FCC License... or your money back!

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

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

CIE's AUTO-PROGRAMMED lessons help you learn faster and easier

Cleveland Institute uses the new programmed learning approach. Our AUTO-PROGRAMMED® lessons present facts and concepts in small, easy-to-understand bits... reinforce them with clear explanations and examples. Students learn more thoroughly and faster through this modern, simplified method. You, too, will absorb... retain... advance at your own pace.

Free nationwide job placement service... for life, for every CIE graduate

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

NEW in 1966

Only CIE offers new, up-to-the-minute lessons in all of these subjects:
- Logical Troubleshooting
- Laser Theory and Application
- Microminiaturization
- Single Sideband Techniques
- Pulse Theory and Application
- Boolean Algebra

Full accreditation... your assurance of competence and integrity

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


Cleveland Institute of Electronics
1776 East 17th Street, Dept PE-37 Cleveland, Ohio 44114

February, 1966
Orbiting Solar Observatory-2, 136.713 mc., has been shut down by a NASA ground station command. Launched February 3, 1965, OSO-2 returned 2,200,000 bits of information prior to shutdown. It now becomes just another piece of space junk.

Last November, the U.S.S.R.—following its usual practice of discounting the work of other nations—claimed a “first” in color TV transmission using their “Molina-2” communications satellite. The Soviets failed to recall that Relay-1 had been used for color TV transmissions in March, 1963.

Direct broadcasting from a satellite to conventional FM home or short-wave receivers is only three to five years away, NASA is currently evaluating a number of proposals for such broadcasts, though FM is apparently being given the nod. Satellite manufacturers see little difficulty in relaying FM—especially after the spectacular success of the ham “OSCAR” project.

The “profit-making” Communication Satellite Corporation, COMSAT, has ordered four new satellites from Hughes Aircraft. Somewhat similar to the COMSAT “Early Bird,” the new satellites will be orbited to provide global TV coverage and simultaneously provide instant voice contact with the Apollo moon astronauts. First of these satellites should be launched within six months.

Explorer-29, launched from Cape Kennedy on November 6, has been used to calibrate camera systems and optical tracking methods. For this work, the flashes from four 1580 candle-second xenon electronic tubes were photographed against a star background. Scientists will use the results of this program for positioning satellites with greater accuracy.

Various SWL’s claim that the tracking beacons in the Gemini capsules can be heard with loud and clear signals. The beacons operate on ground command and transmit on 243.00 mc. With a suitable converter, these beacons should be heard within 400-500 miles of any official Gemini tracking station.

As this magazine issue closes, plans to launch OSCAR IV are being finalized. The U.S. Air Force has scheduled the OSCAR IV satellite—designed and built by radio amateurs—for launching from a Titan IIIc rocket. OSCAR IV will be orbited about 20,000 miles high and will have a life span of one year—or until the rechargeable batteries run dry. A beacon will transmit on 431.925 mc, and on instantaneous translator will receive on 144.10 mc and retransmit on 431.935 mc.
Be creative — and thrifty too!
Save up to 50% with EICO Kits and Wired.

EICO supports your sense of achievement with no-compromise engineering, finest parts, dramatic esthetics, simple step-by-step instructions and large pictorial diagrams. You need no technical background—just pliers, screwdriver, soldering iron. Three million people, ages 8 to 89, have built EICO kits. If you love to create, EICO is for you. And if you want the best buys in ready-to-assemble equipment, again EICO is for you. Judge critically for yourself. Send for your free catalog. See EICO at your local dealer.

ST EQUIPMENT

Model 322 Peak-to-Peak VTM. A must for color or B&W TV and Industrial use. Four-switch ranges on all 4 functions. With Uni-Probe. $29.95 kit. $49.95 wired.

Model 460 Wideband Direct-Coupled 5" Oscilloscope. DC-4.5Mc for color and B&W TV service and lab use. Push-pull DC vertical amp., bal. or unbal. input. Automatic sync limiter and amp. $89.95 kit. $129.95 wired.

Model 324 RF Signal Generator. 150kc to 435mc range. For IF/RF alignment and signal tracing of TV, FM, AM, CB and mobile. Built-in and ext. modulation. $99.95 kit. $299.95 wired.

CITIZENS BAND/ HAM RADIO

New Model 776 Sentinel 23 CB Transceiver. 23-channel frequency synthesizer provides crystal-controlled transmit and receive on all 23 channels. No additional crystals to buy! Features include dual conversion, illuminated 5/8F meter, adjustable squelch and noise limiter, TVI filter, 117VAC and 12VDC transistorized dual power supply. Also serves as 3.5 watt P.A. system. $189.95 wired.

New Model 712 Sentinel 12 Dual Conversion 5-watt CB Transceiver. Permits 12-channel crystal-controlled transmit and receive, plus 23-channel tunable receive. Incorporates adjustable squelch & noise limiter, & switches for 3.5 watt P.A. use, spotting, & Part 15 operation. Transistorized 12VDC & 117VAC dual power supply. $89.95 wired only.

New Model 753 The one and only SSB/AM/CW Tri-Band Transceiver Kit. "The best ham transceiver buy for 1966"—Radio TV Experimenter Magazine. 200 watts PEP on 80, 40 and 20 meters. Receiver offset tuning, built-in VFO, high level dynamic ALC. Unequaled performance, features and appearance. Sensationally priced at $179.95 kit. $299.95 wired.

STEREO/HI-FI

New Model 796 All Solid-State Automatic FM MPX Stereo Tuner/Amplifier, "Very satisfactory product, very attractive price"—Audio Magazine. No tubes, not even multipliers. Delivers 112 watts iHF total to 4 ohms, 75 watts to 8 ohms. Completely pre-wired and pre-aligned 9F, 9F and MPX circuitry, plus plug-in Transistor sockets. $219.95 kit (optional walnut cabinet $14.95), $329.95 wired including walnut cabinet. UL approved.

Model ST70 70-Watt Integrated Stereo Amplifiers, Best buy of highest ranked stereo amplifiers according to Independent testing. $99.95 kit. $149.95 wired. ST40 40-Watt Integrated Stereo Amplifier, $79.95 kit. $129.95 wired, $179 Matching FM MPX Stereo Tuner, $89.95 kit. $129.95 wired.

FREE 1966 CATALOG

EICO Electronic Instrument Co., Inc.
131-01 39th Ave., Flushing, N.Y. 11352 PE-2
Send me FREE catalog describing the full EICO line of 200 best buys, and name of nearest dealer. I'm interested in:

- test equipment  
- ham radio
- stereo/hi-fi
- Citizens Band radio

Name. ________________
Address. ________________
City. ________________
State. ________________ Zip. ________________

1945-1965: TWENTY YEARS OF LEADERSHIP IN CREATIVE ELECTRONICS
CIRCLE NO. 10 ON READER SERVICE PAGE

February, 1966
Hallicrafters new "S-P-R-E-A-D TUNING" lets you zero in with local-station ease and precision from all over the globe!

- Four super-spread short wave bands plus U.S. standard broadcast.
- Logging scale for instant re-tuning of any station.
- All new, sensitive super-heterodyne circuitry.
- Jack for headphone.

ONLY $5995

write for complete specifications

Available in Canada through Gould Sales Co.
5th & Kostner Aves., Chicago, Illinois 60624
Export: International Division

"Quality through Craftsmanship"

CIRCLE NO. 16 ON READER SERVICE PAGE
You can activate one of thousands of career openings if you have the proper training.

PART 2:
CORRESPONDENCE SCHOOLS
(PART 1: RESIDENT SCHOOLS SEPT., 1965)
By KEN GILMORE

In electronics today, it's what you know that counts. There's no room for the half educated, the basement tinkerer, the guy who isn't serious enough to prepare himself with a first-rate education.

And preparation is just the beginning; learning doesn't stop once you're on the job. One educational authority, borrowing the language of nuclear physics, estimates that the 'half-life' of even the best technical education is just ten years. To put it another way, 50 percent of what you learn today will be as out-of-date as the crystal set ten years from now.

All of this adds up to one thing: If you want to be a member of today's fast-moving electronics team, you'll have to get good basic electronics training, then keep re-educating yourself from there on out.
There are two ways you can get a technical education. One is to attend a regular electronics residence school—a trade school, technical institute, or college. It's a good way—especially for basic training.

But suppose you can't. There's no school in your town, or you have a family to support and can't leave your job. Or you just don't have the cash to go to a full-time school or college. These days, you can get a first-rate electronics education at home. Scores of top-notch correspondence schools now offer an incredibly rich variety of courses, designed to make you anything from a radio repairman to an expert in space communications. And once you're on the job, education through the mails is one of the best ways to keep your knowledge up to date.

Before you go rushing off to the nearest post office to get your application in, however, you'll have to make a couple of basic decisions: (1) Exactly what kind of job—among the many fascinating ones available in the field of electronics—do you want to land, and (2) Which school, which courses, will best prepare you to reach this goal?

To make the right decision, you need information. And that's what you'll find in this article. POPULAR ELECTRONICS has talked to scores of education authorities across the country; we've queried home-study school officials and talked to their students and graduates. Here are their answers to the questions you'll be asking:

What can I learn at home?

The answer is—almost anything. Various schools approach the subject of electronics in different ways, at different levels. Some concentrate in one area. Hollywood's Grantham School of Electronics home study division, for example, specializes in preparing you to get an FCC First Class Radiotelephone license—your ticket to a job in radio or TV broadcasting or as a communications technician. Massey Technical Institute of Jacksonville, Florida, and Chicago's Coyne Electronics Institute emphasize training that will help you go into the radio-TV service business on your own.

International Correspondence Schools (ICS) of Scranton, Pennsylvania, on the other hand, offers a wide variety of courses: electronics fundamentals, hi-fi and stereo servicing, radio-electronic telemetry, industrial electronics, and many more. At Chicago's DeVry Technical Institute, you can choose among all the standard courses and such up-to-the-minute fields as computer technology and space and missile instrumentation.

Many schools offer courses on several levels. "We advise beginners to take courses in one of our career programs," says Jack W. Friedman, director of the RCA Institutes Home Study School. "These courses begin with basic electronics and lead through advanced material in television, communications, automation and industrial electronics, transistors, or electronics drafting. Our advanced courses, on the other hand, serve more specific needs, such as helping a technician update himself or move to a higher level."

Some schools offer only advanced programs. "Many courses are keyed for the rank beginner," says G. O. Allen, president of the Cleveland Institute of Electronics (CIE). "Courses of that type serve a much-needed purpose, but we prefer to leave the manual training to them. For the man who has progressed well beyond the intermediate level, we offer a college-level course in communications engineering." Courses at Philco's Technical Institute in Philadelphia and Capitol Radio Engineering Institute in Washington are also designed for the working electronics technician or graduate engineer who wants to upgrade his skills or keep up to date in this fast-moving field.

What jobs can I prepare for?

There's almost no limit. Home-study graduates of Central Technical Institute of Kansas City, for example, hold such positions as engineering technicians in aerospace research and manufacturing, TV cameramen, studio and recording technicians, maintenance and operating technicians with airlines, police departments, railroads, and public utilities. Some own their own radio-TV repair shops. Virtually every major electronics company in the country and many small ones have on their staffs men working in research and development, in manufac-
turing, in testing—men who got their training or updated their skills through correspondence study.

Take a few isolated examples from one school—National Radio Institute in Washington, D.C. NRI graduate David F. Conrad of Reseda, California, is a senior engineering aide for Litton Systems; he checks out magnetic recording devices for a living. Robert L. L'Heureux of Southboro, Massachusetts, works for the data-processing division of Minneapolis-Honeywell. Walter G. Higgins of Portland, Oregon, was a mailman when he studied electronics at home; after his course, he transferred to the Department of the Interior as an electronics technician and now maintains UHF and VHF communications links. Jim Davis of Long Branch, New Jersey, troubleshoots transistorized chopper-stabilized d.c. amplifiers at Electronics Associates, Inc.

The list could go on endlessly.

Most schools claim that between 90% and 100% of their graduates obtain employment in electronics. Says R. Parma of National Technical Schools in Los Angeles, "About 30% of our students are currently employed in electronics. These students feel that they lack the technical skills to achieve advancement in their company. Another 60% of our students are employed outside of electronics, but desire to change their jobs because of the increasing opportunities in this industry."

How long does it take, and how much will it cost?

Time to completion depends on three main things: the contents of the course, how fast you learn, and how much time you put in. Here are some typical examples.

Major programs at Capitol Radio Engineering Institute (CREI) in Washington, D.C., take about three years to complete for the average student studying two to three hours a day. Costs—depending on the subject—hover in the vicinity of $500 to $550 for the entire course. DeVry estimates that the average student studying its $560 course seven to ten hours a week can finish in a year and a half. At CIE an FCC license course costs $325 and ordinarily takes nine to ten months. Coyne's TV servicing course costs $165, will occupy the average student a year and a half.

National Technical Schools in Los Angeles offers a 150-lesson master course in radio, TV, and industrial electronics for $367. Each lesson takes three to four hours, and National Tech urges students to finish at least one a week. Most, however, move faster and complete the course in one to two years.

All times quoted above are average; some students learn faster, some slower. Put in twice as much time, and you'll finish twice as fast. Most schools have a time limit on finishing, too, but will grant an extension if you need it.

One final point: Most schools give substantial discounts for speeded-up payment, even lower prices for cash in advance. All prices given here are for the most extended payment plans the schools offer on a so-much-down, so-much-a-month basis.

By the way, you don't have to hesitate to pay in advance. All reputable schools have fair refund policies if something happens to keep you from finishing.

Once I've received my diploma, are jobs easy to get?

Will the school help me land one?

If you don't already have a job in electronics (many home-study students do), most schools will help you find one. Many have formal placement bureaus (some invite you to use their services for the rest of your life); others will simply forward your grades and a letter of recommendation to prospective employers, leaving the bulk of the job up to you. No reputable school, of course, guarantees you a job on graduation, any more than reputable universities do.
Just how hard—or how easy—you'll find it to land a job with good pay depends on several things. The training you select is one of the big ones. Naturally, you can't expect to get the same job—or the same pay—after finishing a six-month course in basic electronics as you could after a comprehensive three-year course in industrial electronics or advanced communications systems.

One vital factor in job hunting is frequently overlooked. CIE's Allen puts it this way: "For CIE and other well-trained students," he says, "job placement is not much of a problem—if they will face realities. It seems obvious, but many young men from rural areas or small towns expect to find suitable employment at home. They may find it, but they should be prepared to go to the job—the job will seldom come to them. A college graduate seldom works in his home town. The same is true of a highly-skilled professional."

Can home-study graduates compete for jobs with those who get their training in resident schools? "What we're really talking about here," says John Sivatko of ICS, "is what does the employer think. If an industry is unfamiliar with the quality of home-study training, there may be some prejudice against it. The competence of the students is not that different; the attitude of the employer is the pertinent factor."

W. A. Robinson of DeVry makes another point. "The resident student has the advantage of meeting recruiters from various industries who come to the school to interview. The home-study student, however, must go to the employer for his interview. Where home-study programs compare closely with resident programs, employment will probably depend on how effectively the student presents himself to a prospective employer."

In the past, some employers who hired resident-school graduates regularly were hesitant about putting home-study grads on the payroll. To some extent, the situation still exists. "It is only fair to say that correspondence education does not yet receive the recognition it should as adequate preparation for initial employment in the field," says CREI Executive Vice President L. M. Upchurch. But the situation is changing—rapidly. "I'm happy to say the closed-door attitudes exhibited by many employers in the past have been cast out by progressive companies," says D. A. Lockmiller, Executive Secretary, National Home Study Council. "Now we hear this question: 'What does he know and can he use it well?' That's a far cry from the old insistence on pedigree—'Where did you go to school?'

Correspondence school graduates have achieved high-ranking positions in business and industry, too. The national service manager of a large mail order store is a veteran of home study, as are many radio and TV station chief engineers, manufacturers, and company executives. In fact, some educators think that men and women with enough drive, ambition, and self-discipline to complete correspondence courses are likely to be a notch above average. Recently, just on a hunch, ICS sent questionaires to several thousand company presidents around the country, asking how many were former ICS students. About half answered. And of those, an astonishing seven percent were, indeed, ICS alumni. If all former correspondence students had been counted, the number would have been higher.

How about pay?

It's impossible to give precise figures; there's too much variation according to geographical area, amount of training, branch of industry—even the state of business. But here are some samples that will give you an idea of the range. The U. S. Department of Labor's Occupational Outlook Quarterly shows average technicians' salaries in private industry starting in the vicinity of $4900 a year. Also, ICS reports that its graduates average $80-$110 a week.

The range, however, can be far wider. "Some of our recent graduates are well over the $10,000-a-year level already," says Allen of CIE. "At the other extreme we have men who, because they are not willing to relocate or enjoy a certain type of electronics work, are making as low as $2 per hour."

Don't overlook the possibility of working for the federal government. Electronics technicians from GS3 to GS9 earn from $4005 to $9425. You may want to take a civil service test at the end of
your schooling to see if you can qualify. There's virtually no limit to what you can make. Start your own business and your ultimate earnings are determined only by the sweat you're willing to put into it and your ability as a businessman. You can advance rapidly working for others, too. Listen to Charles J. Roesle of Washington, D. C.:

"Six years ago I was at the end of any advancement at $5500 per year. But after completing a National Radio Institute course I passed a Civil Service exam for an Electronics Production Engineer at $7000 per year. In May, 1961, I was promoted to Guided Missile Project Officer at $9000 per year. Recently, I was promoted to Guided Missile Supervisor, with a salary of $11,500 per year."

Incidentally, while you're dreaming of future riches, you can begin making your home-study course pay its own way. Peter Cooke of Coyne surveyed the school's 500 most recent graduates not long ago and asked each one how much money—if any—he had made repairing radios and TV sets in his spare time before he finished his course. Among them, the 500 students had picked up more than $100,000 while studying. That's an average of better than $200 each—more than the total cost of the course.

Can I qualify for enrollment?

You can for most home-study courses if you can read and write and really want to get into electronics. The only additional requirements come from schools that offer advanced courses.

For example, CRII expects students to have a high-school diploma and a job or prior experience in electronics. The whole course, in fact, is designed for the working technician who wants to increase his skill and his pay check, not for the beginner.

Several other schools have similar requirements, virtually all for advanced courses. It wouldn't do you much good to take a course in servomechanism theory if you weren't yet on speaking terms with Ohm's law.

How can I pick the right school for me?

It isn't easy. There are hundreds of schools across the country offering thousands of courses. Prices, estimated time to completion, and many other factors vary widely. But the job, while difficult, isn't impossible. Here's advice from the experts on how to proceed.

Says William B. Callahan, president of Chicago's Commercial Trades Institute: "Look for the schools offering courses in the field you want to study. Compare tuition prices, look for accreditation, state licensing, and a good Better Business Bureau record." Adds J. F. Thompson of NRI: "Compare prices, faculty, and reputation. If you're still in doubt,

Where can I get more information?

For more information on who offers which course and on accreditation, write to the National Home Study Council, 1601 Eighteenth St., N. W., Washington, D. C. 20009, and ask for the Directory of Accredited Private Home Study Schools. It's free.
Should kits be included in a home-study course?

A good case can be made either way. "At best," says M. E. Houghton of DeVry Technical Institute, "a kit is a laboratory, a teaching device that's carefully built into the rest of the course. Our students don't just assemble a kit. Eventually they understand exactly why the kit is built as it is."

Another point in favor: The kits to be constructed in many courses are multimeters, signal generators, scopes, and other useful test instruments. If you're planning to go into servicing, these instruments can form the basis of your equipment.

Some schools, such as Coyne Electronics Institute, feel that kits aren't necessary. A kit's primary purpose, the school maintains, is to familiarize the student with actual electronic hardware. "But most of our students begin to repair radios and TV sets almost immediately," says Peter Cooke of Coyne. "So they don't need kits."

Capitol Radio Engineering Institute offers another reason for the non-kit course. "While we recognize the value of properly integrated kit construction in conjunction with correspondence study, we know that many of our students would find the use of kits impractical because of military restrictions, travel, space limitations, and so on," says L. M. Upchurch, Jr. "Further, since our students are already employed in electronics, their daily work frequently gives them the advantages they might otherwise get from working with kits."

One guideline, then, might be this: If you're a beginner with no electronics experience and no prospect of having a chance to work with equipment during your course, you'll probably do well to select a course with kits. If you will be working with equipment, or if you're already a practicing technician taking advanced courses, then kits are far less important, and in many cases may not be needed at all.

And, of course, there's one other important aspect: Courses without kits, all other things being equal, are certainly far cheaper than those with kits. Some schools offer courses either way.

write one or more graduates." Many schools will supply lists of graduates.

David Lockmiller of the NHSC offers this thought: "First, the school should be accredited by a nationally-recognized accrediting agency. There may be one or two good schools that are not accredited, but it is difficult to evaluate these schools. Look for such things as proof of performance, price, length of the course. Examine a sample lesson. check the employment features. No one of these criteria is conclusive, but they will help you to reach a final decision."

When you're making comparisons, don't overlook some of the special or bonus features a school might offer. Some of these "extras" may not be of value to you, but check to see what's being featured by the school in addition to the regular curriculum. Here are some examples—by no means complete:

- Consultation service. If you have a problem on the job—say in the design of a circuit or repairing a particularly knotty trouble—some schools will have a whack at helping you solve it.
- Schematic service. One school maintains a file of more than a million schematics—from old Atwater-Kent radios of more than three decades ago to the latest color TV sets. For a small fee, the school will copy any schematic and send it to you—an invaluable aid in troubleshooting.
- Course tailoring. Some schools fit the course precisely to your needs. If you already have some background in math or electronics, you can get a series of tests from some schools to see where you stand. Then you start at the right place and don't waste time repeating material you are already familiar with.
- Special devices. A midwest school supplies a projector and training films. Another school sends a transistor trainer—a special board that allows you to rig experimental circuits rapidly. Some
courses often take from 18 months to two years. Despite this rather formidable assignment, we frequently have completion percentages for individual companies as high as 90 to 95 percent—sometimes 100 percent. These men are highly motivated because the company provides funds and often company time for training, and is certainly in a position to influence the student’s future employment. On the other hand, we sometimes encounter completion rates as low as 10 to 15 percent for students enrolling individually for these same courses. Self-discipline simply does not produce the same results as discipline administered by an employer. In some courses that run up to three years, we experience similar results from our group enrollments, but an even lower completion rate for individual students.

Despite these gloomy statistics, you’ll have a lot going for you. “Any reputable school will do all it can to help the student finish the training he has selected,” says DeVry’s W. A. Robinson. “Most schools keep a steady flow of inspirational and motivational material in the mail, particularly to students who lag. In fact, most schools bend over backwards offering extra help to those they feel need it. In the final decision, however, it is the student himself who makes the decision to complete his training.”

“The difference between a completer and a non-completer,” adds R. Parma of National Tech, “is the degree to which he allows himself to procrastinate. Procrastination is the student’s worst enemy, but the fault does not always lie with the student. Home study competes with the family, sports, TV, etc. But whether or not a student completes his course depends on how he rationalizes the importance of his time and career.”

Just who can benefit from home study?

“Anyone who is interested in improving himself,” says Robinson of DeVry. “Anyone who will bend his mind and back to the task,” adds Hal Kelly of the National Home Study Council.

“The question should be,” says John Sivatko of ICS, “Who can benefit from study?” Home study is just a technique. If you can benefit from any kind of learning, you can benefit from home study.”

What does it take to complete a home-study course successfully?

No reputable school will tell you it’s easy. But it can be challenging, interesting, rewarding. The completion average for home-study students is higher than the national college average. The dropout rate in colleges is high—in some cases going up to a peak of 80%—but one out of every three students completes his home-study course.

Why do so many fall by the wayside? “The two most important reasons,” says G. O. Allen of CIE, “are motivation of the student and length of the course involved. For example, we conduct many courses for industrial concerns. These
There's no doubt that the country needs more trained people. "Our economic progress today is being hampered by an increasing shortage of skilled men and women," says NRI's Thompson. "At a time when four million people are jobless, newspapers are crammed with ads for workers who can connect an electronic circuit, program a computer, service aircraft and missile equipment—or even qualify for training in hundreds of new skills that were unheard of 20 years ago. To put it another way, there would be virtually no unemployment if today's four million jobless obtained the skills to match business and industry's needs."

Correspondence education could play an increasingly important role in training men and women for tomorrow's ever-more-demanding jobs. In fact, the whole notion got some pretty high-level endorsement recently, as President Johnson voiced this opinion: "Home-study courses are an important link in the ever-lengthening chain of educational services our nation provides for its citizens. They represent an important resource in our society's commitment to provide unlimited opportunities for every American to reach his highest potential."

"We need correspondence education in this country now more than at any time in our past," says G. O. Allen of CIE, who is also the recently-elected president of the National Home Study Council. "We have a tremendous shortage of classroom facilities and qualified teachers, and this shortage is bound to get worse. Correspondence education can easily help fill the gap."

Maybe it can fill a gap in your life, too, and start you on a rewarding career in the important and fascinating field of electronics.

Should I study at home or go to a residence school?

If you're looking for controversy, this is the question to ask. Of course, if you have a job and a family and can't simply take off and go to a residence school, your choice is easy. You'll study by mail.

But what if you do have a choice? There's no doubt that home study has important advantages. Among them: You can study in your spare time, at odd hours, or while traveling. You don't have to leave home or lose income. You can study at your own pace. You don't miss classes; they wait for you if you're sick or busy. You can move from one city to another without missing a beat. And home study is certainly far less expensive than residence training. You'll probably spend less for an entire electronics course lasting two years or more by mail than for one semester in college.

But would you learn more in a regular classroom? Actually, the evidence shows it's the other way around. One study by the dean of the College of Education of the University of Michigan showed that correspondence students did slightly better on exams than others who learned the same material in the classroom. Several other studies showed similar results. "You learn by doing, not by copying someone else," says Richard S. Frazer, president of Christy Trades School. "You learn more thoroughly because you do it all yourself."

Then should you study by mail in preference to residence school? "If a home-study student is willing to put forth some effort toward self-improvement, we feel it is comparable to the best resident-school training to be found," says J. F. Thompson of National Radio Institute. "It depends on the individual," says John Sivatko of International Correspondence Schools. "Some people can get more out of a home-study course than they can in residence, and vice versa." G. O. Allen of Cleveland Institute of Electronics agrees. "Much depends on the person," he says, "his goals and motivation, his geographical location, his time availability, the nature of the subject to be learned, etc. I will state, however, that other things being equal, I do believe the student who learns through a good home-study
program not only learns better, but retains it longer."

But C. L. Foster of Central Technical Institute says: "We recommend resident school training if it is at all possible. If resident school is not practical, we recommend home-study courses because we believe that worthwhile education can be obtained through home study."

And W. A. Robinson of DeVry Technical Institute brings up another point: "Some types of training are offered at a more advanced level in our resident school than through home-study programs. In such cases, we could not provide equivalent home-study training."

Finally, L. M. Upchurch, Jr., of Capitol Radio Engineering Institute sums up his feeling. "We do not know of any authoritative comparative study of correspondence— as opposed to classroom— learning that has indicated any significant superiority of class attendance. Several studies, on the other hand, have shown slightly better results from home study."

"Comparing correspondence and classroom study of technical subjects is difficult in one respect: laboratory work. Because CREI students are, as a condition of enrollment, employed in the field of electronics, we know that to a considerable extent their practical experience gained on the job is a satisfactory substitute for supervised laboratory work. This is not invariably true, however."

"In any case, we would not ordinarily recommend correspondence study to a prospective student with the qualifications, the means, and the opportunity to attend a good residence school in the same field. (Nevertheless, there are some students for whom home study would be the better choice.) Neither would we claim that the average correspondence student completing our course is as well prepared as the average graduate of a comparable program in residence."

"The value of home study," Mr. Upchurch concludes, "is not as a competitor of residence school instruction, but as a valid educational method for individuals who want and need further education, but whose circumstances are such as to make class attendance undesirable or impossible."
HAVE you ever noticed the difference between the sound of music indoors and the sound of music out in the open air? This difference is due to the presence and absence, respectively, of reverberation. In an enclosed space, we hear the direct sounds from the performing instruments, and the sounds that are reflected from the walls, ceiling, floor, furniture, and other surfaces.

These reflected sounds reach our ears later and slightly weaker than the direct sound because they have traveled a greater distance. The larger the room, the greater the reverb time, and the greater the decay. If the direct sound is loud enough, it will usually cause more than one reflection... each subsequent reflection arriving with greater delay and greater decay.

Reverberation time, as small as it might be, is quite critical. If it is too long, there is a severe echo effect, and if it is too short, the music will sound flat and lifeless, as it would normally sound in a very small room. So important is this reverb time that some concert halls have added electronic reverberation to optimize the natural reverberation characteristics of the auditorium.

For less than $20 plus a little time, you can assemble the reverbation set-
up to be described here for your car radio or your hi-fi set at home. With it, you will be able to electronically enlarge your listening area to concert-hall proportions.

How It Works. A patented Hammond organ reverberation unit, an electro-mechanical device, is used to delay and decay a portion of the sound. A transducer at one end of the reverberation unit acts like a speaker. It picks up the audio signal from the output transformer in a car radio, converts this electrical energy into mechanical energy, and "excites" a couple of sets of springs which are attached to it. (See Fig. 1.)

The signal, now in mechanical form, travels along the springs and energizes an output transducer attached to the other end of the springs. The output transducer acts like a microphone and reconverts the mechanical energy back into electrical energy. It takes approximately 25 milliseconds for the sound to travel down the springs, but not all of the signal gets past the output transducer the first time. Some of the signal "bounces" back and forth from transducer to transducer, through the springs, one or more times. (This feature is purposely designed into the springs to simulate multiple reflections in a room). The delay line has approximately 40 to 50 db insertion loss and so the reverb signal must be amplified to bring its output signal level back up to the original input level.

Almost any audio amplifier could be used to beef up the output of the reverbation unit and feed the signal to the rear-seat speaker in a car, or to a second speaker in the home. But you can build the amplifier shown here and mount it and the reverb unit in a 5" x 9½" x 2" case.

In the transformerless amplifier in Fig. 2, the signal from the reverberation unit is applied between the base of Q1 and the sliding contact on potentiometer R4, which acts as a stabilizing emitter resistor and level control. This unby-passed resistance introduces degenerative feedback to reduce distortion. Distortion is less than 1% at 3 watts output.

The amplified signal from the collector of Q1 is capacitively coupled to the base of Q2. Transistor Q2 amplifies the signal and feeds it to the complementary driver transistors (Q3 and Q4). Transistor Q3 conducts on positive half cycles, and Q4 conducts on negative half cycles, and drives output transistors Q5 and Q6 in a push-pull manner. The voltage drop across D1 and D2 forward-biases the driver transistors slightly to prevent

![Audio Delay Line Circuit Diagram]

Fig. 1. Audio delay line simulates delay and decay characteristics of a large concert hall, in your home or car. Amplifier boosts sound just enough to compensate for insertion loss of the delay line.

February, 1966
Fig. 2. Signal from the delay line is applied to points A and B, then amplified and fed out to a speaker connected to C and D. Level control R4 is adjusted to obtain equal levels of direct and indirect signals. Amplifier distortion is less than 1% at 3 watts output. Class B operation accounts for high efficiency.

crossover distortion. The diodes also provide temperature compensation.

When reverb is desired, S1 switches in the second speaker and the fader control (R18) controls the percentage or mix of direct and “reflected” sound. When S1 is in the normal position, the fader control feeds more or less direct signal to either speaker as desired.

Silicon transistors in all but the output stages make the amplifier temperature-stable. The specified output transistors should be used if at all possible; they are inexpensive and have superior leakage and frequency response characteristics.

Fig. 3. Non-conductive paint is used on component side of printed circuit board to show location of parts.
PARTS LIST

C1, C3—10-µf., 15-volt electrolytic capacitor
C2, C4—5-µf., 15-volt electrolytic capacitor
C5—200-µf., 6-volt electrolytic capacitor
C6—500-µf., 25-volt electrolytic capacitor
C7—100-µf., 15-volt electrolytic capacitor
C8, C9—1000-µf., 25-volt electrolytic capacitor
D1, D2—1N456 silicon diode
D3, D4—IN1692 diode (50 volts P/V, or better)
Q1, Q2, Q4—2N3638 transistor
Q3—2N3706 transistor
Q5, Q6—2N3611 transistor
R1, R3, R7, R10—4700-ohm, 1/2-watt resistor
R2, R6—22,000-ohm, 1/2-watt resistor
R4—1000-ohm printed circuit board type trimmer resistor
R5, R11, R12, R13—1000-ohm, 1/2-watt resistor
R8—25,000-ohm, printed circuit board type trimmer resistor
R9—100-ohm, 1/2-watt resistor
R14, R15—1/2-ohm, 1/2-watt resistor—see text
R16—33,000-ohm, 1/2-watt resistor
R17—220-ohm resistor
R18—20-ohm potentiometer
R19—10-ohm, 1/2-watt resistor
R20—10-ohm, 5-watt resistor
S1—D.p.d.t. switch
T1—Low-voltage rectifier transformer; 117-volt primary, 12-volt secondary with CT (Allied 64 U 733, or equivalent)
1—Reverberation unit; 8 ohms input, 2000 ohms output (Gibbs Type 3G)*
1—Printed circuit board, or other suitable wiring board*
1—5" x 91/4" x 2" aluminum case (Bud AC-403 or equivalent)
Misc.—Terminal strip, 1/2" standoffs, nuts, bolts, wire, solder, etc.*

*The following parts can be purchased from DEMCO, Box 16297, San Antonio, Texas 78216:
reverberation unit, $7; epoxy fiberglass printed circuit board, $2.50; kit, including reverberation unit, printed circuit board and all components for amplifier, except case and external a.c. power supply, $15.00.

Since the power amplifier operates class B, standby or low-level operation causes little power drain. Only at full output is the maximum 0.5 to 1.0 ampere of current required. For use in installations other than in cars, the a.c. supply shown in Fig. 3 can be used to power the (Continued on page 98)

Fig. 4. Bottom view. Reverberation unit (audio delay line) is shock-mounted and hangs from four small springs when the chassis is top side up. Chassis can be mounted under dashboard near the driver.

Fig. 5. For use in the home, a 12-volt power source is needed. If it is not available from existing equipment, you can build this full-wave power supply.

Fig. 6. Foil side of board is shown actual size to help you make your own; however, wiring isn't critical.

February, 1966
ABSENCE of inductive kick across the ignition points in a capacitor discharge (CD) or transistor ignition system prevents many commercially available tachometers from operating properly. Some of these tachs use a vibrator type of chopper and batteries; others use diodes and transistors which are not fast enough to give a true rpm indication. Still others, especially those with inductive input components, tend to load down the ignition system, depriving it of a significant amount of high voltage. Here's a tach that requires very few parts and no batteries, is easy to build, and won't steal any high voltage from your spark plugs.

The entire works including the meter can be put into one package, or as is commonly done, divided into two units—the meter, as one unit, acting as a receiver, and the other components in another unit acting as a sender. The receiver can be mounted on the dash or steering column within view of the driver; the sending unit can be located in any convenient place, including the engine compartment—but keep it away from the hot engine.

**How It Works.** In a negative-ground CD or transistor ignition system, the battery voltage appears across the points as a positive-going rectangular pulse when the points open and close. The pulse is applied across D1 and R1. Zener diode D1, a 1N3017, limits the pulse peak applied across the remainder of the circuit to 7.5 volts. Since this is well below the lowest battery voltage in a 12-volt system, the meter readings will not wander with fluctuating battery voltage.

Capacitor C1 takes on a charge through the meter and resistors R2 and R3 and through D3 when the points are open and the battery voltage is across the points. If the points were to remain open all the time, C1 would charge up at a decreasing rate until it was essentially fully charged. Current through the meter would fall off accordingly. Initially the meter needle would start out very high on the scale and fall off to practically zero, if the needle could respond fast enough. But the engine doesn't stand still and the points keep opening and closing.

When the points close, C1 discharges through D2, the closed points, and R1, and is ready to take on the next surge of current when the points open again. If D2 and D3 respond fast enough, then the average current through the meter will depend more upon the number of...
or TRANSISTOR IGNITION SYSTEMS

pulses in a given time (frequency) than upon the width or shape of the pulse. The faster the circuit responds, the greater its ability to “track” the leading edge of the pulse.

Another benefit of this type of current monitoring is that the dwell time of the ignition points becomes less of an error factor and the meter reading takes on another dimension of accuracy to more perfectly reflect engine rpm. The trick then is to use a pair of diodes that have a high-speed switching action characteristic.

Since we have minimized—if not eliminated—pulse amplitude, pulse width, and pulse shape as meter-response factors, and have “forced” the meter to respond to the leading edge of the pulse, this circuit can be relied upon for extremely accurate readings, and to surpass many commercially available products. As the meter readings are directly proportional to the pulse frequency and since pulse frequency is in direct proportion to engine rpm, the meter can be calibrated to read out rpm.

Resistors R2 and R3 are used to calibrate the meter. Resistor R4 is optional and need not be installed, unless you intend to monitor the waveform across the points with a scope. Not shown is a 0.005-µf. capacitor which can be put across R2 to act as an r.f. bypass to prevent the tach from causing radio interference.

Construction. All parts except the meter are enclosed in a 2¾” x 4” x 2¼” box. Two small L-brackets are attached to the sides of the box to facilitate mounting. Parts layout is not critical, and a larger or smaller box can be used if desired.

The size of the meter does not matter, either, but the meter movement should be 0-1 ma. for a 10,000-rpm full-scale reading, or 0-500 µa. to obtain full-scale deflection at 5000 rpm. You could then use the existing scale and multiply by 1000 to determine rpm. (A reading of...
3.5 ma. would indicate 3500 rpm.) When other commercial rpm meters are used, R3 may have to be jumped, as some of them incorporate 0-2 ma. movements. Regardless of scale markings or meter movements used, you should calibrate the tach before you install it in your car.

Diodes D2 and D3 are fast-acting avalanche types, and are available in matched pairs to within 5% for forward conduction, rise time, and linearity. (See Parts List.) These diodes (Module SD-2) are encapsulated in a compound to keep them both at the same temperature. Maximum variation in the rpm reading due to temperature change is less than 1%. You can substitute other fast acting diodes for this purpose, such as 1N64S, but you are more likely to do better with the SD-2 module. By all means observe po-

**PARTS LIST**

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>12-volt battery</td>
</tr>
<tr>
<td>C1</td>
<td>1-µf., 100-volt capacitor (for 6-volt systems or 2-cycle engines, use 2 µf.)</td>
</tr>
<tr>
<td>D1</td>
<td>1N3017 zener diode (for 6-volt systems, use a 1N64S)</td>
</tr>
<tr>
<td>D2</td>
<td>SYDMUR SD-2 module* (1N645 or equivalent)</td>
</tr>
<tr>
<td>D3</td>
<td>1N91 diode</td>
</tr>
<tr>
<td>D4</td>
<td>0-1 ma. meter for direct calibration to 10,000 rpm (for 5000-rpm maximum reading, use 0-500 ma. meter)</td>
</tr>
<tr>
<td>Q1</td>
<td>2N173 transistor</td>
</tr>
<tr>
<td>R1</td>
<td>100-ohm, 1-watt resistor</td>
</tr>
<tr>
<td>R2</td>
<td>100-ohm carbon, lock-shaft potentiometer</td>
</tr>
<tr>
<td>R3</td>
<td>270-ohm, ½-watt resistor</td>
</tr>
<tr>
<td>R4</td>
<td>100-ohm, ½-watt resistor</td>
</tr>
<tr>
<td>R5</td>
<td>150-ohm, 2-watt resistor</td>
</tr>
<tr>
<td>R6</td>
<td>6800-ohm, 1-watt resistor</td>
</tr>
<tr>
<td>S1, S2</td>
<td>S.p.s.t. switch</td>
</tr>
<tr>
<td>T1</td>
<td>Low-voltage rectifier transformer; 117-volt primary, 24-volt center-tapped secondary</td>
</tr>
<tr>
<td></td>
<td>1—2 ½&quot; x 4&quot; x 2 ¼&quot; box (Premier PMC 1003, or equivalent)</td>
</tr>
<tr>
<td>Misc.</td>
<td>Terminal strips (2), L brackets (2), machine screws and nuts, wire, etc.</td>
</tr>
</tbody>
</table>

*Available from SYDMUR, P.O. Box 25A, Midwood Station, Brooklyn, N.Y., for $3.50.

Parts layout of sending unit is not critical. Fast-acting diodes are encapsulated to keep them both at the same operating temperature for minimum error.

Location and size of holes may vary for different style of terminal strip. It's a good idea to lay out all parts before drilling any holes in the box.
Either a signal generator or a power supply having a 60- and 120-cycle ripple can be used to calibrate the tachometer. The transistor circuit is used to obtain square waves from the sinusoidal waveforms.

SIGNAL GENERATOR

To determine the significance of test signal frequency, consider an 8-cylinder, 4-cycle automobile engine. There are four power strokes, four sparks, and four pulses every revolution. At 900 rpm, there would be 3600 pulses per minute or 60 pulses per second. Therefore, a test signal of 60 cycles is equivalent to 900 rpm. By the same token, a test signal of 120 cycles simulates 1800 rpm.

For maximum meter accuracy, select a check point as close as possible to the engine speeds you are most likely to attain most of the time. Since circuit action is essentially linear, all you need is a single test point. Refer to the calibration and conversion chart to find out what test signals you can use for 4-, 6-, and 8-cylinder, 2- and 4-cycle engines.

Special Considerations. For 2-cycle engines, capacitor C1 should be a 2-µF unit. For 6-volt ignition systems, D1 should be a 1N3824 zener diode (4.3 volts), R1 a 39-ohm, 1-watt resistor, and C1 a 2-µF capacitor. For positive ground systems, simply reverse the leads going to the distributor from the tachometer. Happy motoring.

<table>
<thead>
<tr>
<th>Cylinders</th>
<th>K 2-cycle engine</th>
<th>K 4-cycle engine</th>
<th>fK (4-cycle engine) = rpm</th>
<th>R3 (approx. ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>15</td>
<td>30</td>
<td>1800</td>
<td>47</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>20</td>
<td>1200</td>
<td>150</td>
</tr>
<tr>
<td>8</td>
<td>7.5</td>
<td>15</td>
<td>900</td>
<td>240</td>
</tr>
</tbody>
</table>

February, 1966 57

AmericanRadioHistory.Com
DWELL METER ADAPTER

Use your voltmeter to adjust your ignition points with precision

By DAVID H. BOZARTH

To obtain the hottest possible spark under most operating conditions in a conventional ignition system, the dwell angle of the ignition points should be adjusted in accordance with the manufacturer's specifications in most cases. If the need for a dwell meter does not justify the cost of purchasing one, you can build this voltmeter adapter to enable your meter to read out dwell angle. By using parts from the surplus market, you should be able to hold the total cost below $2.00.

Construction is straightforward and—except for observing polarity—assembly, wiring, and parts layout are not critical. The adapter can be made to plug directly into a voltmeter as shown, or be connected to the voltmeter with a pair of leads. The meter "averages" the pulses and gives a voltage reading which is essentially proportional to the percent of time the points are closed. This percentage may be related to degrees by use of the dwell angle conversion chart on page 92.

To calibrate the adapter, attach lead B to the negative side of the battery and adjust R2 to obtain a full-scale reading on the meter. Use the 5-volt d.c. scale if your meter has one, otherwise the nearest one to it but below the 6.8-volt limit imposed by the zener diode. A full-scale reading would then be an indication of essentially 100% dwell time (points always closed).

To use the adapter, remove lead B from the battery and attach it to the terminal on the distributor going to the primary winding of the ignition coil. (It may be easier to attach the lead to the coil.) On an 8-cylinder engine, for example, if you obtain a 3-volt reading on a 5-volt scale, simply multiply 3 volts by 9 (9° per volt) and you'll arrive at a dwell-angle indication of 27°.

(Continued on page 92)

![Diagram of dwell meter adapter](image)

All parts, including banana plugs, are mounted on a piece of fiberboard shaped to conform to the meter.

Only two leads are needed to complete hookup to the positive side of battery and ignition points.
ELECTROMAZE PUZZLE

By ROBERT C. RADFORD

Here's a new kind of crossward puzzle designed to test your knowledge of electronic terminology. Refer to the clues given and fill in the word called for by the first clue. Start at the arrow. Thereafter, fill in each new word called for by the following clues perpendicular to each preceding word. The last letter in each preceding word will be common to the first or last letter of each new word, and all words will read vertically downward or from left to right. The tenth word will have a letter in common with the word at the first exit. Nine more correct entries will take you to the word at the second exit, which will also share a letter with the last of these nine words. In each case, the first or last letter of the exit word will be the first or last letter of the next word. An additional nine correct entries will put you at the final exit for a perfect score. The Editors invite your comments on this type of puzzle.

Solution appears on page 103

CLUES:
1 A component that introduces inductance in an a.c. circuit.
2 Single unit of a device that converts chemical energy into electrical energy.
3 A luminous glow formed by the difference of potential between two electrodes.
4 Conductors used for transmitting and receiving r.f. energy.
5 Antennas specifically arranged or grouped together so as to produce a desired directivity pattern.
6 High-gain VHF antenna array whose directors are made progressively shorter toward the front of the array.
7 The video information reproduced by a television receiver.
8 Conductor used to establish electrical contact with a non-metallic part of a circuit.
9 Lines produced by a TV receiver flyback pulse.
10 Slang term for ham radio equipment.

Exit 1. The adjustable iron core of a coil.

11 A circuit operating as a switch. The presence or absence of a control voltage can apply or eliminate a signal.
12 Abbreviation for the force that causes current to flow in a circuit.
13 Narrow metallic strips used to produce clutter on enemy radar screen to obscure targets.
14 The paper diaphragm of a loudspeaker.
15 Waveform of a modulated carrier.
16 Two-element electron tube.
17 The unit used to express power ratio.
18 Faith of a completed circuit, especially in servo systems.
19 Maximum amplitude of a sine wave.

Exit 2. A hand-operated switch used in radio telegraphy.

20 System of interconnected electrical circuits.
21 Flow of electrons in a vacuum tube.
22 A three-element electron tube.
23 Group of three phosphor dots on a color television picture tube.
24 Slang word for a parabolic reflector.
25 In solid-state technology, empty space in the valence band of an impurity atom.
26 Preparation of a computer routine in machine language.
27 To remove gases from an electron tube envelope.
28 A secondary emission electrode in a multiplier-type photo-tube.
How To Have Fun While You

23-Channel 5-Watt All-Transistor CB Transceiver

Kit GW-14  $89.95
Assembled GWW-14  $124.95

23 crystal-controlled transmit & receive channels for the utmost reliability. Low battery drain...only .75 A transmit, .12 A receive. Only 2¾" H x 7" W x 10½" D...ideal for car, boat, any 12 v. neg. gnd. use. "S" meter, adjustable squelch, ANL, built-in speaker, PTT mike, aluminum cabinet. 8 lbs. Optional AC power supply, Kit GWA-141, 5 lbs. $14.95.Special 23-Channel Crystal Pack (46 crystals), GWA-142...reg. $137.70...only $79.95. CB crystals only $1.99 each with any Heathkit CB transceiver order!

Powerful 1-Watt Walkie-Talkie!

Kit GW-52A  $69.95
(pair $129.95)

Up to 3 mile inter-unit communications. 10-transistor, 2-diode circuit. Crystal-controlled transmit & receive. Includes $20 rechargeable battery & built-in 117 v. AC battery charger. Adjustable squelch, automatic noise limiter, rustproof metal case, earphone, strap, and crystals (specify channel). 4 lbs.

Deluxe 9-Transistor Walkie-Talkie

Kit GW-21A  $39.95
(pair $74.95)

1 mile range between units. 100 milliwatt input power crystal-controlled transmitter, superhet receiver. Built-in squelch & automatic noise limiter. Includes sturdy aluminum case, earphone, strap, crystals (specify channel). Fast, simple circuit board assembly. 3 lbs. GWA-30 Battery Set (2) $2.95

Fully Automatic Electronic CW Keyer

Kit HD-10  $39.95

All-transistor circuitry. 15-60 words per minute. Solid-state switching—no relays to stick or clatter. Convertible to semi-automatic operation. Built-in paddle. Self-completing dashes. Variable dot-space ratio. Built-in sidetone. Keys neg. voltages only, such as grid-block keying. Transformer-operated power supply. Fused. 6 lbs.

New Amateur Radio Hybrid Phone Patch!

Kit HD-15  $24.95

Features individual gain controls for receiver-to-line & line-to-transmitter audio level; VU meter; 1-switch operation. Minimum of 30 db isolation between transmitter and receiver circuits permit VOX & PTT operation. 4 lbs.

New Relative Power Meter

Kit HM-15  $14.95

Indicates forward or reflected power and SWR. Band coverage 160 through 6 meters. Handles peak power of well over 1 kilowatt. Matches 50 or 75 ohm lines. Essential for tuning and monitoring transmitter/antenna systems. 3 lbs.
Save... Build A Heathkit®!

Deluxe All-Transistor, 10-Band Shortwave Portable!

10 bands tune longwave, standard AM, FM and 2-22.5 mc shortwave. 16 transistors, 6 diodes, and 44 factory-built & aligned RF circuits. Separate FM tuner & IF strip same as used in deluxe Heathkit FM tuners. Two built-in antennas, 4" x 6" speaker, battery-saver switch. Operates anywhere on 7 flashlight batteries, or on 117 v. AC with optional charger/converter GRA-43-1 @ $6.95. Assembles in 10 hours. 17 lbs.

New Deluxe Shortwave Radio!

Compare it to sets costing $150 and more! 5 bands cover 200-400 kc, AM, and 2-30 mc. Tuned RF stage, crystal filter for greater selectivity, 2 detectors for AM and SSB, tuning meter, bandspread tuning, code practice monitor, automatic noise limiter, automatic volume control, antenna trimmer, built-in 4" x 6" speaker, headphone jack, gray metal cab., free SWL antenna. 25 lbs.

Low Cost Shortwave Radio!

Covers 550 kc to 30 mc—includes AM plus 3 shortwave bands. 5" speaker; bandspread tuning; signal strength indicator; 7" slide-rule dial; BFO; 4-tube circuit plus 2 rectifiers; noise limiter; external antenna connectors; Q-multiplier input; gray aluminum cabinet; AM antenna. 15 lbs.

New "Q" Multiplier!

Use with matching GR-64 (opposite) or similar SWL receivers with IF circuits from 450-460 kc. Creates extra-sharp selectivity through an efficient "Q" of 4000 and provides a notch for adjacent signal attenuation. Includes built-in power supply. Charcoal cabinet gray, front panel. 3 lbs.

FREE 1966 Catalog!

Describes these and over 250 easy-to-build Heathkits... save up to 50%. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022 for your FREE copy.

February, 1966
ULTRASONIC PROBE HELPS SAVE EYESIGHT—Doctors practice locating and removing foreign objects from the eye of an anesthetized rabbit using an ultrasonic probe. The probe, called the “Ekoline 20,” and manufactured by Smith Kline Instrument Co., Philadelphia, Pa., emits ultrasonic pulses and picks up the echoes that come back from objects in their path, just like radar. The time difference between pulse and echo, shown as peaks on the scope, indicates the distance between the tip of the probe and the foreign matter. Once pulse and echo coincide, doctors close minuscule forceps attached to the probe tip to remove the foreign object. The device has already saved the eyesight of an 11-year-old boy who all but destroyed an eye when he banged on a cartridge with a hammer; part of the cartridge entered his eye, but it took surgeons a scant 39 seconds to remove it using this instrument. The probe is also finding use in other fields of medicine, and military surgeons in particular are excited over the many possibilities it offers.

MR. COMPUTER, PLAY ME A SIMPLE MELODY—You’ve heard of synthetic fibers, synthetic gems...now get ready for synthetic music. At Bell Telephone Labs, Jean Claude Risset, a 27-year-old French physicist and composer, achieved a trumpet effect by using a special computer program. He recorded trumpet tones on magnetic tape. Each recorded tone was then converted into digital form and the digitalized version fed into an IBM computer. The computer analyzed each tone for its frequency spectrum to show relative amplitudes of the frequency components comprising the tone. The spectra were displayed by the computer in graphic form, and from these displays the computer produced similar spectra. It generated numbers which were converted into electrical signals. These signals were fed to a loudspeaker, resulting in reconstructed tones. In listening to the computer-generated tones, 20 people, including several professional musicians, were unable to tell the difference between the computer trumpet and the real one. So far, only single tones have been synthesized. However, Risset believes that it should be possible to synthesize entire orchestral passages. But the computer’s real value is in producing novel timbre.

Another unique use of a computer is demonstrated by the Bunker-Ramo “Talking Computer” operating at the American Stock Exchange in New York City. Stock exchange members dial a code number for any stock listed on the exchange, and a clear “voice-response” instantly gives the current price, volume, and trend relating to the stock. Well, its not really a voice, rather a response based upon bits and pieces of information stored in the complex memory of a computer. Invented by Emik A. Avakian and Robert J. Buegler of Bunker-Ramo, this patented voice-response system has been in operation for more than a year. An unusual feature of the system is its ability to accept virtually simultaneously different questions from any number of “query” stations and to simultaneously assemble and send back the respective answers. Thus, no station gets a busy signal or has to wait its turn for access to the computer. This is made possible by a time-multiplexing technique which consecutively connects subscribers to the computer at a fast rate.
DEEP-SPACE PROBER PUT IN OPERATION—The world’s most precise radio telescope, a 140'-diameter fully steerable dish for collecting and recording radio signals from outer space, was recently dedicated at the National Radio Astronomy Observatory, Green Bank, West Virginia. This newly completed telescope—with a parabolic collecting surface of more than one-third acre—can be aimed at the tiny, faint radio noises more accurately than any other instrument thus far available. The dish has a 60' focal length and a surface composed of 60 aluminum panels. Because the telescope moves on two axes, it can be pointed to any region of the sky, and can track a celestial object as it moves across the sky. In normal operation, rotation can be made at speeds up to 150° per minute. This telescope has already proved to be a valuable research tool—astronomers using it for the first time detected and measured a radio emission line from excited hydrogen gas in the Omega nebula, a Milky Way nebulousness, at a frequency of 5009 mc. Since then, the line has been measured in more than 10 other nebulosities. The original observation confirmed earlier predictions of a Soviet astronomer that excited hydrogen gas should emit bright lines in the radio range. It also confirms the announcement last year of the detection of two similar lines by Soviet radio astronomy groups. The new radio telescope is to be used to make detailed measurements of hydrogen radiation from the Milky Way galaxy; to determine the intensity of radio sources at various points in the spectrum; to measure radiation from the moon and planets; and to determine the position and brightness distribution of radio sources when their radiation is cut off as the moon passes in front of them.

TRANSISTORIZED MOLAR—What you’re looking at is a tooth. Not a normal tooth—rather what is probably the most unique molar in the world. Scientists have crammed into it six tiny transmitters, 30 components in all. Developed by Ian S. Scott and Dr. Major M. Ash of the University of Michigan School of Dentistry, the tooth measures directions and pressure of forces impinging on its surface and transmits this data to nearby monitors. The electronic tooth should provide dentists with better guides to restoring teeth that have been damaged or decayed.

“ELECTRONIC SURVEYORS” TRACE OLD-TIMERS’ STEPS—One hundred and eight years ago, a party of four men under the leadership of Henry Washington, veteran surveyor (believed to be a nephew of George Washington), surveyed the area of Death Valley, California. The party dragged a 66' chain across the desert floor, laboriously tensioning it, marking, and moving on. Every one-half mile they were required to drive a four-foot stake into the ground. It wasn’t an easy job; in fact, in the time they took to measure 1000 feet, modern-day surveyors can measure 40 miles, and with much greater accuracy. A team from the U.S. Bureau of Land Management recently traced the oldtimers’ steps using an electronic distance measurer (called the Tellurometer “Micro-Distancer”), which measures distance by transmitting microwave pulses, the travel times of which are converted into miles, feet, and inches. Millions of square miles of the country are still unmapped to precision standards. The Bureau of Land Management, for example, has 16 million acres of unsurveyed land in California alone under its jurisdiction; it is engaged in an ambitious program of running new surveys through 10 million acres of this vast domain within the next three years. Electronics marches on.
$1 EXPERIMENTER’S THERMISTOR

Here’s a $1 thermistor that can be used in an electric thermometer, a liquid level controller or alarm, a time delay relay, and many other devices. The EMC4 thermistor, which is made by Fenwal Electronics, consists of a 2”-long glass tube containing a temperature-sensitive bead at the very tip of the tube. Thus, the temperature of a liquid can be monitored with great accuracy by simply immersing the tip into the liquid.

At room temperature (75°F), the thermistor's resistance is about 135,000 ohms; but for every one-degree (F) change in temperature, its resistance decreases by about 2.5%. When immersed in a liquid, the thermistor responds to temperature change in a fraction of a second. In air, it takes approximately 30 seconds.

For some applications, great care is required to limit the amount of current going to the thermistor. For other applications, current is used to deliberately heat up the thermistor for special effects. Before you set out to design a circuit, you must decide beforehand which technique best suits your application.

The bead temperature of this thermistor rises two degrees above ambient temperature for every milliwatt of power dissipated. Thus, for accurate temperature measurements, the thermistor current must be kept low enough to limit power dissipation to well below one milliwatt, unless the self-heating effect is desired.

Fig. 1. Basic circuit of electric thermometer using EMC4 thermistor. Operating range is 0° to 115° F.

Fig. 2. Circuit of liquid level indicator can be line or battery operated. Actual supply voltage is determined essentially by relay used.
Fig. 3. This time-delay circuit can be adjusted to provide a delay of 0.5 to 15 seconds from turn-on.

Figure 1 shows an electric thermometer consisting of a couple of mercury cells, a d.c. microammeter, a thermistor, and a push-button switch (optional). At room temperature, the circuit current is about 20 microamperes, and the self-heating power is approximately 50 microwatts. This low power raises the bead temperature by only 1/20 of a degree. The circuit has a range of 0° to 115° F, and can be calibrated against a good thermometer. One big advantage of the electric thermometer is that the sensor and monitoring meter can be separated by hundreds of feet, using ordinary copper wire between them, with no loss either in sensitivity or accuracy. This is not true of thermocouple-type temperature meters.

Another application, using the self-heating effect of the thermistor, is shown in the liquid level indicator circuit of Fig. 2. Operation is based on the relatively good conductivity of liquids (especially water) as opposed to air, which is a poor conductor. Thus, when we self-heat a thermistor which has been immersed in a liquid, most of the excess heat is rapidly carried away by the liquid, and the thermistor stabilizes at essentially ambient temperature. Under these conditions, the thermistor has a low resistance in air (because it is hot) and a high resistance in liquids (because it runs cooler).

A sensitive relay and a thermistor are connected across either a battery supply or the line-operated power supply shown in Fig. 2. The component values have been chosen to give a 10-ma. current in air, and less than 3 ma. in liquid. Both of these currents are easily sensed by the relay used. If it is desired to use a different relay, the supply voltage must be appropriately regulated.

What can you do with a liquid level control? Lots of things. For example, with the relay contacts connected to a buzzer or solenoid valve, you can use this device as an automatic level control for bird baths, fountains, or swimming pools, or simply as an alarm to tell you when the bathtub is full. Two or more of these indicators can be used at different heights in a tank to serve as a high-low indicator, or as a depth gauge.

As a final example to show the almost limitless applications of the thermistor, consider the time delay relay circuit of Fig. 3. It provides a delay of from 0.5 to 15 seconds from the time it is turned on, depending on the setting of the potentiometer which varies the current through the thermistor. The more current, the faster the thermistor heats up, and the sooner the resistance drops low enough to cause the relay to pick up. Depending on the choice of relay contacts, the relay can "make" contact only after the time lapse, or only during the delay time. This circuit can be used for displays, as a phototimer, motor starter, or for an automatic light control to give you 15 seconds to get down the hallway before the light goes out.

You can get data sheets and application notes direct from the manufacturer, Fenwal Electronics, 63 Fountain St., Framingham, Mass., upon purchase of the thermistor which retails for $1. The EMC4 Thermistor Manual and a list of local distributors are available, free, from the manufacturer.

INFRARED PHOTOCELLS RESPOND TO HEAT

Smart crooks can spot ordinary burglar alarms using conventional photoelectric controllers a mile away. But you can trap these experts with Infrared Industries' infrared photocells that operate in total darkness. Or you can use these photocells to make heat-sensing flame detectors for fire alarms or safety monitors. Because infrared photocells respond to heat instead of
light, they can be used in numerous “secret” applications.

An infrared photocell consists of a small chunk of lead sulfide (galena) mounted at the focus of a mirrored parabola the size of a large flashlight reflector. In the absence of high infrared radiation, it has a resistance of about 1 megohm. In the presence of a light source, such as a match, photoflood lamp, or flashlight, the photocell resistance drops to as low as 200,000 ohms. This 5-to-1 change ratio is quite sufficient to activate a two-transistor relay circuit such as the one described in Lou Garner’s “Super-Sens” in the November, 1965 issue of Popular Electronics.

The light source can be masked with an infrared filter (supplied with the photocell) that passes only infrared light, giving an invisible beam of heat energy that behaves the same as visible light. If you were to look directly at the light source, you would see only a dark red glow. By properly positioning the light source, even this glow could become unnoticeable. If you put the filter over the photocell instead of over the light source, the photocell would ignore all background illumination and respond only to the infrared energy.

If the photocell is positioned so that it can “look” straight at the beam, its resistance will drop. But if the beam is interrupted, say, by an intruder, its resistance immediately goes up again. This change in resistance can be used to operate a relay. Depending on whether the controlled device is to be turned on or off, it is then only necessary to choose the proper relay contacts for the desired control.

The parabolic shape of the photocell housing makes it highly directional. If this directivity feature is not desired, the experimenter can choose other photocell units that are not equipped with the parabola and filter, at a saving in cost. Mirrors or smooth metal plates can be used to reflect the beam around corners.

There’s practically no end to the number of applications to which the infrared photocells lend themselves. Just remember that they behave essentially the same as the more familiar cadmium sulfide photocells, in that their resistance goes down as the incident energy goes up. Remember also that the infrared photocell has a bilateral characteristic, and can be powered by a low-voltage a.c. source, or by a d.c. source. And finally, remember that cadmium sulfide cells are most responsive to orange light while lead sulfide cells (infrared photocells) are most responsive to long-wave heat radiation.

Manufactured by the Photoconductor Division of Infrared Industries, Inc., 63

Fourth Avenue, Waltham, Mass., the B3 SA19 MF photocells with filters are available from Allied Radio (#7 Z 628, in their industrial catalog) and other parts distributors for $5.75 each.

455-KC. I.F. AMPLIFIER MODULE

A fully assembled and prealigned 455-kc. integrated i.f. amplifier module containing a ceramic filter, two transformers, two transistors, one diode, and associated resistors and capacitors, has been put out by the J. W. Miller Company. The strip is said to provide a gain of 55 db, an 8-kc. bandwidth at 6 db, and operate on 2 milliamperes from a 6-volt d.c. source.

Measuring a scant \(\frac{1}{2}''\) x \(\frac{1}{2}''\) x \(1\frac{1}{2}''\), the module is ideal for such applications as the i.f. amplifier in a subminiature superhet AM receiver, in the second conversion stage of CB equipment, and as a high-gain i.f. amplifier for radio control gear. The module can also be used as a lock-in amplifier, and as a precision measuring device in carrier control equipment as well as in other industrial instrumentation apparatus.

For ordinary AM radio applications, the experimenter need only design up to the mixer output, and then pick off the audio signal at the receiver volume control. The module has its own a.g.c. circuit and provisions for a tuning meter. A choice of input transformer taps optimizes operation for straight amplification or conversion.

The case readily comes apart for special requirements, but numerous taps are brought out to allow the engineer or experimenter to conduct a variety of tests or experiments.

The 455-kc. i.f. module (Miller 8903) is available from parts distributors including Lafayette Radio (34 R 8603) and Allied Radio (60 U 099) for $5.75. Data sheet and schematic are supplied with each unit. —30—

68

POPULAR ELECTRONICS
THERE'S ONE IN EVERY CROWD

By BUZ HOLLAND
WA4YKK

"I'm studying this manual on transistors."

"And then she threw all my QSL cards into the fire."

"Move, Cathy. I'm taking a picture for my QSL card."

"Must be on the YL net again... he never talks to me like that."

February, 1966
YOU CAN'T BUY a Wurlitzer organ like the one at Radio City for ten bucks, but you can build the Mini-Organ for less than that. Your youngsters will be delighted—and you'll be, too—at the ease with which such well-known tunes as "Red River Valley," "Blue Bells of Scotland," "Home, Sweet Home," and many others can be played on an instrument you can put together in a couple of hours.

How It Works. The Mini-Organ is a two-transistor, battery-operated multivibrator whose frequency (pitch) is determined by the RC time constant of C1-R1 (Fig. 1). The lowest frequency of oscillation—and hence the lowest tone—is determined primarily by the value of capacitor C1 and series capacitors C2 through C8, while the highest frequency of oscillation (highest pitch) is determined essentially by the setting of potentiometer R1 in series with resistor R2.

When capacitors C2 through C8 are alternately switched in series with C1, a change is produced in the multivibrator frequency which in turn produces a one-octave musical scale. Depending on the characteristics of transistor Q2, capacitor C9 may be required to aid the multivibrator action. Diode D1 provides the feedback path to sustain oscillation.

Switches S1 through S8 are the push-button operating keys that apply the right amount of capacitance in series with C1 to produce the desired tones when pressed. Transistor Q1 is an npn, high-current, high-frequency switching type, while Q2 is a pnp audio frequency type which provides sufficient volume for comfortable listening in a small room. If greater volume is desired, the builder can add as many stages of amplification as may be necessary.

Operating power is supplied by four ordinary flashlight cells in series.

Construction. The Mini-Organ can be laid out and breadboarded on wood or on
a perforated phenolic board as shown in Fig. 2. Breadboard dimensions are best determined by the builder. The push-button keys are spaced ¾" apart at the bottom of the panel, and the opening for the speaker is spaced midway between the holes for the keys and the top edge of the panel.

Main power switch S9 can be combined with the potentiometer, or may be a separate slide or toggle switch as desired. The transistors, the 1-megohm resistor, and the capacitors are mounted on terminal strips.

The entire unit can then be housed in a plastic or wooden case as desired. The keys can either be color-coded or numbered for easy recognition.

**Operation.** Try out the organ by adjusting the potentiometer at different settings as the keys are depressed. If you want a lower tone, increase the value of \( R2 \) in 500,000-ohm increments. To change the tone range slightly, change the value of \( C1 \) in small increments. Using less capacity will give you a higher tonal range.

From here on, you are on your own. Practice with simple tunes within the instrument’s range until you can master your favorites. And have fun.

---

**PARTS LIST**

- **B1**—1½-volt cells (4 required)
- **C1**—0.005-µf. ceramic disc capacitor
- **C2−C8**—0.02-µf. ceramic disc capacitor
- **C9**—0.001-µf. ceramic disc capacitor (optional—see text)
- **D1**—1N54 diode
- **Q1**—2N388 transistor
- **Q2**—2N408 transistor
- **R1**—1-megohm potentiometer with switch
- **R2**—1-megohm, ½-watt resistor
- **S1−S8**—Momentary-contact push-button switch
- **S9**—S.p.s.t. switch
- **SPKR**—8-ohm speaker
- **1−5½" x 7" x 2½" plastic or wooden case
- **Misc.**—5-lug terminal strips (3), small knob, hardware, wire, solder, etc.

---

Fig. 1. Mini-Organ operates on single 6-volt transistor radio battery or four ordinary flashlight cells. If transistors different from those specified are employed, or if oscillation is unstable as indicated by a wavering note, insert C9.

---

Fig. 2. This photograph shows the rear panel of the author’s prototype organ which was later rewired to improve lead dress. Parts are mounted on terminal strips, and the battery is strapped down in the case.

February, 1966
Electronic technicians, hobbyists, and experimenters must learn the meaning of a large number of abbreviations that constantly appear in technical journals and periodicals. For example, VTVM is quickly recognized as vacuum-tube voltmeter. See how many of the commonly used four-letter abbreviations listed here (1-10) you can match with the sketches below (A-J) most closely identified with the meaning of the terms.

1. AFSK
2. DAVC
3. FETS
4. MOPA
5. NTSC
6. PMMC
7. RIAA
8. TPTG
9. UJTO
10. VSWR

(A answers appear on page 108)
After ripping through Florida last September, hurricane "Betsy" turned her destructive power toward the state of Louisiana. Members of the A.L.E.R.T. CB Club (Allied Louisiana Emergency Radio Team), Baton Rouge, immediately went into standby procedure. ALERT stations tracked the hurricane and were kept informed on current weather bulletins. Although organized only five months earlier, the ALERT group was prepared for the emergency, having held a practice exercise only the week before.

On the afternoon of September 9, it was announced that the hurricane would move inland at approximately midnight, packing winds up to 130 mph. ALERT members donned old clothes and prepared for the long night, taking their assigned positions throughout the city.

Five base stations were established in different parts of the city. Mobile units were to report to the base station in their area on a specific frequency. ALERT control was set up in the center of the city, operating on channel 23. After the mobile units reported in to their area base station, the base would then switch to channel 23 to relay information to the control center. The 50 mobile and other volunteer units participating were placed at key positions, including the weather bureau, power company, Civil Defense and Red Cross headquarters, and at all school shelters. Additional mobiles patrolled the streets.

When "Betsy" finally hit full force, the power went out and the streets soon became cluttered with fallen trees, power lines, and debris. Shortly thereafter, portions of Baton Rouge became flooded. All outlying base stations reverted to auxiliary power to keep the CB net alive.

For over seven hours, the ALERT group was the only communication facility between the weather bureau and area radio stations geared to keep the public informed. The units at the power company continued to forward reports of dangerous fallen power lines and poles, while CB'ers at Civil Defense and Red Cross stations coordinated a three-way emergency task force. The units at the school shelters kept a vigil on the needs of refugees, and the mobile units continued to patrol the streets, although they were literally stranded due to the blinding wind, rain, and rising waters.

By daybreak of the 10th, the worst was...
over. Rain and minor wind gusts persisted while ALERT base and control stations remained on auxiliary power. By noon, all refugees had left the shelters. Police and power crews had begun their clean-up. Weary CB ALERT personnel, after a job well done, headed home for a much-needed snooze. All members agreed with Curtis B. Lauret, Jr., KMR4417, that "while the club was less than a half-year old, its purpose had matured quite suddenly and successfully."

**Blood Donors via CB.** The following emergency assist was written up in the *Huachuca Herald*, Sierra Vista, Arizona. Mr. V.E. Patrick, KFA1006, of that city, heard a plea on his Olson "Sidebander" mobile rig for blood needed by a woman who had just been operated on in a hospital in Agua Prieta, Mexico. Two donors were on their way to the hospital, but more were required.

Unable to reach the calling station, Mr. Patrick contacted other CB units in the area whose location put them in a better position to get through. Mr. Patrick then stood by to handle the control and any telephone calls that might be necessary.

In short order, the local CB club, the Cochise County S-Watters REACT Team, obtained three additional donors through use of their CB gear, and assembled them at the Sierra Vista Police Department. The donors were then transported to Bisbee, Arizona, in a patrol car, where they were transferred to another patrol car and rushed to the city of Douglas. Arrangements had been made via radio to permit the donors to pass through all cities involved without loss of vital time, and clearance had been arranged at the border to permit the final vehicle to enter Mexico and proceed to the hospital.

Just 45 minutes after the appeal that Mr. Patrick heard, the donors were at the patient's side ready to give blood. Three additional standby donors were available during the night in the event a further need arose. The patient's husband was most grateful to the blood donors and all the CB'ers who participated and assisted in the "blood run."

**Compact Shack.** Meet Harry C. "Red" Pepper, KHG1742, of Cambridge, Ohio. Harry depends on CB radio to transact business on an everyday basis. He operates a distribution point for the Standard Oil Company. His base dispatching center keeps him in constant contact with his delivery trucks, providing fast delivery to all points within Guernsey County.

Harry has used the Citizens Radio Service for five years, and he maintains that it gives him better control and eliminates a considerable amount of reruns and backloading. He also has SWL gear in his shack for listening to world news and weather reports, plus monitoring and testing gear.

**Report from New Zealand.** Our volunteer reporter/friend Dallas A. McKenzie, of the New Zealand Radio DX League, who first informed us of the issuance of a Citizens Band to New Zealanders back in 1963, has just reported the organization of the first CB club in Wellington, N.Z. The club members consist of 1-watt walkie-talkie users who, on occasion, make 20-mile contacts. The club intends to offer its services to Civil Defense authorities—the portable units presently available for CD use are old World War II units like Z.C. 1's, mainly due to import restrictions on equipment.

At the club's first meeting, it was decided to ask the New Zealand Government Post Office (governing body over the service) for a special frequency of 26.575 for club use. A manufacturer has agreed to change club members' transceivers to the frequency without charge. Present officers are A. Scott, president; L. Coutts, treasurer; Mrs. J. Scott, secretary; and T. Grooby, (Continued on page 99)
MONITOR CERTIFICATE APPLICATIONS AND DX AWARDS

MOST OF YOU are aware of the fact that your Short-Wave Editor is in charge of processing the various DX Awards, but you may not know that yours truly also takes care of the Monitor Certificate applications. Some difficulties have arisen regarding both programs, and your cooperation is urgently needed.

So far as the Monitor Registrations are concerned, each application is entitled to a speedy processing. As much as we would like to adhere to this premise, it hasn't always been possible. Every application has to be checked to make sure that the applicant is qualified—and that he hasn't already received his WPE identification. Some applicants are so anxious to get their certificates that they will apply two, three, or even five times within a single month. Extensive cross-referencing on our part has been necessary to avoid the very real possibility of any one person receiving several WPE identifications.

Many applicants have to be contacted for additional information. Some are asked to produce proof that they are qualified. We make it a practice to contact those who list unreasonably large numbers of QSL cards on their applications. For example, one fellow recently listed several hundred thousand QSL's. We asked him to produce at least five for our inspection, and he was unable to produce any whatever.

Others will send in batches of QSL cards that are nothing more than samples of cards, obtainable from many card printers. These applicants are turned down, as are those who are obviously just certificate-seekers who have little or no interest in the hobby.

We send out hundreds of certificates each month. To insure your receiving yours as quickly as possible, we ask that you (1) send in only one application; it will be taken care of just as soon as possible; and (2) do not apply if you are not qualified or if you are not sincerely interested in the SWL'ing hobby.

Processing the DX Awards applications is also time-consuming. In spite of the fact that the rules and regulations specifically state that the listing of states, countries, or provinces must be in alphabetical order, many applications contain listings which are haphazardly arranged. In each such case, the listing has to be closely checked to be sure that there are no duplications. Often there are, and additional correspondence is required before the award can be made.

Many SWL's who have already obtained, say, a 25 Countries Award, will at a later (Continued on page 109)

With a Lafayette KT-340 receiver, Steve Kennedy has 20 countries verified out of 25 heard, and 31 states verified out of 36 heard. Otherwise known as WPE4IAX, Steve lives in Sarasota, Fla.
## ENGLISH-LANGUAGE BROADCASTS TO NORTH AMERICA

### TO EASTERN AND CENTRAL NORTH AMERICA

<table>
<thead>
<tr>
<th>EST</th>
<th>GMT</th>
<th>STATION LOCATION</th>
<th>FREQUENCIES (MC.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:15 a.m.</td>
<td>1215</td>
<td>Helsinki, Finland (Tues. &amp; Sat.)</td>
<td>15.185</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9.53 or 11.84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Melborne, Australia</td>
<td>5.97, 15.32</td>
</tr>
<tr>
<td>7:30 a.m.</td>
<td>1230</td>
<td>Montreal, Canada</td>
<td>15.165</td>
</tr>
<tr>
<td>8 a.m.</td>
<td>1360</td>
<td>Copenhagen, Denmark</td>
<td>15.195</td>
</tr>
<tr>
<td>9 a.m.</td>
<td>1400</td>
<td>Stockholm, Sweden</td>
<td>15.175, 17.825</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oslo, Norway (Sun.)</td>
<td>15.115, 17.89</td>
</tr>
<tr>
<td>6 p.m.</td>
<td>2300</td>
<td>London, England</td>
<td>6.195, 7.13, 9.51</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moscow, U.S.S.R.</td>
<td>7.15, 7.205, 7.31</td>
</tr>
<tr>
<td>7 p.m.</td>
<td>0000</td>
<td>London, England</td>
<td>6.195, 7.13, 9.51</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moscow, U.S.S.R.</td>
<td>7.15, 7.205, 7.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sofia, Bulgaria</td>
<td>6.188, 9.61</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tirana, Albania</td>
<td>6.07</td>
</tr>
<tr>
<td>7:30 p.m.</td>
<td>0030</td>
<td>Tokyo, Japan</td>
<td>7.265</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bonaire, Netherlands Antilles</td>
<td>11.78, 15.135</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Budapest, Hungary</td>
<td>9.605 or 11.82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kiev, U.S.S.R. (Mon. &amp; Thurs.)</td>
<td>7.105, 9.833</td>
</tr>
<tr>
<td>7:50 p.m.</td>
<td>0050</td>
<td>Vatican City, Vatican</td>
<td>7.12, 7.31</td>
</tr>
<tr>
<td>8 p.m.</td>
<td>0100</td>
<td>Accra, Ghana</td>
<td>5.98, 7.25, 9.645</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Berlin, Germany</td>
<td>9.76</td>
</tr>
<tr>
<td></td>
<td></td>
<td>London, England</td>
<td>5.97, 6.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Madrid, Spain</td>
<td>6.195, 7.13, 9.51</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moscow, U.S.S.R.</td>
<td>6.13, 9.615</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peking, China</td>
<td>7.15, 7.205, 7.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prague, Czechoslovakia</td>
<td>11.86, 11.945, 15.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rome, Italy</td>
<td>5.93, 7.115, 7.345</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Venice, Italy</td>
<td>5.96, 9.63</td>
</tr>
<tr>
<td>8:15 p.m.</td>
<td>0115</td>
<td>Berne, Switzerland</td>
<td>6.08, 6.12, 9.355</td>
</tr>
<tr>
<td>8:30 p.m.</td>
<td>0130</td>
<td>Beirut, Lebanon</td>
<td>9.575</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bucharest, Romania</td>
<td>5.98, 9.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cologne, Germany</td>
<td>6.075, 9.64</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hilversum, Netherlands</td>
<td>6.085 or 9.59 (via Bonaire)</td>
</tr>
<tr>
<td>8:45 p.m.</td>
<td>0145</td>
<td>Stockholm, Sweden</td>
<td>5.99</td>
</tr>
<tr>
<td>9 p.m.</td>
<td>0200</td>
<td>Copenhagen, Denmark</td>
<td>6.025, 6.185</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lisbon, Portugal</td>
<td>6.195, 7.13, 9.51</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Madrid, Spain</td>
<td>7.15, 7.205, 7.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moscow, U.S.S.R.</td>
<td>11.86, 11.945, 15.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peking, China</td>
<td>9.745, 11.915</td>
</tr>
</tbody>
</table>

### TO EASTERN AND CENTRAL NORTH AMERICA (CONT.)

<table>
<thead>
<tr>
<th>EST</th>
<th>GMT</th>
<th>STATION LOCATION</th>
<th>FREQUENCIES (MC.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 p.m.</td>
<td>0300</td>
<td>Bucharest, Romania</td>
<td>5.98, 9.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buenos Aires, Argentina (Mon.-Fri.)</td>
<td>9.69</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Havana, Cuba</td>
<td>6.135</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moscow, U.S.S.R.</td>
<td>7.15, 7.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quito, Ecuador</td>
<td>9.745, 11.915</td>
</tr>
<tr>
<td>10:30 p.m.</td>
<td>0330</td>
<td>Accra, Ghana</td>
<td>6.11</td>
</tr>
<tr>
<td>11 p.m.</td>
<td>0400</td>
<td>Havana, Cuba</td>
<td>6.135</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moscow, U.S.S.R.</td>
<td>7.15, 7.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quito, Ecuador</td>
<td>9.745, 11.915</td>
</tr>
</tbody>
</table>

### TO WESTERN NORTH AMERICA

<table>
<thead>
<tr>
<th>PST</th>
<th>GMT</th>
<th>STATION LOCATION</th>
<th>FREQUENCIES (MC.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:10 a.m.</td>
<td>1510</td>
<td>Cologne, Germany</td>
<td>9.735, 11.795</td>
</tr>
<tr>
<td>7:15 p.m.</td>
<td>1515</td>
<td>Berne, Switzerland</td>
<td>11.715</td>
</tr>
<tr>
<td>6 p.m.</td>
<td>0200</td>
<td>Melbourne, Australia</td>
<td>15.22, 17.84</td>
</tr>
<tr>
<td>6:50 p.m.</td>
<td>0250</td>
<td>Taipei, Taiwan, China</td>
<td>9.72, 11.825, 15.345</td>
</tr>
<tr>
<td>7 p.m.</td>
<td>0300</td>
<td>Madrid, Spain</td>
<td>6.13, 9.615</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Melbourne, Australia</td>
<td>15.22, 17.84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moscow, U.S.S.R.</td>
<td>9.64, 11.755, 15.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peking, China</td>
<td>9.457, 11.82, 15.095</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Seoul, Korea</td>
<td>11.925</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tokyo, Japan</td>
<td>11.78, 15.125</td>
</tr>
<tr>
<td>7:15 p.m.</td>
<td>0315</td>
<td>Stockholm, Sweden</td>
<td>5.99</td>
</tr>
<tr>
<td>7:30 p.m.</td>
<td>0330</td>
<td>Accra, Ghana</td>
<td>6.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prague, Czechoslovakia</td>
<td>5.93, 7.115, 7.345</td>
</tr>
<tr>
<td>7:45 p.m.</td>
<td>0345</td>
<td>Berlin, Germany</td>
<td>5.57, 6.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lisbon, Portugal</td>
<td>6.025, 6.185</td>
</tr>
<tr>
<td>8 p.m.</td>
<td>0400</td>
<td>Moscow, U.S.S.R.</td>
<td>7.255, 9.54, 9.64</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peking, China</td>
<td>9.457, 11.82, 15.095</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sofia, Bulgaria</td>
<td>6.07</td>
</tr>
<tr>
<td>8:15 p.m.</td>
<td>0415</td>
<td>Bangkok, Thailand</td>
<td>11.91</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Berne, Switzerland</td>
<td>6.12</td>
</tr>
<tr>
<td>8:30 p.m.</td>
<td>0430</td>
<td>Budapest, Hungary</td>
<td>7.105, 9.833</td>
</tr>
<tr>
<td>9 p.m.</td>
<td>0500</td>
<td>Cologne, Germany</td>
<td>6.145, 9.735</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Havana, Cuba</td>
<td>6.135</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moscow, U.S.S.R.</td>
<td>7.255, 9.54, 9.64</td>
</tr>
<tr>
<td>10 p.m.</td>
<td>0600</td>
<td>Buenos Aires, Argentina (Mon.-Fri.)</td>
<td>9.69</td>
</tr>
</tbody>
</table>

*CST is one hour earlier than EST; MST is one hour earlier than PST.*
A SAFETY BELT MAY SAVE YOUR LIFE

A SHORT TIME AGO, Bill, W5NQR, was atop his 45' antenna tower putting the finishing touches on the installation of a Mosley TA-33 tri-band beam antenna. He gave a final twist on the wrench to tighten a nut on one of the U-bolts fastening the beam drive shaft to the rotator. The U-bolt snapped, and the wrench flew up and hit him on the forehead. Stunned, Bill slumped against the tower. There he hung until his head cleared; then, with lots of advice being shouted up from the ground, he carefully loosened the safety belt a bit and inched his way down. After first-aid treatment, Bill went back up the tower, replaced the broken U-bolt, and finished the installation.

Contrast Bill's experience with the tragic experience of a Los Angeles amateur last winter who fell from his tower to his death. Nobody knows exactly what happened, but the amateur in Los Angeles was NOT wearing a safety belt.

A good lineman's safety belt is quite an expensive item for an individual to buy. However, it would seem to be an excellent investment for any radio club to make for the benefit of its members. Probably the best place to obtain such a belt is through the local power company or through a company that installs and services towers and advertising signs. Sometimes a good used belt can be obtained quite reasonably when an employee of one of these companies changes jobs and has no further use for his belt. Or you may be able to borrow or rent a safety belt from one of the men over a weekend or on his days off. Get a lesson on how to wear and use it, too.

Even better than renting or borrowing a safety belt is to hire the owner of the belt to help with the actual work. While the price of hiring a good lineman or "rigger" is high (you pay by the hour), it is amazing how much faster and easier an antenna job goes when you are standing on the ground telling the lineman what to do up in the air. The fact is, if you have all the preliminary work done ahead of time and are prepared to tell the lineman exactly what to do when he gets there, what would be an all-day job for you might take the lineman only an hour or two. You will have to tell the lineman what to do, however, because he probably knows no more about putting up antennas than you know about installing polyphase power lines.

Michael M. Dodd, WA4HQW, of McLean, Va., gave his station a professional look by housing his equipment in an attractive, home-constructed console. Major gear shown includes a Johnson "Navigator" transmitter, a Hallicrafters SX-117 receiver, a Heathkit SWR bridge, and a 100-watt, home-built power amplifier. Mike will receive a free one-year subscription to POPULAR ELECTRONICS for submitting the winning photo for February in our Amateur Station of the Month contest. If you would like to enter, send us a clear picture of your station with you at the controls, and some details on your equipment and ham career. Mail your entry to: Amateur Radio Contest, c/o Herb S. Brier, P.O. Box 678, Gary, Indiana 46401.

AMATEUR STATION OF THE MONTH
Starting out as a Novice at the age of 12, Douglas C. Smith, K4OAP, Lauderdale By The Sea, Fla., had worked up to a commercial First Class Radiotelephone license three years later. He is now equipped for SSB, CW, UHF, VHF, and MARS operation.

The two assistant operators below are the daughters of Walt, WA5LZP. All three are waiting to add the state of New Mexico to Walt’s 40-meter WAS total.

Annual Novice Roundup. The 1966 ARRL Novice Roundup will take place between 6 p.m., local time, February 5, to 6 p.m., February 20. Each amateur operates a maximum of 40 hours in this contest. Novices work each other and all other classes of amateurs; other classes of amateurs work Novices. You earn one point each time you exchange serial numbers and the names of your respective ARRL sections with each station worked. Your total score equals the number of contact points earned, plus the highest code speed shown on your ARRL code proficiency certificate, the sum multiplied by the number of different ARRL sections worked.

All Novice bands (3.7-3.75, 7.15-7.2, 21.1-21.25, and 145-147 mc.) may be used, and CW-to-CW, phone-to-phone, and CW-to-phone contacts count, but a single station may be worked only once. You can obtain contest log sheets by mailing a request accompanied by a stamped #10 return envelope to the ARRL, 225 Main St., Newington, Conn. 06061. Send your score to the same address by the end of the month.

The ARRL will issue certificates of achievement to the highest scoring Novice in each ARRL section. A list of these sections is printed in each issue of QST.

ARRL DX Competition. In this international contest, you operate on phone February 12-13 and March 12-13; and on CW February 26-27 and March 26-27. Starting times are 2400 GMT on the respective Fridays, and ending time 2400 GMT the following Sunday. Amateurs in the U.S. (including Alaska and Hawaii) and Canada work the world on all amateur bands. You send a signal report and the name of your state or province to each DX station worked. The DX station, in turn, sends a signal report followed by his transmitter power. The same DX station may be worked only once per amateur band.

In the U.S., CW stations may work six stations in the same country per band; Canadian CW stations may work eight. There are no quotas on phone. All indications are that the 15-meter band should be wide open for DX during the contest; so we recommend that Novices keep their ears open for DX on the 15-meter Novice band. And General Class operators who overlook the 10-meter band will most likely miss out on some good DX contacts.

If you plan to enter either the phone or CW contest in a big way, send a request for log sheets and other material to the ARRL, together with a self-addressed, stamped envelope.

News From the Club Papers. Who is that knocking? In the U.S., some amateurs have had the thrill of hearing the FCC knock at the door while they were on the air—to check their transmitter power and their compliance with the amateur regulations. In Canada, according to Hugh Cassidy, WA6AUD, in the San Francisco Section Courier, the knocking that some amateurs have heard at their doors has heralded the arrival of the Royal Canadian Mounted Police wanting to inspect their radio equipment. There is a very high tariff on imported radio gear in Canada, and apparently someone up there thinks that some amateurs forgot to pay the duty.

According to the October, 1965, Collector and Emitter of the Aeronautical Center Amateur Radio Club, Inc., Oklahoma City, this club has voted to award each club member earning an Extra Class license a distinctive club insignia—which is being designed by Bill Moore, KSHTF.

The U.S. Army Hawaii MARS Bulletin for September, 1965, may contain one answer to the question asked by some ama- (Continued on page 101)
ACCORDING to recent news reports, more and more firms are seriously considering getting into the thin-film and monolithic integrated circuit products market. In fact, if present trends continue, it won’t be long before most mass-produced electronic equipment will be utilizing integrated circuits.

This change will not come overnight. It will be more evolutionary than revolutionary; but barring a new breakthrough in technology, or a world-shattering war, the change is inevitable. Just as the transistor has virtually displaced the vacuum tube in audio amplifiers, radio receivers, industrial controls, and even computers, so will integrated circuits displace discrete components in future equipment production. These predictions are based on the following known facts:

- The Admiral Corporation will shortly introduce a color television set using an integrated video detector. Furthermore, except for a vacuum tube in the high-voltage deflection circuit, and the picture tube, the set will be fully transistorized.
- The Ford Motor Co. is planning to use an integrated circuit speedometer/odometer in future models of its popular “Mustang.”
- A manufacturer of taximeters is planning to use integrated circuits, developed by Stewart-Warner Microelectronics, Inc., in a new all-electronic taximeter. These meters will be cheaper, smaller, and more reliable than conventional electromechanical types.
- Nearly half the logic circuits used in Honeywell’s new flight computer consist of monolithic integrated circuit arrays. Dubbed “Alert,” the new computer will be used by NASA and the U.S. Air Force.
- A broadcast-band television receiver, about the size of a deck of cards (1½” x 3” x 4”), has been built by Westinghouse Electric Corp. to demonstrate the use of integrated circuits. Except for an external power supply, the only discrete components in the receiver are the SCR’s used for electrostatic deflection, and a 1” CRT. Westinghouse has also assembled a radio transmitter the size of a fountain pen, using similar manufacturing techniques.
- A new marketing group has been organized by RCA to handle the sale and distribution of commercial integrated circuits.
- Integrated circuits suitable for logic and computer applications are now being offered by Fairchild at off-the-shelf prices, competitive with those of medium-quality transistors.
- Hewlett-Packard, one of the world’s largest electronic instrument manufacturers, is planning to set up its own integrated circuits manufacturing facility.
- Several manufacturers of semiconductor devices, including Motorola and Raytheon, have produced complete multi-stage, medium-power (1-watt) integrated-circuit audio amplifiers in packages no larger than conventional low-power transistors.
- At least one firm, Stewart-Warner Microcircuits, Inc., has succeeded in putting together a single integrated circuit containing 2000 diodes, 50 transistors, and 100 resistors, on a monolithic chip measuring only 100 by 100 mils!

Reader’s Circuit. Submitted by reader Mark Schure (19 Troy Pl., Schenectady, N.Y.), the general-purpose mixer-preamp circuit shown in Fig. 1 can be used for tape recording functions where multiple inputs are desired, with p.a. systems, and with audio amplifiers to provide multi-channel inputs. Featuring high-impedance input, the unit will accept a variety of pickup devices, including crystal microphones, crystal phono cartridges, high-impedance magnetic telephone pickup coils, and guitar microphones.

Mark has used a conventional resistive mixer network followed by a two-stage, direct-coupled complementary audio amplifier (Q1-Q2). Jacks J1 through J4 provide the signal inputs through respective level controls R1, R3, R5, and R7. Individual input signals at S1-S4 contact terminals are applied across respective isolation resistors R2, R4, R6, and R8 to master gain control R9, where they are combined.

Depending on R9’s setting, a portion of the combined signal is coupled through C1 to the audio amplifier. Resistor R10 in Q1’s emitter serves both to increase the amplifier’s effective input impedance and, by introducing degenerative feedback, to minimize distortion and improve circuit stability. The amplified output signal is developed across Q2’s collector load resistor, R11, and...
is applied to output jack J5 through C2. Operating power is supplied by B1, through S5.

Jacks J1 through J4 are standard open-circuit phone jacks, while J5 is an RCA-type phono jack. The level controls are 0.5-megohm audio taper potentiometers, each equipped with a s.p.s.t. switch. The fixed resistors are all half-watters. Capacitors C1 and C2 are tubular paper types although small disc ceramics can also be used. Transistor Q1 is a 2N218 npn type and Q2 is a 2N170 npn unit. Battery B1 can be either a 2N6 or 2U6 9-volt battery, or, if preferred, six penlight cells connected in series.

The mixer-preamp can be assembled on an etched circuit board, a perforated phenolic board, or a conventional metal chassis. The assembled unit can be housed in a 4" x 2 1/4" x 2 1/4" Minibox, or you may prefer to use a sloping-front meter case instead. Another possible arrangement is to "build-in" the circuit as part of an assembled amplifier.

There's only one point that's likely to cause a little difficulty. Because Mark has relied on Q1's internal leakage to establish a base bias, it may be necessary for you to apply external bias for optimum performance if a low-leakage transistor is used here. Therefore, we recommend that a half-watt fixed resistor be connected between Q1's base lead and the negative battery terminal. The correct value must be determined experimentally but, in general, it should fall between 1 and 5 megohms.

In operation, the microphones or other inputs are connected to the appropriate input jacks, while output jack J5 connects to the amplifier with which the mixer-preamp is to be used. Use shielded (coaxial) cables to reduce hum and noise pickup.

Manufacturer's Circuit. Hams, students and advanced experimenters working with medium-power, high-frequency circuits should be interested in the r.f. power amplifier design shown in Fig. 2. It is capable of delivering 15 watts at 50 mc. when driven with a 1-watt signal, and is one of several circuits illustrated in Bendix's Engineering Data Sheet for 2N3627-2N3630 npn silicon power transistors (Bendix Semiconductor Div., Holmdel, N.J.). The basic circuit design can be modified for use at different frequencies, or at lower power levels, with different transistors and a power supply.

Transistor Q1 is an npn type used in the tuned amplifier circuit. In operation, C1, C2, and L1 form a resonant impedance-matching input network. Base bias is supplied by B1 through choke RFC1, which by-passes the r.f. to ground through C3 and C4. The resonant collector load includes C5 and L2 as well as an impedance-matching network made up of L3, C8 and C9. Collector current is furnished by B2 through L2, and r.f. bypassed by C6 and C7.

Except for hand-wound coils L1, L2 and L3, conventional r.f. parts are used in the circuit. The coils all have a 7/8" diameter and are wound of No. 16 wire. Coil L1 consists of six turns, L2 of four turns, and L3 of seven turns. The r.f. choke (RFC1) is a standard 7.0-microhenry unit. Transistor Q1 is a Bendix 2N3629 or 2N3630. Capacitors C1, C2, C5, C8 and C9 are air dielectric trimmer capacitors. Capacitors C3 and C7 are high-quality ceramic or mica types, while C4 and C6 are feedthrough ceramics. Jacks J1 and J2 are standard r.f. coaxial connectors.

As is true of most r.f. circuits, layout and lead dress are quite critical and the

Fig. 1. General-purpose mixer-preamplifier circuit submitted by reader Mark Schure features high-impedance input for crystal microphones and crystal phono cartridges, as well as a variety of other pickup devices.

80
Fig. 2. This 15-watt, 50-mc. r.f. power amplifier is one of many designs described in Bendix Corporation's data sheets on the 2N3627-2N3630 silicon power transistors. Basic design can be modified for applications at other frequencies and power levels.

circuit should be assembled only by those who are thoroughly familiar with good r.f. circuit layout techniques. The circuit should be wired on a metal chassis, and there should be an isolation shield between the base and collector circuits, as shown by the dashed line in Fig. 2. All signal leads must be kept short and direct.

The completed circuit is tuned by adjusting \( C1 \) and \( C2 \) for resonance and proper drive (supplied by an external source) and \( C5, C8 \) and \( C9 \) for collector circuit resonance and a proper output impedance match.

Transistors. Although transistor circuit efficiency is a factor often overlooked by hobbyists and experimenters alike, it is of prime importance to design engineers. Poor efficiency wastes power, and this may not only reduce useful battery life, but can cause actual component damage.

Efficiency is usually expressed as a percentage figure. It is defined as the ratio of power out to power in, and is determined by dividing a circuit's output power by its input power, and multiplying the quotient by 100. The theoretical maximum efficiency which can be achieved from a given circuit depends on its class of operation, which can range from 50% for Class A amplifiers to better than 90% for Class C amplifiers. However, these figures are never quite achieved in practice. The numerical difference between the input and output power levels represents a power loss which represents energy dissipated as heat by the circuit components.

Naturally, you can't get something for nothing, and, therefore, you can't obtain more power from a circuit than you supply to it. In practical terms, then, an amplifier delivering several watts can't be operated for any appreciable length of time on a penlight cell or miniature battery, no matter how clever the design.

An example may prove helpful. Consider a push-pull power amplifier stage requiring 12 volts at 833 ma., and which supplies 6 watts of power to a loudspeaker. The input power in watts is:

\[
P = E \times I \quad \text{(amperes) or,} \quad P = 12 \times 0.833 = 10 \text{ watts (approx.)}
\]

On this basis, the circuit has an efficiency of \( 100 \times 6/10 = 60\% \). Therefore, the actual power loss is 4 watts \((10 - 6)\). This loss is transformed into heat by the various circuit components, with the greater portion, or "the lion's share," dissipated by the transistors. If the transistors are not adequately heat-sinked, they may overheat and sustain permanent damage.

Here are some practical steps you can take to insure maximum circuit efficiency:
- Use the minimum forward base bias needed to insure adequate gain, good linearity, and minimum distortion. A circuit may operate satisfactorily with excessive bias, but considerable power will be wasted.
- Don't overdesign ... don't use a power amplifier stage unless power is needed to drive a subsequent stage or external load. Wherever practicable, use low-power rather than high-power transistors.
- Where feasible, use push-pull Class AB or Class B stages in place of the less efficient Class A circuit.
- Make sure that circuit input and output impedances are matched, to insure efficient power transfer between stages or to the load.
- Wherever possible, use high operating voltages and lower currents to reduce \( IR \) losses; but make sure you don't exceed the transistor's voltage ratings.

(Continued on page 101)
BUILD...

Tickler or stimulator—take your pick; once you grab it, you'll let go quick

By FAIRIS S. BURT

ONE LOOK at the foil-covered electronic stimulator is enough to give you the creeps. Do you have enough guts to hold onto it with both hands? Under that shiny aluminum "skin" beats a "stout heart" with enough zip to pulse your muscles without so much as moving a finger. After your first reaction, if you are still holding on, you will feel great—especially after you let go. While it may come as a shock to you, the stimulator is completely safe; there's no dangerous high voltage or current to worry about.

How It Works. Pulses generated by a simple single-transistor modified Hartley oscillator are transformer-coupled by a reverse-connected filament transformer to a couple of electrodes. Resistor $R_1$ and capacitor $C_1$ determine the frequency of the pulses; changing the values of either of these components or changing battery voltage will change the frequency. Different frequencies create dif-

(Continued on page 84)

Unusual application of filament transformer steps up Q1's pulse output to excite the electrodes—and any one who happens to be holding on to them.
Some Plain Talk from KODAK about Tape:

The lowdown on low-noise tapes...
and on low-speed tapes

Designing a "low noise" tape is a bit like trying to fit a six-foot man with a pair of pants tailored for a five footer. Cutting off his legs is a solution... but it lacks elegance. Tapewise, if all you do is use a low-noise tape, you end up with lowered output; i.e., mighty short legs. And if you push up the gain, where's the low noise you were hoping for?

The art of low noisemanship requires a bit more finesse. And it's not so hard to master if you take a listen to KODAK'S Type 34A Hi Output Professional Tape. Try this test: Listen to a "no signal" tape at high gain. Now turn down the gain until the hiss disappears. Wouldn't it be nice if you could listen to the tape that way? The solution, obviously, is to pick a tape you can put a lot on — and play it back at low gain... and low noise, naturally!

Enters the star. Compared to our own Type 31A Standard Play Tape, and to the low-noise product from a competitor we must keep mum about, the chart below reveals that KODAK Type 34A Hi Output Tape gives five or more additional decibels of undistorted output. At similar output levels, Type 34A is just as quiet as the next fellow's. It does this with an increase in print-through over general-purpose tapes. Pretty nice for silence lovers. The values expressed in the chart are in decibels at optimum bias settings using our Type 31A as the reference.

Some like it slow. In medieval times, a favorite subject of theological discussion was just how many angels could dance on the head of a pin. KODAK can provide no informed opinion on this question, but leaps into the fray when it comes to how much signal you can squeeze on a given length of tape. Since tape started, tape speeds have been dropping. First it was 15 ips, then 7½ ips; the day of 3⅞ ips is here for some. And the recorder manufacturers still haven't stopped. Who knows where it will end.

But there are some problems involved. At 15 ips a single cycle of signal at 1,000 cycles-per-second covers 15 thousandths of an inch longitudinally on the tape as it travels by. At 1⅛ ips (to go to extremes) it's down to less than 2 thousandths of an inch. As a result, as tape travel speeds decrease, tape "resolution," to borrow a photographic word, becomes more and more important. A second problem is that external magnetic flux on the tape available to thread the reproduce head also decreases in proportion. This means that you need a high-efficiency tape. Last but not least, the tape itself has to be thin 'or maximum footage on a given reel. People buy long-playing tapes because they play long.

Put all these problems together and our trusty KODAK 11P ½ Mil Double Play Tape sounds better and better. Look at the chart which compares it to a premium-priced famous name brand recently improved for low speed... and to a competitive general-purpose tape. KODAK 11P shows off as well as the first, and better than the second. Figures are in decibels using our 11P as the reference.

KODAK Sound Recording Tapes are available at most electronic, camera, and department stores. New, 24-page, comprehensive "Plain Talk" booklet covers all the important aspects of tape performance, and is free on request. Write: Department 3, Eastman Kodak Company, Rochester, N. Y. 14650.

<table>
<thead>
<tr>
<th>KODAK 31A Tape</th>
<th>Premium-priced competitive low-noise tape</th>
<th>KODAK 34A Tape</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bias</td>
<td>+0.4</td>
<td>+0.8</td>
</tr>
<tr>
<td>Sensitivity at 37.5 mil wavelength</td>
<td>-3.0</td>
<td>+11.4</td>
</tr>
<tr>
<td>Input at 2% harmonic distortion</td>
<td>+10.0</td>
<td>+13.0</td>
</tr>
<tr>
<td>Output at 2% harmonic distortion</td>
<td>+11.5</td>
<td>+16.3</td>
</tr>
<tr>
<td>Sateuration Output</td>
<td>+19.0</td>
<td>+23.6</td>
</tr>
<tr>
<td>Maximum Dynamic Range</td>
<td>79.0</td>
<td>79.0</td>
</tr>
</tbody>
</table>

KODAK, Tape: Enter, the Star. Designed to give five or more additional decibels of undistorted output at similar output levels, Type 34A is as quiet as the next fellow's. It does this with an increase in print-through over general-purpose tapes.
different sensations, but it’s best to stick to the values given in the Parts List.

**Construction.** All components are mounted inside a cardboard tube about 9" long and 2½" in diameter. End plugs for the tube can be fashioned from styrofoam plastic such as that used in packaging. They can easily be cut to shape with a small knife. (If you can’t get styrofoam, you can use wood, metal, or even cardboard.) Hollow out one plug to hold the on-off switch. Then drill a ¼" hole ½" from each end of the tube to accommodate the wires for the electrodes.

Follow the pictorial diagram when wiring the unit. Note that the transistor is mounted directly onto the transformer mounting flange and the flange is bent upward slightly to allow clearance when you insert the circuit into the tube.

Use long leads between the components and the tube to allow for the removal and replacement of the entire electronic package, or just removal of the battery. Leads of 8" or more should be used to connect T1’s center tap to S1, the emitter of Q1 to the battery holder, and one side of the secondary winding of T1 to the cardboard tube. The other side of T1’s secondary should be made about 12" long. Strip about 3" of insulation from the 8" and 12" leads attached to the primary winding of T1, and insert one lead through the hole in the one end of the cardboard tube and the other lead in the other end of the tube.

Wrap the leads around the tube at each end once or twice.

Now cut two 4" x 14" strips of aluminum foil and roll them “squarely” over the tube flush with the ends of the tube, leaving a 1” separation in the middle as shown in the photo on page 82. To obtain good electrical contact with the bared wires coming from the inside of the tube, roll the aluminum foil on tight, smooth and squeeze out any trapped air, and tape the ends. Each strip of foil must make contact with only one lead. Incidentally, a good source of aluminum foil is your local grocery store.

**Using the Stimulator.** After you insert the circuitry into the tube, tissue or other soft filler can be stuffed in to keep the works in place. Cap the two ends of the tube with the styrofoam, and you’re ready to go into the shocking business.

Push the button, hold on to the two aluminum electrodes and you’ll feel that stimulating flow of current travel up your arms. Then try it out on your friends. Stimulation, anyone?

---

**PARTS LIST**

- B1—1.5-volt battery
- C1—100-µf., 10-volt electrolytic capacitor
- Q1—2N176 transistor (or equivalent)
- R1—1800-ohm, ½-watt resistor
- S1—S.p.s.t. switch
- T1—Filament transformer: 117-volt primary, 6.3-volt CT secondary (Thordarson 21F09 or equivalent)
- 1—9” x 2½” cardboard tube (approx.)
- Misc.—Aluminum foil, wire, solder, etc.

---

All components, including battery, fit into cardboard tube. Primary leads from T1 pass through inside of tube to the outside, and are covered with foil. About 1” of space separates the 4”-wide electrodes.
Regency does it again

New! Range Gain II Transceiver

Choose Range Gain II for its outstanding quality features: exclusive double side-band reduced carrier provides horizon-to-horizon coverage; all 23 channel crystal controlled transmit and receive, built-in crystal filter, delta tuning, automatic noise limiter, metered control and adjustable squelch. Choose Range Gain II for outstanding value. Only $219.95

New! All-Go, Solid State Ranger Mobile Transceiver

Get the Ranger for maximum power in minimum size (6 3/4" x 2 1/2" x 7 1/2"). Extra-heavy duty transmitter output transistor gives powerful crystal controlled signal on 11 channels; mechanical filter gives the ultimate in sensitivity. Adjustable squelch. Glass epoxy circuit board. External speaker and public address facilities. Get Ranger for only $169.95

and so does

New! Colt 23 CB Transceiver

You can get crystal-controlled transmission on all 23 channels with the new Colt 23. What's more, it has many of the features you'd expect to find only on sets costing much more: double conversion superhet receiver, illuminated "S" meter, automatic noise limiter, positive squelch control, mobile mounting bracket, built-in AC and transistorized 12V DC power supply. Complete with channel 11 crystal. $129.95

New! Pacer II CB Transceiver

Eleven crystal-controlled channels for industry's lowest price—is just one of the reasons why Pacer II is your best buy in CB. It also gives a built-in, solid state DC power supply, an ANL switch and a big "S" meter. Plus these important features: 23-channel superhet receiver and a quick-change, external crystal socket. Complete with channel 11 crystal, mobile mounting bracket, AC and 12V DC cords. $99.95

New! Mustang II CB Transceiver

Start in CB for less than $80—When you choose our new Mustang II, you get the answer to a low-cost start in CB. Mustang II has eight crystal-controlled channels, a quick-change, external crystal socket, "S" meter; 23-channel, tunable receiver; positive squelch control. Complete with channel 11 crystal, 12V DC power supply cord. $79.95

Regency Electronics Inc.

Metrotek Electronics Inc.

7900 PENDELEON PIKE • INDIANAPOLIS, INDIANA 46226

February, 1966

CIRCLE NO. 53 ON READER SERVICE PAGE
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.

You can install and maintain electronic circuitry in missiles and rockets . . . specialize in microwaves, radar, and sonar.

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

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

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

CHOOSE YOUR FIELD — INSURE YOUR FUTURE!

1 ELECTRONICS-TV RADIO SERVICING AND COMMUNICATIONS
A basic course thoroughly covering fundamentals of electronics, radio, TV servicing and communications.

2 MASTER COURSE IN ELECTRONICS-TV-RADIO, ADVANCED TV AND INDUSTRIAL ELECTRONICS
Qualifies you as a Master Electronics Technician — the Man in Demand.

3 FCC LICENSE COURSE
Preparation for this government license essential for many interesting jobs in radar, radio, television, communications, guided missiles, many others. Upon completion of this course, if you do not pass the FCC exam, your tuition will be refunded in full.

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.

INDUSTRY WELCOMES N.T.S. STUDENTS AND GRADUATES
N.T.S. "Project Method" Courses can help you get a new and better job — or move up to higher pay in your present one.

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.

Most courses include Equipment Kits. There are no Kit Deposits. Everything included in your low tuition.

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 REPLY CARD OR COUPON 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.

CLASSROOM TRAINING AT LOS ANGELES

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

NATIONAL SCHOOLS

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

February, 1966

BENEFIT NOW AND ALL YOUR LIFE WITH N.T.S. HOME TRAINING

The personal guidance you receive during your training can be very helpful to your progress. Many N.T.S. students are able to earn more money within a few months. You can pick and choose your career. Work in industry or go into business for yourself.

Your services will always be in demand wherever you go — and you can pick your spot! N.T.S. Graduate Advisory Service can help you answer technical questions in establishing your own business and in countless other ways after you’ve completed your training.

NATIONAL TECHNICAL SCHOOLS

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

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

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

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.

Dept. 205-26
INDUSTRIAL ELECTRONIC CIRCUITS AND APPLICATIONS
by R. Ralph Benedict and Nathan Weiner

This book represents a thorough revision of Introduction to Industrial Electronics written by Prof. Benedict several years ago. New material has been added and other material updated. The first half of the book deals with basic electronics, the last half with the principles of the devices and circuits employed in industrial electronic applications. Practical problems are discussed in conjunction with the theoretical principles, and several chapters are devoted exclusively to semiconductor devices and circuits. The book should be especially useful to the non-electrical engineering college student, and the industrial engineer who wants to bring himself up to date on current practices in industry.


HIGH FIDELITY SYSTEMS, Second Edition
by Roy F. Allison

Called a layman's guide to the installation and care of sound systems in the home, this expanded and revised edition of High Fidelity Systems covers all aspects of choice of equipment, installation, operation, and maintenance in clear, non-technical language. The new material includes specific advice on how rooms with acoustic problems can be improved for better listening and some valuable troubleshooting charts intended to isolate defective components and to illustrate what to look for when trouble starts.

Published by Dover Publications, 180 Varick St., New York 14, N. Y. Soft cover. 90 pages. $1.00.

ELECTRONIC COMPONENTS, TUBES AND TRANSISTORS
by G. W. A. Dummer

Here's an unusual book in terms of its topic and content. It has five chapters dealing entirely with electronic components, from resistors and capacitors to magnetic and
electromagnetic materials and devices. Vacuum tubes, transistors, and other semiconductors are also covered. All components are illustrated either by orthographic or perspective drawings, and each is described in terms of its physical and electrical characteristics. If you want to know more about the basic materials needed for the building blocks of electronic equipment, this book is for you.

Published by Pergamon Press, Inc., 122 E. 55 St., New York 22, N. Y. Soft cover. 166 pages. $3.95.

MICROELECTRIC CIRCUITS AND APPLICATIONS

by John M. Carroll

This book is a collection of about 75 reprinted articles from Electronics magazine. Considering the rapid pace of integrated circuit development, some of these articles are only of historical interest. However, this is a handy compilation of useful background information on cryogenics, thin film circuits, opto-electronics, field-effect devices, etc.


NEW LITERATURE

Chances are you'll find something of particular interest to you in Edmund Scientific's new 148-page catalog. Among the nearly 4000 items in the Edmund line are such newcomers as a 6-volt nickel-cadmium battery, magnet variety kit, science fun chest, and moire pattern kits. Other items include all kinds of tools, telescopes, intensity lamps, crystal growing kits, magnifiers, solar cells, and almost anything you can think of. Write to Edmund Scientific Co., 107 E. Gloucester Pike, Barrington, N. J. 08007, for your copy.

The Datak Corporation, 63 71st St., Guttenberg, N.J., has put out a 32-page bulletin on "Letraset Instant Lettering." It includes samples of all the type faces and sizes in which these dry transfer sheets of letters and numerals are available, and also covers such related products as "Instantex" texture sheets for tint application, "Presto-Color" color film sheets, and "Project-A-Type" letters and numerals in color for making slides and transparencies. There is a special section for the

First One-Piece All-Channel Antenna with Individual UHF and VHF Orientation

new JERROLD

Coloraxial™ Pathfinder™

Now you can pull in strong VHF, UHF, and FM signals all from a single antenna, with the assurance that all three bands are properly oriented for best reception.

The new PATHFINDER offers this all-channel versatility plus a choice of 75-ohm coaxial or 300-ohm standard outputs. Prices are as low as $21.95 list.

Note from the illustration that the UHF section is hinged for individual orientation and maximum directivity. You get all the flexibility of separate antennas, without the losses from coupling separate antennas to a common downlead. Rugged square-boom construction and Golden Armor corrosion-resistant finish assure long life. Flat response across all 82 channels, low VSWR, excellent front-to-back ratio make PATHFINDER the antenna to answer every TV and FM reception need. Send coupon for complete information.

CIRCLE NO. 21 ON READER SERVICE PAGE

February, 1966


LITERATURE (Continued from page 91)

electronics industry—including preset words and drafting symbols.

Servicing aids for color television and transistorized radio and TV are emphasized in B&K's catalog of professional test equipment. Among the units described are two transistorized analysts which provide d.c. power, carrier generators with modulation and in-circuit and out-of-circuit transistor testing. For color TV, the catalog covers both a transistorized portable color generator and a complete TV analyst for bench use. Write to the B&K Division, Dynascan Corp., 1801 West Belle Plaine Ave., Chicago, Ill. 60613, and ask for Catalog AP-22.

You can learn all about the various Empire "Grenadier" stereo speaker systems from a new 8-page multi-color folder available from Empire Scientific Corp., 845 Stewart Ave., Garden City, N.Y.

H. H. Scott's new 1966 Guide to Custom Stereo is a colorfully illustrated 20-page brochure which features photographs, descriptions, and specifications of all Scott components, kits and speakers. It also explains how stereo works and how to choose the components most suited to individual acoustic and budget requirements. For your free copy, write to H. H. Scott, Inc., Dept. P., 111 Powdermill Rd., Maynard, Mass.

DWELL METER ADAPTER (Continued from page 58)

Zener diode $D_1$ is a 1N3016, or equivalent, rated at 6.8 volts at 1 watt. Diode $D_2$, a 1N91, protects the circuit from a reverse connection to the battery. The other two components are: $R_1$, a 290-ohm, $\frac{1}{2}$-watt resistor; and $R_2$, a 150,000-ohm potentiometer.

If your car has a positive ground ignition system, reverse the connections of leads $A$ and $B$ to the distributor and the battery.

<table>
<thead>
<tr>
<th>Full Scale (volts)</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 Cylinders</td>
</tr>
<tr>
<td>1.5</td>
<td>60*/volt</td>
</tr>
<tr>
<td>2.0</td>
<td>45*/volt</td>
</tr>
<tr>
<td>3.0</td>
<td>30*/volt</td>
</tr>
<tr>
<td>5.0</td>
<td>18*/volt</td>
</tr>
<tr>
<td>6.0</td>
<td>15*/volt</td>
</tr>
</tbody>
</table>

TELEX

...for the ultimate in private listening

PERSONAL TV LISTENER
Enjoy Television in private without disturbing others. Full rich sound through comfortable individual earphones. Others don't hear a thing. Ideal for late night viewing or keeping house quiet during children's programs. With extra ear sets two can listen.

TELEX 1200
• Superior sensitivity and response • Extra rugged and tamper proof • Field serviceable • Reinforced cord design with quick disconnect • Available with or without microphone boom • Dynamic microphone and speakers

FIRST CHOICE OF EXPERTS FOR:
Ham
Short Wave Listening
Citizens Band
Aircraft
Hi-Fi Stereo
Mobile Communications
Educational Systems
Industrial Communications

COMMUNICATIONS MICROPHONE
• Transistorized, noise-canceling, dynamic • Voice response characteristics proved superior by test • Standard equipment on most new American aircraft • Ideal for all communications • Carbon noise-canceling type also available. Both types FAA approved (150 C58)

TELEX ACOUSTIC PRODUCTS

More Than 100 Telex Headsets, Microphones, Pillow Speakers and Private Listening Devices are available. Write for descriptive literature today. Dept. 8-8
3054 Excelsior Boulevard, Minneapolis, Minn. 55416
THE MOST COMPLETE AND UP-TO-DATE GUIDE TO THE EXCITING WORLD OF SPECIALIZED RADIO COMMUNICATIONS!

ONLY $1.25

4 FACT-PACKED SECTIONS

Short Wave Listening
Amateur Radio
Citizens Radio Service
Business Radio Service

148 PAGES...

All-new and better than ever, the 1966 COMMUNICATIONS HANDBOOK brings you exclusive information on such vital subjects as getting started in SWL—buying equipment and station reporting; establishing your CB station, public service activities; ham license applications procedures, learning the code; typical business radio installations...

PLUS a special nation-wide listing of 250 amateur radio clubs offering code and theory courses and a roster of 400 CB clubs—both lists available nowhere else!

... and much, much more. Everything you need to know about your specialty is covered by a leading authority in the field—from basic instruction for the beginner through the most advanced data and techniques.

Complete with charts, tables and illustrations galore, it's a big, valuable "encyclopedia" of communications information you'll use all year long.

Just what you've been looking for? Then clip the handy coupon below and send for your copy today!

GET THE EXQUISITE LEATHERFLEX-BOUND EDITION

The 1966 COMMUNICATIONS HANDBOOK is now available in an attractive, gold-embossed, Leatherflex-bound edition—a superb addition to your library of permanent reference books. This deluxe volume will be mailed to your home, postpaid, for just $3.00, when you check the appropriate box on the order form.

Ziff-Davis Service Division • Dept. CH
589 Broadway • N.Y., N.Y. 10012

YES! Send me a copy of the 1966 COMMUNICATIONS HANDBOOK, as checked below:

☐ $1.25 enclosed, plus 15¢ for shipping and handling. Send me the regular edition. ($1.50 for orders outside the U.S.A.)

☐ $3.00 enclosed. Send me the Deluxe Leatherflex-bound edition, postpaid. ($3.75 for orders outside the U.S.A.) Allow three additional weeks for delivery.

NAME  

ADDRESS  

CITY  
STATE  
ZIP CODE  

PAYMENT MUST BE ENCLOSED WITH ORDER.
THE NEW EMPIRE 888P CARTRIDGE

THE LIVING CARTRIDGE

Listen to its unbelievable frequency response that spans the complete orchestral spectrum one full octave above and below the fundamental range of any musical instrument. No other cartridge series can reproduce the entire musical range as precisely and with such clarity as the Empire 888, 888P or 888PE. See your HI Fidelity dealer today and hear it live. For complete literature write Empire Scientific Corp., 845 Stewart Ave., Garden City, N.Y.

EMPIRE

CIRCLE NO. 108 ON READER SERVICE PAGE

HAM HOBBY CLEARINGHOUSE

If you have a hobby or interest in addition to amateur radio and would like to talk about it on the air, you can contact other hams with the same hobby through this column. To be listed here, just send a legibly printed postcard to Ham Hobby Clearinghouse, Popular Electronics, One Park Ave., New York, N.Y. 10041, including on it your call letters, other hobbies, the frequencies you use, mode of operation, when you operate, and your name and address.

WN1DJA—Astronomy and camping; 40 meters; Saturdays and Sundays. (Arthur J. Arruda, Jr., 63 Gifford Ave., N. Dartmouth, Mass.)

WA1DSZ—Music, physical sciences, teen-age net; 80 through 10 meters, AM or CW; 1300 to 2130 EST. (Blair Harden, 39 Hartford St., Natick, Mass. 01762)

WA1FAJ—Stamps, reading, interior decorating; 75 meters, AM; most days of week. (Mark H. Lasner, 19 High Point Rd., Westport, Conn. 06880)

WB2AMN—SWL'ing, professional broadcasting, contemporary music, cars; 2 and 6 meters, phone; holidays, weekends, and after school hours. (Robert Sauter, Front St., Upper Nyack, N.Y. 10960)

WB2BEU—Models airplanes and railroading, fishing, basketball, chess, mechanical drawing; 3.85, 7.27, 14.22, and 21.88 mc., AM phone; 1 to 3 p.m. and 9 p.m. to 12 p.m. daily except Friday. (Larry Robinson, 934 Bronx River South, Apt. L, Bronx, N.Y. 10460)

WB2KDP—Medicine, bacteriology; 40 meters CW and 6 meters phone; daily 5:30 to 6 a.m. EST, Sundays 10 to 12 a.m. (Glenn J. Gerber, 217-16 67 Ave., Bayside, N.Y. 11364)

WB2MBV—Volunteer fireman, cars; 2 and 6 meters; weekends. (Bob Bersak, 962 Allen Lane, Woodmere, Long Island, N.Y. 11598)

WB2QLP—Commercial aviation; 2 meters, AM; most every evening and weekends. (Jordan Marsh, 611 Lafayette Blvd., Long Beach, N.Y. 11561)

WB2QWV—Model rocketry, astronautics, science, ham TV, and home-brew projects; 20 meters, SSB; 3 to 6 p.m. EST daily. (Hank Wohltenjen, 146 Daleham St., Staten Island, N.Y. 10308)

WB2QXH—Photography, model railroading, and homebrew ham equipment; 6 and 2 meters; weekends, and most evenings on school days. (Rich Brummer, 22 Cottage Dr., Massapequa, N.Y. 11759)

WN2TKP—Shell and rock collecting, antennas; 80, 40, and 15 meters after 3 p.m. EST. (Bob Bersak, 86 Leslie Rd., Colonia, N.J. 07067)

WN2UGP—Chess and coin collecting; 80 meters; weekdays between 1900 and 2100 GMT. (David Cantor, 189 Rider Ave., Patchogue, N.Y. 11772)

WN2UVP—Astronomy, coin collecting, judo and karate; 15 meters, CW; some weekday afternoons after (Continued on page 96)

LEARN Electronics Engineering AT HOME

For years, design and maintenance of electronic equipment has been an increasingly popular hobby. Now it is easy to learn the fundamentals of electronics and engineering while enjoying the fun of this exciting hobby. This course is designed for the adult who has little or no previous knowledge of electronics. It stresses practical application of electronics and does not review trigonometry or mathematics. Weekly assignments and projects include actual hands-on work with radio kits, checkers, and free time projects. The course includes all necessary electronic devices and printed materials. The course is self-paced and requires about 20 hours per week. Students may enroll at any time and are encouraged to start with the first lesson. The cost is $195.00 plus $7.00 per week for legitimate electronic kits.

AmericanRadioHistory.Com
A PUBLISHING FIRST

THE ONLY COMPLETE GUIDE FOR SERVICEMEN AND HOBBYISTS TO EVERY MAJOR PHASE OF CONSUMER ELECTRONICS SERVICING!

For the progressive serviceman who wants to find out how to service better and faster . . . how to expand his business by handling a wider variety of electronics equipment —

For the "do-it-yourself" hobbyist who wants to save hundreds of dollars by installing and repairing his own equipment —

The 1966 ELECTRONICS INSTALLATION & SERVICING HANDBOOK has arrived! The only comprehensive and authoritative guide to every major phase of consumer electronics servicing. There's nothing like it anywhere!

A handy, on-the-bench reference volume containing 128 pages—over 150 illustrations, charts and tables—on how to spot, analyze and correct trouble . . . quickly, efficiently and economically!

GET THE EXQUISITE LEATHERFLEX-BOUND EDITION for just $3 POSTPAID!

The 1966 ELECTRONICS INSTALLATION & SERVICING HANDBOOK is also available in an attractive, gold-embossed, Leatherflex-bound edition—a superb addition to your library of permanent reference books. This deluxe volume will be mailed to your home, postpaid, for just $3.00, when you check the appropriate box on the order form.

Complete, in-depth coverage of: the fundamentals of servicing • servicing b/w & color TV • AM-FM household radios • stereo/hifi • CB equipment • intercom and PA systems • antennas • transistorized ignition systems. Hundreds of money-saving techniques and shortcuts. Every up-to-date method and procedure. All in easy-to-understand language for the novice . . . yet thorough enough to answer the professional's most complex question!

You'd have to purchase several expensive manuals to equal this kind of incisive, all-inclusive coverage. But now you get it all in the 1966 ELECTRONICS INSTALLATION & SERVICING HANDBOOK. A small investment that will pay for itself many times over with just one practical application. only $1.25

February, 1966
H B A M  M O B B Y  (Continued from page 94)

3:30 EST, weekend days and Saturday night. (Bruce Heimlich, 8-09 Plymouth Dr., Fair Lawn, N.Y. 07412)

WA3DLU—Color photography, also would like to contact WW II buddies of the 773 Tank Destroyer Battalion; 80, 40, 15 meters CW, 6 meters phone; evenings. (John F. de Huarte, 9629 52nd Ave., College Park, Md. 20741)

WN4QY—Surfing and swimming; 40 and 15 meters, CW; any afternoon, all day weekends. (Dennis Legendre, 300 N.W. 190 St., Miami, Fl. 33169)

WN4ZLC—Reading, stamp collecting, hunting, and radio construction; 40 meters, CW; weekends and holidays. (LaRoy Sansbury, 2934 Temple Lane, Charlotte, N.C. 28205)

W5SNT—Stamp collecting, model rocketry, and water sports; 80 meters; 7 to 9 p.m., most weekdays and Saturday. (Jimmy Rushing, 602 San Patricio Ave., Taft, Texas 78390)

WB6HBK—Science; 80 to 10 meters AM,CW; Saturday afternoons. (Daniel Beugelmans, 4174 Don Mariano Dr., Los Angeles, Calif. 90008)

WB6OGF—Stamp and coins, athletics, woodworking; 40 through 10 meters CW or AM, daily. (David C. Gilbert, 547 Virginia Dr., Tiburon, Calif.)

WN6RBL—Construction projects, coin collecting, and guitar; 40 meters, CW. (Shan. Jackson, 30 Junipero, Long Beach, Calif.)

WN7RUU—Photography, coin collecting, geology, math, reading; 40 meters; weekdays 3 to 12 p.m. PST, and all weekend. (Andrew Gudas, 518 N. Clover Ave., San Jose, Calif. 95128)

WA6VHL—Model railroading; 80, 40, 20 meters CW; nights and weekends. (Jerry Leisenring, 14930 Gale Ave., Hacienda Heights, Calif. 91745)

WN7CYY—Stamp and coin collecting, lapidary, boating, private aircraft; 80 meters, sometimes 40 meters. (Roger Attwell, Route 4, Box 500, Everett, Wash.)

W8IEC—Stamp and coin collecting, DXing, and member Ford Tin Lizzy Club; 80 through 10 meters, CW. (Steve Solo, 12932 Gable St., Detroit 12, Mich.)

WN8RQA—Reading, flying, boating; 3.735 mc. weekdays 7 to 9 a.m. EST, 21.165 mc. evenings from noon to 2 p.m., and 2 meters phone on Sundays. (Mike Martz, Box 517, Sidney, Ohio 45365)

WA8EXS—Slot-car racing; 80 through 6 meters, mostly SSB, some CW; evenings and weekends. (Charles Bennett, 1407 18th St., Bettendorf, Iowa)

Available from your Hy-Gain Dealer or Distributor

HY-GAIN ELECTRONICS CORP.
8507 N.E. Highway 6
Lincoln, Nebraska 68501

CIRCLE NO. 18 ON READER SERVICE PAGE

"Hang on, OM; I won't keep you half a mho!"

AmericanRadioHistory.Com
LAFAYETTE Model HB-555 Mobile-Adé™
5-Watt Solid-State Mobile CB Transceiver

14 Transistor, 4 Diode Circuitry • 12 Channel Crystal-Control Transmit and Receive • Double Conversion Superhet Receiver with Super Selective Mechanical Filter • Push-Pull Audio Amplifier/Modulator.

New ultra-compact pace setting design with full 5-watt input, only 2¾" high. Operates on 12VDC negative or positive ground and or 117VAC with optional AC power supply. Complete with built-in 3x5" speaker, push-to-talk mike, bracket and pair of channel 9 crystals.

LAFAYETTE Model HB-600
25 Channel Transceiver

Unique RF Noise Silencer • 23 CB Channels Plus Choice From 5 Business Band Channels

Lafayette's finest! Unbelievable noise reduction (Pat. Pend). Also all solid state circuitry, low current drain, crystal synthesis, mechanical filter, Built-in solid state AC & DC power supplies. FCC Type Accepted.

LAFAYETTE Model HA-130
Superhet CB Walkie-Talkie

Crystal-Controlled Superhet Receiver • Plug-in Crystals

Lightweight, provides clear communications up to 1 mile. With channel 10 receive and transmit crystals, earphone and battery, in durable black and silver high impact plastic case.

FREE 1966 Catalog 660
512 Pages

Everything in Electronics for Home and Industry from the "World's Hi-Fi & Electronics Center"

CIRCLE NO. 47 ON READER SERVICE PAGE
amplifier. It is best to build the power supply in a separate case to avoid hum pickup.

**Construction.** To simplify matters, a printed circuit board is used for the amplifier, as shown in Fig. 6. It is shown actual size in case you decide to make your own.

Note the lead arrangement for Q5 (the 2N3706). If bent properly and installed as shown, the flat side of the case will face resistor R12. If you cannot locate any proper size 0.5-ohm resistors for R14 and R15, you can make them by winding 15 inches of #36 magnet wire on a resistor body and soldering the ends of the wire to the resistor leads; use at least a 1000-ohm resistor.

The delay line assembly must be shock-mounted to prevent car movements and road bumps from activating the springs. To do this, suspend the reverberation unit from the top of the case with four springs, one in each corner. Allow sufficient clearance between the unit and the case to prevent contact even when you hit the brakes hard.

To mount the springs, drill two small (#60) holes about ¾” apart for each spring. Start from the inside of the chassis and thread the end of the spring through one of the holes, and then back through the other hole into the case. Do not shorten the leads from the reverberation unit; they must be long enough to allow free movement.

Mount the unit in the case, the open side facing in, as shown in Fig. 4. Dress all the leads from the unit to extend past the output end. The output end of the delay line is the end with the shielded transducer.

**Installation.** In automotive installations, the fader control and switch can be mounted on a separate panel and located within easy reach of the driver. The leads can then be run to the reverberation amplifier, which can be mounted in the trunk or some other convenient place.

Disconnect the speaker from the car radio’s output transformer and connect it to the fader control. Then install a rear-seat speaker and connect it to the fader control. This will allow you to select either direct output to both front and rear speakers, or direct output to the front speaker and reverberation output to the rear speaker. Of course, if your car is already equipped with a fader control and a front and rear speaker setup, you’re that much ahead of the game—all you need add is the d.p.d.t. switch (SI).

To adjust the amplifier for proper operation, connect it to a 12-volt power supply. It’s a good idea to install a 1-ampere fuse in the + lead. Measure the voltage at the collector of Q5 (it can normally range from 4 to 8 volts) and adjust trimmer resistor R8 to obtain a 6-volt reading. The purpose of this adjustment is to obtain symmetrical operation.

After you install the amplifier, tune in your favorite program—and enjoy your concert hall on wheels.

---

**The famous Mercury Model 1101 TUBE TESTER**

**NOW in a wire-it-yourself KIT!**

Illustrated step-by-step instructions make the Model 1101 extremely easy to build. Tests more tubes for dynamic cathode emission, shorts, grid leakage and gas than many testers costing hundreds of dollars...tests new Decals, Magnavols, 7-pin Nuvistors, Nover, Compexions, 12-pin type battery type auto radio hybrid tubes, foreign and hi-fi tubes and industrial types. Employs brilliant 2-point test principle—greatest safeguard against obsolescence, Modern airplane luggage design case... It also tests all popular picture tubes.

**Write for complete catalog of kits and wired instruments—and name of nearest distributor.**

**MERCURY ELECTRONICS CORP.** 315 Roslyn Road Mineola, N.Y. 11501

**CIRCLE NO. 50 ON READER SERVICE PAGE**
ON THE CITIZENS BAND
(Continued from page 74)

N. Braddock, and Miss D. Whitham, club committee.

Dallas further relates that CB licensees now number over 1000 in New Zealand, with approximately 400 in the Wellington area. Calls for the area are prefixed as "AK" for the Auckland region, "WN" for Wellington, etc.

Civic Aid. Members of the Tri-County Citizens Band Radio Club, Sterling, Ill., late last year assisted during the Illinois Junior Sports Jamboree held in that city. TCCBRC members intercepted all buses arriving at the jamboree, spacing their arrival at the registration center. Individual members then remained with the buses whenever they were moved during the ceremonies. Two base units were in operation at the junior high school, each on a different frequency. And a club member stayed near the state chairman at all times to inform him of any problem. In addition, club personnel made up a large part of the chaperone forces, providing policing units at the dorms on an around-the-clock basis.

During the jamboree parade, club personnel aided in the formation of sections and helped to keep the parade running smoothly. Later, the group assisted in sporting events by keeping the announcer informed through the use of walkie-talkies. Operators reported times in the running of field and track events as well as the heights and distances met by jumpers. They en-

A special booth was set up by Tri-County CB Radio Club (Sterling, Ill.) members at the Illinois Junior Sports Jamboree where they assisted as described above. Shown in the photo, left to right, are Leo Waldbusser, Larry Meyers, Bob Maxwell, Dave Rearley, Vernon Rosnow (president), and Helen Fransen.

February, 1966
LEARN ELECTRONICS

COYNE ELECTRONICS INSTITUTE

Electronics Engineering Technology — Degree (2 Yrs.)
Electrical-Electronics Technician — Diploma (40 Wks.)
TV-Radio-Electronics Technician — Diploma (40 Wks.)
Combined Electronics Technician — Diploma (32 Wks.)
Practical Electrical Maintenance — Diploma (80 Wks.)
Practical Refrigeration Air Conditioning and Appliance Repair — Diploma (24 Wks.)
Specialized Industrial Electronics — Diploma (16 Wks.)
Introduction to Electricity-Electronics — Certificate (8 Wks.)
FCC First Class Radiotelephone — Certificate (100 Hrs.)

Special finance plans. Part time employment service while in school. Also Free graduate employment service.

Use this coupon to get our FREE BOOK "YOUR OPPORTUNITIES IN ELECTRONICS"

COYNE ELECTRONICS INSTITUTE, Dept. of Electronics 26-M 1501 W. Congress Parkway, Chicago, Illinois 60607

Name ____________________________ Age ______
Address __________________________ Phone ______
City _______ Zone _______ State ______

Unlike most other schools, we do not employ salesman

CIRCLE NO. 7 ON READER SERVICE PAGE

Say You Saw It In Popular Electronics

SSBCO TRUE SINGLE SIDEBAND for CB
Go SS8 on 27mc Citizens Band

TREMENDOUS BARGAIN!
SS8-27 SIDEWINDER... $164.95

write for
MONEY BACK Trial Offer
SSBCO-P.O. Box 101 Northtown Station, Chicago, Ill. 60645

100 POPULAR ELECTRONICS

abled the announcer to keep spectators aware of the state of the meet.

By the time the TCCBRC CB operators had delivered attending dignitaries to the awards banquet, they had put in some 620 man-hours, utilizing 33 walkie-talkies, 5 base stations, and 42 mobile units.

1966 OTCB Club Roster. In order to keep our roster of active clubs current, all CB clubs, rescue teams, and special police groups who have not reported to this column in the last year are requested to do so now. Include your current membership totals, officers, club activities, emergency assists, and sample club decal and membership card. And please continue to provide us with your club newspaper or bulletin on a monthly basis. All groups are urged to send in photographs of activities, emergency teams, assists, and any unusual application connected with CB radio. Forward this material to Matt P. Spinello, CB Editor, Popular Electronics, One Park Avenue, New York, N.Y. 10016. The clubs listed below have recently organized or are bringing us up to date on their present status.

Vero Beach, Florida: The Dog House CB’ers, Inc. This club has been active since January, 1964. Their call is KMP2992, issued July, 1965, for 50 units. Activities include aiding Civil Defense authorities, and the control station monitors 24 hours on weekends in order to aid the H.E.L.P. program. Club works hand in hand with amateurs in the area; members have been invited to attend classes to qualify for amateur tickets. Present officers include: Ed Ashley, 7Q0834, president (retired); L. B. Ginder, KDI1805, vice president; Bert Oechsle, secretary; Chuck Homer, KDH2258, treasurer; Paul Jacobs, KMP2748, and Frank Melton, KDI2396, communications officers.

Hillside, Maryland: Prince George’s Volunteer CB Rescue Service, Inc. Organized in October, 1964, this group provides a mobile CB patrol on the new Capitol Beltway, Rt. 495, surrounding the entire Washington, D.C., metropolitan area. They work with local and state authorities during emergencies, and provide walkie-talkie and mobile units with a special skidiving unit to search areas. Officers: Andrew F. Przekop, KCB1870, president; Owen Mason, KCG1895, vice president; Harriet Fleck, KLV0295, secretary; Carrie Letcher, KCG2384, treasurer; and Jerry Peluzzo, KJE0246, chairman, emergency committee.

New York, New York: The Bronx Westchester CB Association. There are 80 members in this group, which has its own quarters and ham shack. They are equipped with gear and mobile units to help in emergencies at a moment’s notice.
SOLID STATE

(Continued from page 81)

- Keep non-working circuit resistances at a minimum. Where large currents are involved, as in multi-watt power stages, use moderate-to-heavy gauge hookup wire.

Product News. A new series of dual trigger diodes is now being produced by the Mallory Semiconductor Co. (424 S. Madison, DuQuoin, Ill. 62832). Essentially symmetrical three-layer avalanche devices, they are designed for use in activating SCR's and bi-switches. The unique electrical characteristic of these diodes causes a symmetrical switching device to fire whenever the breakdown voltage is exceeded in either direction, thus triggering two SCR's with one diode. Identified as the STD series, the new Mallory diodes have a 1-watt power rating and breakover voltage ratings ranging from 24 to 120 volts.

Expensive semiconductors need protection! Recognizing this fact, ATI Industries (9030 Bellanca Ave., Los Angeles, Calif. 90045) is now producing a special high-speed, high-current solid-state switching device designed to protect equipment circuits from overvoltage or overcurrent transients which would normally damage or destroy semiconductors. This semiconductor protector (SCP for short) has a response time of 500 nanoseconds, or less, and is available in models with voltage ratings ranging from 3 to 1000 volts at currents of up to 150 amperes.

That concludes the "SOLID STATE" story for now, fellows. Back next month...

-Lou

AMATEUR RADIO
(Continued from page 78)

...to why they should join MARS (Military Affiliate Radio System). The Hawaiian MARS director offers to write a letter that should help any member of his MARS group who is drafted by the Army to be assigned to signal work.

In the October, 1965, issue of Auto Call, published by the Foundation of Amateur Radio, Washington, D.C., Marty, K3LFB, reports that Bill Grenfell, of the FCC, speaking at the September 11 meeting of the Rock Creek Amateur Radio Association, told about a fellow who included a check for $16 with his license application. The actual fee was $8, of course, so the applicant was sent a refund check for eight dollars. Then the original $16 check "bounced"!
New Browning CB Mobile Unit.

- Distinctive new styling.
- 23-channel operation, crystal controlled.
- Nuvistor cascade front end.
- No synthesized circuits.
- Twelve tubes.
- Two transistors.
- Five diodes.
- Only 4" high, 10 1/4" wide, 8" deep.

See the Raven at your franchised Browning Service Center now.

Write Browning for complete literature and specifications.

---

### News and Views

C. K. Moon, publicity director of the Poughkeepsie Sports Car Club reports that last September 26 the Poughkeepsie Amateur Radio Club supplied communications for the annual Gibson Girl Rally. Thirty sports cars covered 253 miles of unfamiliar roads and were checked in and out of eight check points by radio. In addition to 2-meter, FM mobile units at each check point, relay stations were installed on two nearby mountains to insure that all reports would reach the control. Communications worked without a hitch . . . W. Page Pyne, WN3EOP, 540 North Locust St., Hagerstown, Md., works 40 meters using a home-brew 10-wattter feeding a random length of wire and a Heathkit "Twoer" receiver. On 2 meters, he uses a Heathkit "Twoer" feeding a coat-hanger antenna, which works fine for local contacts . . . Danny Ferguson, WN4WYC, 212 Piedmont Ave., Rockmount, Ga., works 15 meters most of the time. His Heathkit DX-40 transmitter, 3-element beam, and Hammarlund HQ-145C receiver have knocked off 45 states and 16 countries. Danny offers to sked anyone needing a Georgia contact and says he will even buy a ham his General ticket by the time this is being read.

Rich Casey, WA9LRL, 8939 Parkside Ave., Morton Grove, Ill., works 2 and 6 meters with a Heathkit "Twoer" and "Sixer." On 2 meters, Rich uses a 3-element, home-brew beam 35' high, and he has a dipole under it for 6 meters. In addition, he likes to experiment with other antennas and has worked four states using a clothes-hanger dipole . . . Robert Mauro, WN2UHY, 150-518th Ave., White stone, N.Y., operates on 40 meters. He feeds a 40-meter dipole antenna 25' high with an AMECO AC-1T transmitter and receivers on a Lafayette HA-350 receiver. Although his transmitter power is only 8 watts, Bob has worked 12 states and two countries. A 20-wpm code-proficiency certificate and the way he handles his bug key prove that code is not one of his problems . . . Steve Gord, WN8000, 1414 Warwick Drive, Birmingham, Mich., has just discovered the value of a good receiver and a good antenna. In his first four months on the air receiving on an old, inexpensive receiver and feeding his Heathkit DX-40 transmitter into a nondescript dipole, Steve managed to work five states. Then he got a Hallicrafters SX-100 receiver and put up a HY-Gain 18-AVQ antenna. Six log hours later, his states-worked total was 22.

Ron Vincent, WAC00R, 2345 Washington St., Eugene, Ore., runs his EICO 720 transmitter at 65 watts on phone and 75 watts on CW to drive either a HY-Gain 14-AVS vertical antenna or an 80-meter dipole, and he receives on a Hallicrafters SX-95. With this combination Ron has acquired 48 states worked and confirmed, and cards from 23 of the 46 countries he has worked. When not chasing DX with "high" power, Ron fools around with a 10-watt home-brew transmitter, and is in the midst of building a 5-watt, 80/40-meter transis torized transmitter . . . Keith G. Beebe, W4QQQ, 4859 100th Way, North, St. Petersburg, Fla., made over 2000 CW contacts in a year and a half on the air. In the process, he worked 45 states and 19 countries on three continents. Even more to be proud of is his selection for membership in the A-1 Operators' Club; Keith is also a member of the QRP and Rag Chewers' Clubs. W4QQQ's equipment includes a Globe "Sidebander" transmitter, a Lafayette KT-320 receiver, a home-brew 20-meter beam on a 40' tower, and a 40/15-meter inverted-V antenna. At Klein, W2PMX, 2886 Colby Court, Brooklyn, N. Y., feeds a "long-wire" antenna between 80 and 15 meters with a Sideband Engineers SBE-33 transceiver. But Al's on-the-air time is being crowded by a new activity. Because he likes to build things, Al offers to build any electronic gadget described in any electronic magazine (although he prefers this one, because he has a complete file of back issues) for about the cost of the parts.
Charles Collingwood, W8BYN, 823 S. Main St., Findlay, Ohio, uses both a horizontal dipole and a vertical antenna. He drives them with a homebrew 6AG7-807 transmitter running a power of 75 watts, and receives on a Knight-Kit R-55A receiver. Operating on 15 meters exclusively, Chuck has worked 13 states, nine of them confirmed...

Mark Kellog, WHOM6X, 3311 So. 106th St., Omaha, Neb., has worked 22 states, but he has great difficulty getting QSL cards from any stations except W9's. Mark loads his Globe "Chief" to 75 watts to excite his 40-meter dipole, and he receives on a Hallicrafters SX-99. Bruce Kaplan, WH3BYC, 29 Homestead Rd., Levittown, Pa., has something that many Generals in his area do not have—a QSO with Wyoming. His tools are a Heathkit DX-35 transmitter and a Knight-Kit R-55A receiver. Mark also has 16 other states besides Wyoming worked...and he just received a Hammarlund HQ-100A receiver for his birthday. "See you" in the Novice Roundup or in the DX Contest. Send your "News and Views," photos, and club bulletins for the next column to: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana 46401.

73, Herb, W9EGQ

---

**ELECTROMAZE SOLUTION**

*(Puzzle appears on page 59)*

1. Coil 15. Envelope
3. Arc 17. Decibel
4. Antenna 18. Loop
5. Array 19. Peak
8. Electrode 22. Triode
9. Retract 23. Triod
10. Rig 24. Dish
  Exit 1. Slug
11. Gate 25. Hole
12. EMF 26. Encode
13. Chaff 27. Evacuate

---

**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

Dept. PE-266 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

CIRCLE NO. 24 ON READER SERVICE PAGE 103

February, 1966
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’s Career Institutes train 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 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.


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 breadboard 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-26
A Service of Radio Corporation of America
350 West 4th St., New York, N.Y. 10014

The Most Trusted Name in Electronics

February, 1966
A - D AFSK (Audio Frequency Shift Keying) is a type of modulation where the carrier is shifted between two discrete frequencies, and is often used in RTTY (radioteletype) communications work.

2 - H A DAVC (Delayed Automatic Volume Control) circuit does not apply a negative control voltage to the grids of the controlled amplifier tubes until the input signal is large enough to overcome a predetermined bias on the d.a.v.c. diode.

3 - A FETS (Field-Effect Transistors), like vacuum tubes, are basically voltage amplifiers and have high input impedance. Conventional transistors are generally current amplifiers, and have low input impedance.

4 - G A MOPA (Master Oscillator Power Amplifier) is a radio transmitter consisting of an oscillator and an r.f. amplifier.

5 - I The NTSC (National Television Standards Committee), a group representing the major television manufacturers, research laboratories, and broadcasters, prescribed the system used to transmit and receive commercial television in the United States.

6 - F The PMMC (Permanent Magnet Moving Coil) meter movement (PMMC) employs a pointer mounted on a pivoted coil, a permanent magnet, and current-carrying coil return control springs.

7 - C The RIAA (Record Industry Association of America) equalization curve is a standard widely used by the phonograph record industry.

8 - B A TPTG (Tuned-Plate Tuned-Grid) oscillator employs parallel resonance in both plate and grid circuits, and the frequency of oscillation is dependent on the resonant frequency of each of the tuned circuits.

9 - J The UJTO (Unijunction Transistor Oscillator) utilizes the stable firing voltage characteristics of the transistor in a relaxation circuit.

10 - E The VSWR (Voltage Standing-Wave Ratio) is the ratio of the characteristic impedance of a transmission line to the impedance of the load connected to the output end of the line.
SHORT-WAVE LISTENING  
(Continued from page 75)

date submit a list of 25 additional countries for a "50" award, along with a notation to refer to their original listing of 25 countries—not an easy task by any means, considering the huge volume of applications that are processed. And often we find, once again, that the applicant has submitted one or more duplications and, again, additional correspondence is necessary.

To insure your receiving your DX Awards as quickly as possible, we ask that you (1) be sure that your listings are in alphabetical order, thus automatically eliminating duplication, and (2) each time you apply for a higher award, send in a complete list. You will find this easy to do if you keep a copy of the list you submitted for the lesser award.

If you intend to apply for any of the DX Canada Awards, the provinces now deemed acceptable include: Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, Quebec, Saskatchewan, Yukon Territory, and Northwest Territories. For award purposes, the Yukon and Northwest Territories are being considered as provinces.

Photo, Anyone? Would you like to have your picture in this column? Send us a black-and-white photo of your SWL "shack" with you in it. The photo should be at least 4" x 6" and should have good contrast; blurred prints cannot be properly reproduced. And all of the equipment shown must be identified by make and model number. Mail the photo to: Short-Wave Editor, P.O. Box 333, Cherry Hill, N.J. 08034. Be sure that it is one you can spare for we cannot return it.

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 LISTENING, P.O. Box 333, Cherry Hill, N.J., 08034. In time to reach your Short-Wave Editor by the fifth of each month, be sure to include your WPE Monitor Registration and the make and model number of your receiver. We regret that we are unable to use all of the reports received each month, due to space limitations, but we are grateful to all contributors.

Algeria—R. Algiers is noted on 6175 kc. from fade-in around 2200 with Eng. to 2330 and Spanish to 2300 close. This is in parallel to 9650 kc. and to the 100-kw. medium-wave outlet on 880 kc., which has also been reported in East Coast areas.
Get Your First Class Commercial
F.C.C. LICENSE
and earn your
A.S.E.E. DEGREE

Move up. Increase your salary and prestige. How? By acquiring the knowledge and skill that industry needs and pays for!

The unique A.S.E.E. degree program available at Grantham School of Electronics teaches you what industry wants you to know for advanced employment. And you can complete three-fourths of this program while at home on your present job. Only one semester must be completed in residence.

Get the facts from our free catalog. Then, with our assistance, get the knowledge. Your F.C.C. license, your A.S.E.E. degree, and higher-paid employment follow naturally. Ask for Catalog 63.

Grantham School of Electronics
1505 N. Western Av., Hollywood, Cal., 90027
(Phone: HO 9-7878)
408 Marion Street, Seattle, Wash., 98104
(Phone: MA 2-7277)
818-18th St., NW, Washington, D.C. 20006
(Phone: 298-7460)

FREE!

INTERNATIONAL CATALOG
your 1966 buying guide

for precision
made radio crystals and
electronic equipment

International Crystal Mfg. Co., Inc.
18 No. Lee, Okla. City, Okla. 73102
Rush Free Catalog

Name
Address
City. State Zip

CIRCLE NO. 20 ON READER SERVICE PAGE

CLANDESTINE STATIONS

An unidentified "U.S.S.R. regional" station noted often on 5915 kc. is the quasi-clandestine Bizim Radyo, whose xmtr is reportedly in Bucharest. An ID in Turkish was caught just before the 2058 s/off.

R. Libertad's often-quoted "25-meter" frequency has been found to be 11.865 kc., on which the station was logged at 0000.

Radio Peyk-e Iran, according to an item from R. Switzerland, broadcast in Persian and Arabic from 1350 to about 1800 on 9560, 11.410, and 11.895 kc. It is surmised (the report states) that the anonymous programs are compiled in East Germany and broadcast from xmtrs in Bulgaria in the direction of Iran and Iraq. (Editor's Note: American sources have, for some time, thought that the broadcasts originated from a 50-kw. xmtr in the Russian sector of Berlin, Germany.)

A station has been heard on 4190 kc. with the call-sign WERG and a location somewhere in New Jersey. Playing old and modern pop records, it identified itself as 'The last word in radio, WERG. New Jersey, on 4190 kc.' It was tuned at 2310-2325 when the announcer said it would move to 4340 kc. No move was made, however, and it returned to the air from 2335 to 2352, when operations apparently ceased. Does anyone have any further information on this station?

there are songs and anmuts in (probably) Cambodian. This channel usually has considerable RTTY QRM.

Chile—Seldom heard is La Cruz Del Sur, Santiago, 11.848 kc. Badly squeezed by Paris and R. Teleco (Paraguay). It has a religious program at 2330.

China—To improve reception for our listeners on the East Coast of N.A., we have made some changes... Peking now beams to this area at 0000-0100 on 15.066 and 17.680 kc., and at 0100-0200 and 0200-0300 on 7035, 9480, 11.945, 15.080, and 15.095 kc. Other xmtrs were noted on 15.570 kc., in addition to their Spanish beam at 0045, and on 11.505 kc. in Chinese from 2353 to past 0000 with six time pips at 0000.

Colombia—A new or possibly misplaced Colombian on 613 kc. bears further checking. With an ID of R. Centro Popular, it is heard from 0040.

Cyprus—The BBC Near East Mediterranean Re-

Austria—Vienna has revised its schedule. It now reads: to the Orient at 1700-2200 on 11.845 kc. (replacing 9610 kc.); to South America at 0000-0200 on 17.755 kc. (replacing 11.956 kc.); to India and Indonesia at 1300-1500 on 17.770 kc. (replacing 17.800 kc.); to Australia and New Zealand at 0900-1100 on 17.875 kc. (replacing 17.810 kc.); to Japan at 1100-1300 on 11.875 kc. (replacing 11.725 kc.); and to South Africa at 0700-0900 on 17.875 kc. at 1200-1700 on 17.770 kc. (17.750 kc. is no longer in use). R. Sweden reports that xmtrsn from Vienna may be changed often and, in some cases, overseas programs may be purely suspended because the station will begin broadcasting with 100-kw. xmtrs in late 1966.

British Guiana—Station ZFY. Georgetown, was tuned at 5980 kc. at 0840 with singing; at 0848 with an ID for R. Drenthe, then located at 0905 with an ID and music; and at 1000 with a commercial, ID, and time given as 6:15 a.m. A morning devotional service followed.

Burma—Station XZK2. Rangoon, 4797 kc., has been monitored with the carrier on at 1055, music and s/on anmts at 1100 in Burmese. The 6032-kc. outlet carrier Program I (also in Burmese) at this time and is heard frequently.

Cambodia—R. Phnom Penh, 5940 kc., is noted at times with the best signal around 1020-1045 when
lay at Limassol operates on 15,420 kc. with Eng. until 1700 and again at 1900.

Czechoslovakia—Prague’s winter schedule reads: to Europe at 0500-0530 in German, at 0930-1100 in German to Austria, at 1100-1200 in French and at 1200-1300 in Italian on 6055 and 9545 kc.; at 1200-1230 in Eng. on 5660, 11,960, and 15,285 kc., at 1230-1300 in Spanish (Sat) and Sundays and at 1300-1330 in Spanish on 6135, 11,960, and 15,285 kc. and again at 1300-1430 in Italian (Sat) and Sundays) on 6055 & 9505 kc. at 1700-1730 in Italian, at 1830-1900 in Spanish and at 1900-1930 in Eng. on 5930 and 7345 kc.; to Africa at 1500-1530 in Swahili and at 1530-1600 in Eng. on 7245, 9550, 11,990, and 15,285 kc. (and on 6055 kc. to Europe and N. Africa), at 1630-1730 in Arabic on 7285, 9795, and 11,990 kc., at 1730-1830 in Eng. on 5930, 7285, 7345, 9795, and 11,990 kc., at 1830-1900 in French on 7285, 9795, and 11,990 kc., at 1900-2030 in Arabic and at 2030-2130 in French on 5930, 7345, 9795, and 11,990 kc.; to South and Central America at 2120-2230 in Portuguese and at 2230-2300 in Czech and Slovak on 5930, 7345, 9795 and 11,990 kc., at 2300-0000 in Spanish, at 0000-0100 in Portuguese and at 0200-0300 (to Central America and Mexico) on 5930, 7115, 7345, 9795, and 11,960 kc.; to N. A. at 1330-1400 in Czech and Slovak (Sundays only) and at 1400-1500 in Eng. (Sundays only) on 15,285, 15,448, and 17,825 kc., at 0100-0200 and 0330-0430 in Eng. and at 0300-0330 in Czech and Slovak on 5930, 7115, 7345, 9795, and 11,990 kc.; to the Far East and Australia at 0700-0800 in Eng. on 9505, 15,230, 15,285, and 21,450 kc. (and on 6955 kc. to Europe). Medium-wave xmsns to Europe include one at 2305-2330 in Eng. on 1097 kc. Several reporters also indicate that the African Service at 1530-1630 in now being carried on 15,260 kc.

Ethiopia—Station ETLP, R. Voice of the Gospel, Addis Ababa, has Eng. from 0330 on 7165 kc. on Tuesdays, Wednesdays, and Thursdays as indicated last month. This is preceded by an Arabic xmsn from 0300 and followed by another Arabic

---

Three receivers are featured in the listening post of David Smith, WPE1GBC, Everett, Mass.: a Hallicrafters S-120, a “Realistic” 148/175 fire/police receiver, and, for standby, a Hallicrafters S-119.

February, 1966
Whether on land, sea or air, your radio communications will be more dependable with TEXAS CRYSTALS... made with the same precision, care and quality as those supplied to numerous space projects. And, you’ll appreciate the attractive prices. Send for descriptive catalog today.

If your dealer can’t supply your TEXAS CRYSTALS, send his name with your order to our plant nearest you.

TEXAS CRYSTALS
A Division of Whitehall Electronics Corp.
1000 Crystal Drive  4117 W. Jefferson Blvd.
Fort Myers, Florida  Los Angeles, California
Phone 813  WE 6-2109  Phone 213 731-2258

CIRCLE NO. 38 ON READER SERVICE PAGE

...right into your tape recorder — then play it back and listen to the lively sound of your own voice — so natural, no one can tell the difference. University's new revolutionary Attaché is the smallest cardioid dynamic microphone ever made. Priced right too! Free! "Microphones "66" — a book every owner of a tape recorder should have.

UNIVERSITY SOUND
A Division of Whitehall Electronics Corp.
Dept. B-64  Box 1056
Oklahoma City, Okla.  73101

CIRCLE NO. 42 ON READER SERVICE PAGE

A Hammarlund HQ-100A receiver is used by Tom Kent, WPE8ETL, Shaker Heights, Ohio. A DX'er for only two years, Tom already has 78 countries logged.

period from 0400. The 9755-kc. outlet is tuned at 1400-1430 in native language and native music after an opening ID in English.

Formosa—Voice of Free China, Taipei, carries Eng. at 0250-0350 on 7130, 11,825, 11,860, and 15,345 kc., at 1000-1045 on 7130, 9685, 9685, 11,825, and 11,860 kc., and at 1530-1610 on 7130, 9685, 9720, 11,725, 11,825, 15,125, and 17,890 kc. The 'Dream Show' is aired at 1130-1200 on 7130, 9685, 9720, 11,725, and 17,890 kc. West Coast monitors report that the 1530-1610 kc. xmsn can only be heard on 9685, 9720, and 11,725 kc.

Gilbert & Ellice Islands—R. Topata operates VTV2, 4912.5 kc., and VTV3, 3220 kc., in Eng. on Thursdays at 0730-1030 and in Gilbertese daily except Thursdays and Saturdays at 0430-0700. The only xmsn noted in the U.S. in recent weeks was in Washington, D.C., a tentative logging of the Eng. program.

Haiti—Station 4VB, Port au Prince, formerly known as R. Commerce, was calling itself La Voix de la Revolution Duvalieriste in Eng., Spanish and French when noted on 5985 kc. from 0200 to 0400.

Israel—There is an additional xmsn on Sundays (possibly in Eng. but this is not confirmed) at 0800-1000 and in French at 1000-1100 on 11,910 kc. to Europe and on 9009 kc. to South Africa. In the evening, French begins at 2100 and Eng. at 2040-2100 on 1009, 9625, and 9725 kc.

Korea (North)—R. Pongnyang (or R. Korea—either or both may be used) has Eng. at 2300-0000 on 11,745 kc. to S. E. Asia. They open in Chinese at 2200.

Lebanon—Beirut has a xmsn to North and Latin America at 0130-0400. In French and Spanish on 9675 kc., but they still ID as operating on 9710 kc.

Luxembourg—R. Luxemboury has been noted from 2315 with Eng. religious programs on 6090 kc.

Malaysia—The Commercial Service of R. Malayasia is noted at 1000-1030 on 7300 in English. Voice of Malayasia, 6175 kc., signs on at 1115 in Eng. to S. E. Asia, Australia, and New Zealand, and gives dual channels as 11,900, 7100, and 6100 kc. English news is given at 1130. R. Malayasia Baraowak has Eng. on 5979 kc. at 1300-1400 and on 4950 kc. at 1400-1600.

Mexico—Station XEUMT, Universidad Iberoamericana, Sisoguichi, Chihuahua (mailing address: Mexico City) is on the air weekdays only with s/off at 2330 on 5960 kc. They broadcast educational programs.

Monaco—Trans World Radio, Monte Carlo, has Eng. xmsns on 7260 kc. on Mondays, Tuesdays, Wednesdays and Saturdays at 0630-0730, on Tuesdays and Fridays at 0630-0715, and on Saturdays at 0630-1230.

Netherlands—The Eng. schedule for R. Nederland, Hilversum, effective until March 6, reads: to N.A. at 1555-1615 (Tuesdays and Fridays) on 15-,
SHORT-WAVE CONTRIBUTORS

Dave Siddall (WPE1EBN), Hyannis, Mass.
Stanley Mayo (WPE1EGK), Portland, Maine
Edward Kalin (WPE1GEL), W. Hartford, Conn.
Perry Brainin (WPE2KVK), Bronx, N. Y.
Bernard Greens (WPE3MNY), Brooklyn, N. Y.
Lothar Koenig (WPE2NTB), Fort Hamilton, N. Y.
Ray Schlegel (WPE20AO), Rochester, N. Y.
Hernan Kinahan, Jr. (WPE29EE), Yonkers, N. Y.
George Sprout (WPE1GMDW), Reading, Pa.
Grady Ferguson (WPE4BC), Charlotte, N. C.
Jimmy Dearing (WPE1IES), Roanoke, Va.
Paul Juddins (WPE1LSO), Herndon, Va.
Jack Keene (WPE3SMIP), Houston, Texas
Gary Kiefert (WPE3DZD), Tecumseh, Ohio.
Shaler Hansch (WPE6BPV), Pasadena, Calif.
John Wollten (WPE2OBO), Salt Lake City, Utah
Tom Kent (WPE3ETL), Shaker Heights, Ohio
John Rosenbaum (WPE8HTO), South Blvd., Ind.
A. R. Nickel (WPE9PKM), Vincennes, Ind.
John Beaver, Sr. (WPE80AE), Pueblo, Colo.
Douglas Hammock, Jr. (WPE9EOF), Morehouse, Mo.
Bert Pfister (WPE3EI), Sudbury, Ont., Canada
Trevor Burke (WPE1IW), Victoria, B. C., Canada
Koy Cohen, Plainview, N. Y.
Bob Hill, Washington, D. C.
Gary Tremblay, Bakersfield, Calif.
John Young, Jr., Redondo Beach, Calif.
John Zapieck, Wading River, N. Y.
Radio Prague, Prague, Czechoslovakia
Sweden Calling DX’s Bulletin, Stockholm, Sweden
Swiss Broadcasting Corp., Berne, Switzerland

425 and 11,730 kc. at 2030-2050 (Tuesdays and Fridays) on 11,730 and 9525 kc., at 2050-2150 (except Sundays) and at 1855-2030 (Sundays only) on 9505 and 6085 kc., and at 0125-0220 (via Bonaire) daily on 9590 kc.; weekdays only to Australia and New Zealand at 0725-0820 on 9715, 11,730, and 11,970 kc., to S. Asia at 1425-1520 on 15,425 and 17,810 kc., to Africa and Europe at 1835-1950 on 6025 and 9590 kc., and to Europe at 1555-2000 on 6025 and 6085 kc.
There is a xman from Bonaire, daily, at 1955-2050 on 15,220 kc. The “Dutch By Radio” course has been discontinued and replaced by “What’s In The Paper!” · “Holland Makes It” has been superseded by “Holland in 1990.”

Nigeria—Voice of Nigeria, Lagos. 7275 kc., has an Eng. news summary from 2200 to 2205 s/off dual to 15,255 and 11,900 kc., but the 7275 kc. xman is not announced.

Peru—A station noted on 6350 kc. is thought to be R. Pacifico, Lima, in a possible move from 9675 kc. It was noted around 0300 on an irregular schedule and may give ID as OA.ZAK.

Station OA.XXX. R. Nazca, Nazca, 4790 kc., is tuned at 0501-0518 under nearly impossible RTTY QR.M. R. Luz, Lima, 3355 kc., is poor to fair at 0335 with Latin American music.

Portugal—Emisoras Nacional, Lisbon, has added these new services: to Canada at 0300-0345 on 5975 kc. (tuning locates French at 0255. Eng. to at least 0320) ; to New Zealand at 0730-0815 and to the Far East at 0815-0900 on 7130 and 9645 kc.; to Europe at 0915-2100 on 6025 and 7225 kc.

Rwanda—The new Deutsche Welle relay station in Kigali (250 kc.) is on the air, and Eng. is scheduled to W. Africa at 0500-0715 on 11,805 kc., at 1215-1300 on 17,705 kc. and at 1745-1830 on 17,805 kc.; and to East Africa at 1015-1045 on 9765 kc. and at 1545-1615 on 9695 kc.
Some testing is still in progress on 17,755 kc. around 1740-1945, and on 17,770 kc. between 1820 and 0100 in German, English, and French; reports are requested.

Spain—A new frequency of 9760 kc. is being used by R. Nacional Espana, Madrid, for Eng.·spank·ing listeners at 0200-0230. The program consists of light music, talks, and report requests.

Switzerland—Berne has been heard on 11,220 kc. from 2300 s/on in Spanish and later in French.
Their latest schedule lists three xman s to N. daily at 0115-0245 on 5555, 6120, and 6080 kc., at 0415-0545 on 6120 kc. and at 1215-1345 on 11,715 kc.

Thailand—A report from Thailand to R. Sweden

February, 1966

113
indicates that the Ministry of Communications has, in principle, approved a plan to allow the erection of a VOA short-wave station in northern Thailand. The planned power is 400 kw.; target date is towards the end of 1966.

U.S.S.R.—Ashkabad, Turkmen SSR, 4825 kc., has been logged once at 0300 when the powerful RTTY station that usually blankets this frequency was off. A man spoke in Turkmen at 0130 and a woman in Russian (probably a Moscow Home Service relay) at 0210.

**Vietnam City—Vatican Radio** is excellent to 1640 s/off in an African language on seldom-heard 11,875 kc. **Vietnam (North)**—According to a recent schedule, Hanoi broadcasts in Eng. at 0500-0515, 1300-1330, and 1530-1600; in French at 2245-2300, at 0415, and at 1400-1430; in Cambodian at 0930-1000 and 1230-1300; in Laotian at 0900-0930 and 1200-1230; in Thai at 0530-0600 and 1300-1330; in Cantonese at 1130-1200 and 1430-1500; and in standard Chinese (Mandarin) at 1530-1600 and 0430-0500; all on 9760, 9840, 11,640, and 11,840 kc. Other xmas were noted from 1080 to past 1130 with music and native-language news on 11.760 kc.; at 0330-0400 on 15.140 kc.; at 0400-0430 on 15.155 kc.; and at 0430 and around 1600 on 15.170 kc.

**Vietnam (South)**—Saigon is noted on 4877 kc. from 1046 to past 1140 with Home Service programs of light music and Vietnamese language. Saigon carries French daily at 1100-1200 and Eng. at 1200-1300 on 9755 kc.

**DX STATES AWARDS PRESENTED**

To be eligible for one of the DX States Awards designed for WPE Monitor Certificate holders, you must have verified stations (any frequency or service) in 20, 30, 40, or 50 different states in the U.S. The following DXers have qualified for and received awards in the categories indicated.

**FIFTY STATES VERIFIED**

Jonah Heffler (WPE2GPN), Bronx, N. Y.
Robert Ramlo (WPE9FTQ), W. Allis, Wis.
David Smith (WPE1GBC), Everett, Mass.

**FORTY STATES VERIFIED**

David Rodgers (WPE5DRJ), Buffalo, Okla.
Park Brown (WPE4EAN), Trox, N. Y.
Robin Martin (WPE2GHE), Glen Head, N. Y.

**THIRTY STATES VERIFIED**

Gary Atkins (WPE4EHL), Louisville, Ky.
David Nager (WPE2NLK), Bronx, N. Y.
Kenneth Fraga (WPE2NPH), New York, N. Y.
Phl Svingley (WPE9HLR), Muncie, Ind.
Ronald Dohmen (WPE0EGH), New Prague, Minn.
Ralph Brown, Jr. (WPE9HQQ), Lake Forest, Ill.
Gale Shafer (WPE7CBG), Deming, Wash.
Richard Laughter (WPE0DXT), Elwood, Nebr.
Charles P. Mohr, Jr. (WPE2MKI), White Plains, N. Y.
Robert Coleman (WPE4FXO), Atlanta, Ga.
Stephen B. Olsen (WPE0EAE), Robbinsdale, Minn.
Robert H. French (WPE8FGH), Bellaire, Ohio.
Arnold Galina (WPE1FGS), Worcester, Mass.
Mike Patton (WPE51AA), Houston, Texas.
John Draut (WPE2JVI), Riverdale, N. Y.
Bob Hartman (WPE2LSL), New Haven, N. Y.
Dwayne Hannah (WPE5DEM), Houston, Texas.
Mary Pollack (WPE4EBPQ), Hickory, N. C.
Fred R. Miller (WPE3GIV), Olmstead AFB, Pa.
Larry Hoffman (WPE0EGK), University City, Mo.
Robert T. Rooney (WPE3AE), Ridley Park, Pa.
Stuart I. Hecht (WPE4HKV), Jacksonville, Fla.
Joseph V. Muckin (WPE2MKF), Spotwood, N. J.
Douglas Messimer (WPE3FM2), Enola, Pa.
Ray K. Hartman (WPE2WSW), Kennewick, Wash.
Ovide Brudo (WPE1EEX), Methuen, Mass.

**TWENTY STATES VERIFIED**

Donald Stock (WPE0EHP), Waukon, Iowa.
Steve Smay (WPE0EAW), Springfield, Mo.
Dick Stout (WPE9GLW), Chatham, Ill.
Donald Reinholz (WPE8CHR), Oakland, Calif.
Mike Miltock (WPE8HUA), Los Gatos, Calif.
Ed Rudder (WPE4EXY), Halifax, Va.
Richard Kindt (WPE3GKQ), Cleona, Pa.
Wm. D. Kasperkoski (WPE2MRL), Ontario, N. Y.
Robert M. Johnon (WPE6GAL), Big Bend, Calif.
Dale Meyer (WPE8IVF), St. Clair Shores, Mich.
Elliot Strauss (WPE2NOO), West Orange, N. J.

Dennis Zink (WPE4AIR), Charlotte, N. C.
Winston Young (WPE6EQL), N. Hollywood, Calif.
David E. Bono (WPE6FVS), San Lorenzo, Calif.
Alan Pinney (WPE2MKQ), Nuneaton, N. J.
George E. Molnar, Jr. (WPE2MBW), Buffalo, N. Y.
Gerald R. Dalum (WPE0DEH), Minot AFB, N. D.
Jim Mahoney (WPE6GRD), Oakland, Calif.
James S. Wilkie (WPE0DRX), Columbus, Mo.
Richard B. Cooper, Jr. (WPE1GHA), Wayland, Mass.
Gene Boling (WPE9HQP), Muncie, Ind.

Gene Zukowski (WPE9HPY), Cicero, Ill.
David Raycroft (VE3PEFE), Hamilton, Ont., Canada.

Andy Fritz (WPE2NIK), Dayton, Ohio.
Dave Schmidt (WPE3GKR), Green Ridge, Pa.
Philip Smith (WPE8IAI), Dayton, Ohio.
Harvey Lindenbaum (WPE4HIF), Surfside, Fla.
Dennis Balls (WPE3GII), Hamer City, Idaho.
Stuart Grattle (WPE0DDO), Sioux City, Iowa.
John Kotlarik, Jr. (WPE9HND), Chicago, Ill.
Mike Cischoff (WPE4JUC), Fort Thomas, Ky.
Thomas Berry (WPE4HPS), Niceville, Fla.
William Zlobak (WPE2QNO), Bridgeton, N. J.
Arnold Matsunobu (KH6PE3O), Keaau, Hawaii.
Ray Wasky (WPE8FCK), Cleveland, Ohio.
Mario Calderi (WPE1FFP), Lincoln, R. I.
John P. Kowolik (WPE2ZLZ), New Haven, N. Y.
Gerry Cohen (WPE1FNT), W. Hartford, Conn.
Ronald Brown (WPE3FNR), Baltimore, Md.
Donald E. Robinson (WPE4IK), Athens, Tenn.
Dwain Davis (WPE1GJD), Cranston, R. I.
Rick Warner (WPE7CFV), Eugene, Oregon.
John Rosenbaum (WPE9HTO), South Bend, Ind.
Robert Weitzel (WPE0EKA), Seward, Nebr.
Clarence Haugerman (WPE2NRU), Delaware, N. J.
John Failows (WPE2EMU), Winnipeg, Man.
Canada Lyle Fredell (WPE7CKH), Tacoma, Wash.
Howard Lythe (WPE2FXY), Bronx, N. Y.
John Dyskan (WPE8BBY), Canfield, Ohio.
Ted Van Beek (WPE7BW), Morristown, N. J.
James Kubus (WPE7CGW), Ferndale, Wash.
John Hall (WPE2ZLO), Hornell, N. Y.
George Holley (WPE61P), Grose Pointe Shores, Mich.

Randy Burg (WPE6SGAR), Beverly Hills, Calif.
Michael Busse (SV1PE1E), Athens/Paiahcon, Greece.
Steve Barley (WPE4IEL), Bassett, Va.
Bruce Reynolds (WPE8EKU), Warrensburg, Mo.
Steve Passner (WPE2NSC), Bloomfield, N. J.
Mike Nichols (WPE4IKN), Atlanta, Ga.

AmericanRadioHistory.com
COMMERCIAL RATE: For firms or individuals offering commercial products or services, 90¢ per word (including name and address). Minimum order $9.00. 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, 55¢ per word (including name and address). No Minimum! Payment must accompany copy.

FOR SALE

FREE! Giant bargain catalog on transistors, diodes, rectifiers, SCR's, zeners, parts. Poly Paks, P.O. Box 942, Lynnfield, Mass.

MESHNA'S TRANSISTORIZED CONVERTER KIT $4.50. Two models convert car radio to receive 30-50 mc or 100-200 mc (1 mc tuning). Meshna, Lynn, Mass. 01901.


GOVERNMENT Surplus Receivers, Transmitters, Snooperscopes, Radios, Parts, Picture Catalog 25¢. Meshna, Nahant, Mass. 01908.

CB WPE QSL Cards. Samples Free. Radio Press, Box 24, Pittstown, New Jersey.


"SPECIALI WPE-SWL-CB-QSL cards, 3 colors, $2.50 per 100. Free Samples, Garth, Jutland, New Jersey."


WEBBER Labs. Transistorized converter kit $5.00. Two models using car radio 30-50 Mc or 100-200 Mc, one Mc spread. Easily constructed. Webber, 40 Morris, Lynn, Mass.


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.

CITIZEN BANDS! Get base station Performance with your mobile unit! 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.

TRANSISTORS—Miniature Electronic Parts. Send for free catalog. Electronic Design Control Company, P. O. Box 1432K, Plainfield, N.J.

INVESTIGATORS, FREE BROCHURE, LATEST SUBMINIATURE ELECTRONIC SURVEILLANCE EQUIPMENT, ACE ELECTRONICS, 11500-L NW 7TH AVE., MIAMI, FLA. 33168.

CIRCUIT Boards, Parts for "Poptronics" projects. Free catalog. DEMKO, Box 16297, San Antonio, Texas 78216.

TRANSISTOR ignition systems. Famous "Operation Pick-up" kit finest components only $13.95 Pp. Also other systems and components available. Free catalogue. ELECTROMART, Box 2680, Milwaukee, Wisconsin 53214.

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.

DIAGRAMS—SENT AIRMAIL—TELEVISION $3.00. RADIO 1919-1965 $2.00. GIVE MODEL. DIAGRAMS, BOX 55, WILLIAMSPORT, PA. 17704.

FREE "HOW TO BUY GOVERNMENT SURPLUS INFORMATION" With 20 pounds of New Surplus Electronic Equipment. Tubes, Transistors, Relays and countless other valuable components for $4.95. Send $1.00 deposit, shipped via parcel post. Evergreen Electronics, Box 2233, Everett, Washington 98202.

COLOR-BAR Generator, Sencore CG-126, Unused, Only $86 Jeff Fiala, 2523 S. Homan, Chicago 60623.

CONVERT any television to sensitive, big-screen oscilloscope. Only minor changes required. No electronic experience necessary. Illustrated plans. $2.00. Reico Industries, Box 10563, Houston 18, Texas.

NEW Surpressor and Silencer Transistor locators detect buried gold, silver, coins. Kits, assembled models. $19.95 up. Free catalog. Reico-A33, Box 10563, Houston 18, Texas.

ACHTUNG! Das machine is nicht fur Gengingeroken und mittengraben. Is easy schnappen der Springswerk, blowenfusen und poppen-corken mit spitzensparken. Ist nicht fur gerwerken by das Dummkopfen. Das rubber-nerkenn sightseeren keepen hands in das pockets. Relaxen und watch das Blinkenlights. This attractive, brass metal plaque only $20.00 each, p.p., Southwest Agents, Dept. P, 8331 Hwy. 80 West, Fort Worth, Texas 76116.

WALKIE-TALKIE. Construct 2 x1'x 1/2" transistorized, long range, 100 milliwatt marvel for $10. Plans, FREE GIFT, $2.00. Baker Electronics, R.R. 3, Greenecastle, Ind.

TELEPHONE VOICE SWITCH: (L5-500). ACTUATES AUTOMATICALLY AND UNATTENDED ANY TAPE OR WIRE RECORDER. PICTORIAL INSTALLATION INSTRUCTIONS INCLUDED. $23.75. POST PAID USA, WJS ELECTRONICS, 737 NORTH SEWARD, HOLLYWOOD, CALIF. 90038.

INVESTIGATORS: KEEP IN STEP WITH ADVANCEMENTS IN THE ART OF ELECTRONICS FOR THE PROFESSIONAL. SEND $1.00 FOR EQUIPMENT BROCHURE. WJS ELECTRONICS, 737 NORTH SEWARD, HOLLYWOOD, CALIF. 90038.

BUG DETECTOR: WILL DETECT AND LOCATE SUEREPHTIOUS TRANSMITTING DEVICES IN CONFERENCE ROOMS, HOME AND OFFICES, ETC. WRITE FOR DETAILS. WJS ELECTRONICS, 737 NORTH SEWARD, HOLLYWOOD, CALIF. 90038.

SAFE GUARD PRIVACY! New instrument detects electronic 'bugs,' wire-tapping and snooping devices. Free information. Dee Equipment, Box 7263-E7, Houston 8, Texas.


ELECTRONIC "CRACKAJACKS," transistors—photocells—relays. Guaranteed prize box $1.00 plus 15¢ pp. DART ELECTRONICS, Box 214, Jericho, N.Y.

REVERBERATOR (ECHO) UNIT: Build your own. Complete plans, drawings, schematic and parts list. $3.00. Use with automobile radio, home radio or record player. Technical Writers Group, Box 5501, State College Station, Raleigh, N.C. 27607.

RADAR: Build your own ultrasonic doppler radar. Detect motion of people, automobiles, even falling rain drops. Transistorized, uses standard small 9-volt battery. Complete plans, drawings, schematic diagrams and parts list. $4.00. Technical Writers Group, Box 5501, State College Station, Raleigh, N.C. 27607.


LOWEST Prices Electronic Parts. Confidential Catalog Free. KNAPP, 3174 8th Ave. S.W., Largo, Fla.

BUILD A "LIVE" TV CAMERA CHEAPER THAN EVER! Simplest 5 tube circuit to date. EXCELLENT PERFORMANCE is ensured by hundreds of constructors all over the country. Circuit specifically designed to use maximum number of standard, readily available parts—most can be obtained from "junkbox" or discarded TV sets. We furnish only the hard-to-find components and EASY-TO-FOLLOW PLANS. Choose from 6 different kits (including printed circuit models). Prices start as low as $16.95! Plans included FREE with each kit or available separately for $3. Low reflectiv second order of any kit. PERFECT FOR HAMS, EXPERIMENTERS, SCIENCE FAIR STUDENTS. Check our unbelievable prices. RUSH 10¢ FOR INFORMATION PACKED CATALOG. Box 396P, ATI RESEARCH, South Sioux City, Neb. 68776.


FREE ELECTRONICS (new and surplus) parts catalog. Bigelow Electronics, Buffalo, Ohio 44517.

BARGAINS! Electric Motors! Supplies! Manuals! Modelec, Box 10025, Kansas City, Mo. 64111.

SECURITY ELECTRONICS introduces its NEW 1966 line of SURVEILLANCE EQUIPMENT. Improved NEW designs for maximum performance and greater value. FREE DETAILS. Security-Electronics, 890, N.Y., N.Y. 10017.


DETECTIVES GO or no GO in HIGH QUALITY LOW COST Electronic Surveillance Equipment SILMAR MAKES the DIFFERENCE. Write Todday! SILMAR ELECTRONICS, 3476 N.W. 7th Street, Miami, Fl., 33125.

TRANSISTORCOM AMPLIFIER KIT $2.95 ppd. Manufacturers surplus, Complete with switch & PC board. Assembles in 1 hour. Detailed instructions, multi-remotes. Assembled—tested $1.00 extra. DART ELECTRONIC DEVICES, BOX 214, JERICHO, N.Y.


MINIATURE Relays Half-Size DPDT 24 Volt Coil $3.98, Crystal Cans $2.75. Write For Literature. Radco, P.O. Box 10473, San Diego, Calif. 92110.

IT'S SUPERCALIFRAGILISTICEXPIALIDOCIOUS, Free information on Kit-of-the-Month Club and new catalog of etched circuit boards and radio books. Many exclusive items. Leader Enterprises, Box 44718KP, Los Angeles 90044.

BEEP . . . BEEP . . . BEEP . . . 100 milli watt, 3 transistor, 2"x1½"x½" CB telemetering transmitter signals its location for miles. Hundreds of scientific and James Bond uses. Build for $5.00. Illustrated construction manual and FREE GIFT, only $2.00. Details free. Baker Electronics, R.R. 3, Greencastle, Indiana 46135.

110VAC 60cy 350 Watts. From car generator. Easy conver- sion. Plans $2.00. TEDCO, P.O. Box 12098, Houston, Texas 77071.


GIANT TESLA COIL—FORTY-INC SPARKS! Complete plans, photo $5.00; details 30¢. Huntington Electronics, Inc., Box 9, Huntington Station, Shelton, Conn. 06486.

MOISTURE METER electronically determines moisture content of soil. Tells when to water lawn, etc. Plans $1.50. Holiday, 2614 Fillmore, El Paso, Texas 79930.


PRINTED envelopes, return address labels, business cards. Free samples. G. Schollingsberg, 2737 Lake St., Salt Lake City, Utah 84106.

TV CAMERA UNDER $40.00—Completely transistorized space-age Flying Spot Scanner, Schematics. Photographs —Plans for $3.00. Beck, 2950 Sarah Court, Newport Park, Calif. 91320.

NEED RESISTORS? Brand new, FAMOUS NAME, ½ watt 10% standard carbon. Any regular 10% value from 10 ohms to 2.7 megohms, $0.50 each. Postpaid. Any quantity assorted. Pick your own values. Minimum order $1.00. Immediate delivery. TEPCO, Box 508, Tullahoma, Tenn. 37388.

ELECTRONIC SURVEILLANCE DEVICES, detects, hobby- ists. SNOOPER FM wireless microphone $44.50. TAILA- BEEP, bumber beeper $74.50. TELEGAB phone transmitter $49.50. Other guaranteed high quality items in our catalog. Fudulaa Associates, 1134 Avenue Road, Toronto 12, Ontario, Canada.

COMPLETE beams, ½"-1" aluminum; Four-Element Citiziens Band $15; Three-element 15 meters $16; Three- element 20 meters $22; Express collect. GOTHAM, 1807 Purdy, Miami Beach, Fla.

5 LIGHT SENSITIVE CELLS—The same type used in satellites and computers, $1.00 buys $35.00 worth of cells. Can be used for switching devices, electric eye door openers. Circuit diagram enclosed. Postpaid. Limited time offer. Solar Systems Inc., 8210 W. Kimball Ave., Skokie, Ill.
TEST TRANSISTORS using your multimeter, Tester $2.98, 35 Electronics, P.O. Box 501, Mundelein, III. 60060.

MESSENGER III, 11 sets of crystals, mobile antenna, Ceseo "Transcheck," All for $189.95 plus shipping. Randall Communications, 7035 N. 39th Street, Milwaukee, Wis. 53209.

TAPE RECORDER SALE. February, 1966

WANTED


WANTED Laboratory Test Equipment. Electronicaft, P. O. Box 13, Binghamton, N.Y. 13902.

AUDIO/RF ENGINEER WANTED Rapidly growing high fidelity manufacturer wants talented circuit designer with experience in audio and RF. Located in New England, offers tremendous opportunity. Send resume to: Box 115, Popular Electronics, One Park Ave., New York, N.Y. 10016.

TUBES

BEFORE You Buy Receiving Tubes, Transistors, Diodes, Electronic Components and Accessories . . . send for Giant Free Zalbytron 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? Zalbytron Tube Corp., 469-E Jericho Turnpike, Mineola, N. Y. 11502.

TUBE Headquarters of World! Send 10¢ for Catalog (tubes, electronic equipment) Barry, 512 Broadway, N.Y.C. 10012.

RADIO & T.V. Tubes—33¢ each. Send for free list. Cornell, 4213 University, San Diego, California 92105.


TAPE AND RECORDERS

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 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-ME Terrace Way, Santa Rosa, California.

STEREO TAPES. Save up to 60% (no membership fees, postpaid anywhere U.S.A.). Free 60 page catalog. We discount batteries, recorders, tape accessories. Beware of slogans "not undersold," as the discount information you supply our competitor is usually reported to the factory. SAXITONE, 1776 Columbia Road, Washington, D.C.

TAPE RECORDER SALE. Brand new, latest models, $10.00 above cost. Arkay Sales, 1028-C Commonwealth Ave., Boston, Mass. 02215.
TOOL Catalog send 25¢. Silvo Hardware, 107 Ziff Walnut, Phila., Penna. 19106.

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.

METERS-TEST EQUIPMENT REPAIRED-CALIBRATED, free catalog. Bigelow Electronics, Bluffton, Ohio 45817.


SHORTWAVE LISTENING

SWL GUIDE, English programs listed by the hour. 1966 EDITION, $2.00. SWL Guide, 218 Gifford, Syracuse 2, N.Y.

RADIO NEW YORK WORLDWIDE announces formation of SWL Club! A unique club for shortwave listeners, offering services as: Address Bureau, aiding members in locating station’s addresses; Identification Bureau, helping listeners identify unknown stations; Monthly Bulletins, sent to all members. Want to join? Send $1.00 to Radio New York Worldwide SWL Club, New York, N.Y. 10019.

PATENTS

INVENTIONS; Ideas developed for Cash/Royalty sales. Raymond Lee, 130-G West 42nd, N.Y.C. 10036.

CLASSIFIED ADVERTISING ORDER FORM

Please refer to heading on first page of this section for complete data concerning terms, frequency discounts, closing dates, etc.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>11</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>16</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>21</td>
<td>22</td>
<td>23</td>
</tr>
<tr>
<td>26</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>31</td>
<td>32</td>
<td>33</td>
</tr>
<tr>
<td>Words @ 55¢ (Reader Rate)</td>
<td>=</td>
<td>$</td>
</tr>
</tbody>
</table>

Insert time(s) Total Enclosed $2.88.

NAME

ADDRESS

CITY ZONE STATE

Signature

WORD COUNT: Include name and address. Name of city (Des Moines) or of state (New York) counts as one word each. Zone or Zip Code numbers not counted. (Publisher reserves right to omit Zip Code if space does not permit.) Count each abbreviation, initial, single figure or group of figures or letters as a word. Symbols such as 55mm, COD, PO, AC, etc., count as one word. Hyphenated words count as two words. PE-266

118  POPULAR ELECTRONICS
HIGH FIDELITY

"LOW, Low quotes: all components and recorders. HiFi, Roslyn 9, Penna."

HiFi 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, 239 (P) East 149th Street, New York 10451.

FREE! Send for money saving stereo catalog £2P£2E and lowest quotations on your individual component, tape recorder, or system requirements. Electronic Values, Inc., 200 W. 20th St., New York, N.Y. 10011.

NEW Mfrs. B.S.R. record changers, UA15 model with stereo cartridge $13 each. Parts guaranteed or units exchanged. Quantity discount. CHANGERS, Box 144, Jerome Avenue Station, Bronx, N.Y. 10468.

EQUIPMENT


INSTRUCTION

LEARN While Asleep, hypnotize with your recorder, photograph. Astonishing details, sensational course free! Sleep-Learning—Electronic Parts. Send name, address and zip code number to McGee Radio Company, 1901 McGee Street, Dept. EQ, Kansas City, Mo. 64108.


PICTORIAL Study In Amateur Radio. Free Details. Dwight Cross, 1212 Lynch, St. Louis, Mo. 63118.

RESUME Writing Instructions $1.00. Fred Holder, Box 1364 Fleetwood Annex, Covina, Calif.


IBM 1401 Programming CAN be learned by Home Study. For information write to SAS, Box 437, New York 10009.

FCC LICENSE TRAINING THROUGH TAPE RECORDED INSTRUCTION. Bob Johnson Audio-Visual License Training, 1201 Ninth, Manhattan Beach, Calif.

MUSICAL INSTRUMENTS


INVENTIONS WANTED


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.

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 Needing Help with any problem, financial, development, securing manufacturer, obtaining patent. Write the organization that delivers action and results—not promises. Pioneer Invention Service, Dept. 79, 150 Broadway, New York 38, N.Y.


INVENTORS! Don't sell or license your Invention for cash or royalties until you receive our offer. Financial assistance available. For Free Information, write: Dept. 71, International Invention Institute, 17 Park Row, New York 38, N.Y.

AUTHORS' SERVICES

AUTHORS! Learn how to have your book published, promoted, distributed. FREE booklet "ZD," Vantage, 120 West 31 St., New York 1.

WANTED WRITERS! Short stories, articles, books, plays, poetry. Will help place, sell your work. Write today, free particulars! Literary Agent Mead, Dept. 37A, 915 Broadway, New York 10, N.Y.


February, 1966 119
GOVERNMENT SURPLUS

"GOVERNMENT SELLS!"—Surplus Electronics; Oscilloscopes; Transceivers; Test Equipment; Radar; Walkie-Talkies; Boats; Jeeps; Aircraft; Misc.—Send For—"U.S. Depot Directory-Procedure"—$1.00—Service, Box 425 (ZB), Nanuet, N.Y.

GOVERNMENT Surplus. Complete Sales Directory $1.00. Surplus Publications, Box 45781E, Los Angeles 45, Calif.


JEOPS Typically From $53.90 . . . Trucks From $78.40 . . . Boats, Typewriters, Airplanes, Electronics Equipment, Photographic Equipment, used. 100,000 Bargains Direct From Government. Complete Sales Directory and Surplus Catalog $1.00 (Deductible First $10.00 Order). Surplus Service, Box 820-J, Holland, Mich. 49424.

BOOKS


FREE catalog Aviation/Electronic/Space books. Aero Publishers, Inc. 329 PE Aviation Road, Fallbrook, Calif. 92028.

FREE CHECKLIST—ELECTRONICS BOOKS THE WORLD-OVER FROM EXCLUSIVE U.S. DISTRIBUTOR. LISTS ALSO AVAILABLE OF COUNTLESS OTHER SPORTS, HOBBIES, LEISURE TIME ACTIVITIES. INDICATE SPECIAL INTERESTS. ENCLOSE 10c FOR POSTAGE AND HANDLING. WIDE WORLD BOOK CENTER, P.O. BOX 153, NEW ROCHELLE, N.Y. 10802.

MOVING?

ATTACH LABEL HERE

If you've recently changed your address or plan to in the near future, be sure to notify us at once. Affix address label showing old address here, and print new address below.

My New Address is:

<table>
<thead>
<tr>
<th>name</th>
<th>please print</th>
</tr>
</thead>
<tbody>
<tr>
<td>address</td>
<td></td>
</tr>
<tr>
<td>city</td>
<td>state</td>
</tr>
<tr>
<td>zip-code</td>
<td>date at new address</td>
</tr>
</tbody>
</table>

Notify us of your address change as far in advance as possible—it takes about 2 months for a change to become effective. (E.g. A notice received in May becomes effective with the July issue.)

Mail to: POPULAR ELECTRONICS

1255 Portland Place, Boulder, Colorado 80311

ELECTRONICS HANDBOOK. Packed with information. Definitions, charts, tables, etc. $1.50. General Research, P.O. Box 545, Warrenton, Virginia.


MUSIC

POEMS wanted for new songs. Nashville Music Institute, Box 532-E, Nashville, Tennessee.

ENJOY "Music-Only" programs now available on the FM broadcast band from coast to coast with M.A.'s sub carrier detector used with your tuner. Kit $49.50 Wired $75.00. Music Associated, 65 Glenwood Road, Upper Montclair, N.J. (201) 744-3387.

REAL ESTATE

FLORIDA WATER WONDERLAND—Home, cottage Mobil-sites. Established area. $590 full price, $9.00 a month. Swimming, fishing, boating. Write: Lake Weir, Box KG38, Silver Springs, Fla. AD 6-1070 (F-1)

FREE!—ALL NEW SPRING CATALOG. Giant 180 pages! Thousands of properties described, pictured—Land, Farms, Homes, Businesses—Waterfront, Recreation, Retirement. Selected Best Buys from The World's Largest. 490 Offices, 35 states Coast to Coast. Mailed FREE! STROUT REALTY, 60-2D East 42nd St., N.Y., N.Y. 10017


FREE! 152-page 1966 SPRING catalog! Over 1800 PICTURES! Farms, Ranches, Homes, Businesses, Vacation and Retirement Properties in 28 states coast to coast! UNITED FARM AGENCY, 612-EP West 47th St., Kansas City, Mo. 64112.

HYPNOTISM

FREE Hypnotism, Self-Hypnosis, Sleep Learning Cata-log 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.

HYPNOTIZE secretly, cleverly, one glance . . . or money back. $2. Eltons, Box 18223-P21, Indianapolis, Indiana 46218.

PHOTOGRAPHY—FILM, EQUIPMENT, SERVICES

MEDICAL Film—Adults Only—"Childbirth"—1 reel 8mm $7.50—16mm $14.95. International-E, Greenvale, L.I., New York.


PERSONALS

INVESTIGATORS, FREE BROCHURE, LATEST SUBMINIA-TURE ELECTRONIC SURVEILLANCE EQUIPMENT. ACE ELECTRONICS, 11500-K NW 7th AVE., MIAMI, FLA. 33168.


"HYPNOTIZE . . One word . . One fingersnap," on stage. Satisfaction—or refund. $2.00. Hypnomanister, Box 9309-E8, Chicago 90.
EDUCATIONAL OPPORTUNITIES

LEARN While Asleep. Remarkable, Scientific, 92% Effective. Details Free. ASR Foundation, Box 7021, Dept. e.g., Lexington, Kentucky.

B.Sc. DEGREE (Engineering) or College Entrance by home study. Send $1 for 1966 Prospectus. CIST, Suite 694, 263 Adelaide St. W., Toronto, Canada.

DO-IT-YOURSELF

SAVE! Build Transistorized Treasure Finder. Details Free. Del Research, Box 347E, Alden Manor, Elmont, N.Y.

PHOTOGRAPHS

PHOTOGRAPHS and transparencies wanted, to $500.00 each. Valuable information free—Write Intraphotograph-PE. Box 74067, Hollywood 90004.

BUSINESS OPPORTUNITIES


VENDING Machines—No Selling. Operate a route of coin machines and earn amazing profits. 32-page catalog free. Parkway Machine Corporation, 715P 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, 3543 East 16th, Los Angeles, California. 90023.

I MADE $40,000.00 Year by Mailorder! Helped others make money! Start with $10.00—Free Proof. Torrey, Box 3566-N, Oklahoma City, Oklahoma 73106.

PIANO Tuning learned quickly at home. Tremendous field! Musical knowledge unnecessary. Information free. Empire School of Piano Tuning, Dept. PE, Box 327, Shenandoah Station, Miami, Florida 33145. (Founded 1935.)


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.


EARN BIG MONEY! Learn Electric Appliance Repairing at home in your spare time. How to use Christy Electronic Tuner and Trace to make repairs. Make $5-6 per hour in kitchen or basement. Pay later. Send for FREE BOOK. CHRISTY TRADES SCHOOL, 3214 W. Lawrence, Dept. A-2714, Chicago 60625.

FREE ADVERTISING in 100 Electronic Magazines, Details 10c. Dee, Box 211, Beverly Hills, Calif.


MAILORDER LAWS $2.00. Kelvin Kahn; Attorney, 4504 Pine, Philadelphia, Pa.

EARN MONEY AT HOME in spare time repairing all appliances. Do housewiring, motor rewinding, electrical maintenance. We show you how. send 8 trouble shooting instruments, business getting materials, etc. Write for FREE book. Pay Later Plan, Advance Trades School, Dept. E-118, 5944 Newark, Chicago 60631.


FREE "Franchise Profit Letter" tells how unique NFR service is helping thousands seeking profitable business. Write today. National Franchise Reports, D-528, 333 North Michigan, Chicago 60601.

EARN $240.00 a Month at home, spare time, doing only two $5.00 Invisible Mending jobs a day. Big money paid for service that makes cuts, tears disappear from fabrics. Steady demand. Details free. Fabricon, 1572 Howard, Chicago 26, Ill.

REMAILING SERVICE


EMPLOYMENT INFORMATION


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.

CALIFORNIA EMPLOYMENT. Selected names, addresses of Electronic and Aerospace companies now hiring. Airmail. $2.00. Employment, 3105 Mount Vernon, Bakersfield, Calif.

---

First Time

FREE

3-TRANSISTOR AMPLIFIER SALE

$1.00

FREE POLY PAK WORTH

$25

BONUS $1 FREE

3 INFRA-RED DETECTORS, $1 with leads 100's of projects.

$1

30 COILS & CHOKES, $1.00 each, transformers, etc...

$1

10 ELECTROLYTICS 1.5, 3.0, 6.0, 12.0, 25.0, 50.0 & 100.0 volt.

$1

30 HOBBY TRANS'RS; 1F, Rf, C, etc, Harmony, etc...

$1

60 CERAMIC COND'RS; 25, 35, 50, 63, 100, 125, 220, 330, 470, 680, 1000, 2200, 10,000, 22,000, 47,000, 100,000, 220,000 micro.

$1

25 "EPoxy" SILICON DIODES,750 mil, silicon untested.

$1

60 INSUL'YD RESIST'RS 1/2, 1/2, 1.2W, Carbon, 5% toler.

$1

30 POWER RESIST'RS, 3 to 30W, to 25,000 ohms.

$1

10 LITTLE "LYTICS" FOR transistor sets, 10-1150mfd.

$1

15 PNP TRANSISTORS CXC72, 2N197, etc., cases.

$1

5 SOLAR "SUN" CAPS 12V 1.2Wamt.

$1

50 ONE-WATTERS 300V, 3A, 5% toler.

$1

10 RCA PLUG/JACK SETS, 150 stud, 150 Pcs. 4 prig.

$1.50


$1

40 DISC COND'RS 1000pf to 10uf.

$1

40 PREC'SN RES'TRS 1/2, 1/2W, ass't. 1% values.

$1

75 HALF WATTERS 300 Volts.

$1

10 VOLUME CONTROL 300V, 3A, 5% toler.

$1

10 NPN TRANSISTORS B-5, 2N3904, 2N3905, etc.

$1

4 TRANSFORMERS FOR transistor projects.

$1

100 PRINTED CIRCUIT parts, hobby & mini work.

$1

150 TRANSISTOR SOCKETS 100pf to 40uf.

$1

10 TRANS'TRS, 2N3055, 2N3056, etc.

$1

FREE ROYAL AIDE, $1.00 PAK.

$1

FREE 3-TRANSISTOR AMPLIFIER $1.00.

$1

FREE POLY PAKS P. R. BOX 6423;

So. Lynnfield, Mass.

Circle No. 29 on Reader Service Page

February, 1966
STAMPS AND COINS

500 DIFFERENT, $1.00. Approvals. Smith, 508E Brooks, College Station, Texas 77840.

FREE—Mint British Colonials from Antarctic Territory, Borneo, Brunei, St. Christopher, Nevis, Caymans, Trangganu, Pitcairns, Free with approvals. VIKING, Great Neck 50, N.Y.

WOW! 110 ALL Different Germany 10¢ Commemoratives, Airmals, High Values, Big catalog, bargain lists plus selections of fine stamps from our approval service, returnable without obligation. Jamestown Stamp, Dept. A26EG, Jamestown, N.Y. 14701.

VALUABLE UNITED STATES STAMPS—Only 10¢! Scarce genuine centennial postage stamp, picturing first USA (issued in 1847!); Collection all-different United States—Ancient 19th Century, $1.00 stamp, etc.; Collection beautiful commemoratives: American Revolution, Wild West, 1893 Columbian, many others. Plus Collector's Guide; other fine stamps from our approval service returnable without obligation; Complete new profusely illustrated USA Catalog, only 10¢! H.E. HARRIS, Dept. C-34, Boston, Mass. 02117.

VALUABLE COLLECTORS’ ITEMS! John F. Kennedy commemorative envelope bearing portrait of famous President and highly- prized First Day Cancellation on his 47th birthday. PLUS Assassination Anniversary Cover postmarked officially with scarce NOVEMBER 22nd DALLAS, TEXAS CANCELLATION! As an introduction to the World’s Most Rewarding Hobby—Rush 25¢ for both historic Memorial Treasures. We’ll also send fine stamps from our approval service returnable without obligation—plus FREE Collectors’ Catalog and New Offers of JFK stamp issues just released! Kenmore Stamp Co., Milford KP-934, New Hamp.

MAGNETS

ALNICO-CERAMIC—FLEXIBLE—ASSEMBLIES. What you need, we have. Maryland Magnet, 5412H Gist, Baltimore, Md. 21215.

MISCELLANEOUS

BEERS, PEACH BRANDY, WINES—Strongest Formulas, $2.00. (Complete brew supplies—hydrometers catalog 10¢)—Research Enterprises, 29-D Samoset Rd., Woburn, Mass.

RADIO ANNOUNCING. Learn Homel Books, magazines: Disk Jockey, Box 11-PE, Aberdeen, South Dakota 57401.

WINEMAKERS: Free illustrated catalog of yeasts, equipment. Semplex, Box 7208, Minneapolis, Minn. 55412.

POEMS or New Songs Wanted. Tin Pan Alley, Inc., 1650 Broadway, New York, N.Y. 10019.

STAMMER—Stutter—No More. (Dr. Young). Write: Gaucho, Box 9309-E8, Chicago 90.

POPULAR ELECTRONICS
February 1966
ADVERTISERS INDEX

READER
SERVICE NO. ADVERTISER PAGE NO.
1 Allied Radio .................. 90
American Institute of Engineering & Technology .................. 94
2 Antenna Specialists Co., The .................. 27
52 B & K Manufacturing Co. .................. 111
3 Browning Laboratories, Inc. .................. 102
4 Burstein-Applebee Co. .................. 109
Capitol Radio Engineering Institute, The .................. 16, 17, 18, 19
Christy Trades School, Inc. .................. 108
5 Cleveland Institute of Electronics .................. 34, 35, 36, 37
6 Consolciated Auto Wholesalers, Inc. .................. 119
7 Cyan Electronics .................. 108
8 Cyan Electronics Institute .................. 94
9 DeVry Technical Institute .................. 7
10 EICO Instrument Co., Inc. .................. 39
11 Eastman Kodak Company .................. 83
12 Electro-Voice, Inc. .................. 110
FOUTH COVER
106 Empire Scientific Corp .................. 94
13 Finney Company, The .................. 31
14 Fisher Radio Corporation .................. 23
Gernsback Library Inc. .................. 9
25 Grantham School of Electronics .................. 110
26 Hallicrafters .................. 40
17 Heath Company .................. 66, 61, 62, 63
18 Hy-Gain Electronics Corp. .................. 18
29 International Correspondence Schools .................. 5
20 International Crytal Mfg. Co. .................. 110
21 JFD Electronics Corporation .................. 11
22 Jerold Electronics Corporation .................. 91
32 Johnson Company, E.F. .................. 33
23 Kuhn Electronics Inc. .................. 23
24 Lafayette Radio Electronics .................. 97
30 Mercury Electronics Corp. .................. 98
35 Metrok Electronics, Inc. .................. 85
24 Milwaukee School of Engineering .................. 103
25 Multi-Elmac Company .................. 99
26 National Radio Institute .................. 29
27 National Technical Institute .................. 112
28 New-Tronics Corporation .................. 109
29 Olson Electronics Incorporated .................. 11
30 Pace Communications Corp .................. 10
31 Peace-Simpson, Inc. .................. 12
32 Poly Pak .................. 19
33 Precision Electronics Division of Designatronics, Inc. .................. 21
34 Progressive "Ed-Kits" Inc. .................. 11
32 RCA Electronic Components and Devices .................. 25
38 RCA Institutes, Inc. .................. 104, 105, 106, 107
39 Ray-Tel .................. 20
40 Raytheon Company .................. 20
41 Remington Rand U.S.I. .................. 85
42 Regency Electronics, Inc. .................. 85
43 Rotron Corporation ................. .................. 6
44 SBBG .................. 100
45 Sams & Co., Inc., Howard W. .................. 38
46 Shure Brothers, Inc. .................. 30
47 Sonar Radio Corporation .................. 101
48 Squires-Sanders, Inc. .................. 8
49 Telex .................. 92
50 Texas Instruments .................. 112
51 Turner Microphone Company, The .................. 14
52 U.S. Army .................. 28, 29
53 United Radio Co. .................. 112
54 University Sound .................. 94
55 Valparaiso Technical Institute .................. 43
56 Walker Electric Corp. .................. 4
57 Xcellite Inc. .................. 26

CLASSIFIED ADVERTISING 115, 116, 117, 118, 119, 120, 121, 122

122 POPULAR ELECTRONICS

Printed in U.S.A.
RCA all-new, rare-earth Hi-Lite Color Picture Tubes are being stocked by smart dealers who are ready for the replacement color picture tube business.

why?

Hi-Lite's rare-earth phosphors provide picture brightness unsurpassed in the color TV industry. Natural color reproduction. Great black-and-white pictures, too! RCA's Hi-Lite Color Picture Tube Line is here. Now! Available in 19-inch and 25-inch rectangulars and 21-inch round tube types.

What about you? Are you ready for color?
These new beauties are tough. No fragile plastics or lightweight metal. A 400-ton high-pressure die-casting machine turns two pounds of molten metal into a solid stand that laughs at heavy service. And tough baked enamel plus heavy chrome plating guarantees lasting good looks.

Just touch the big bar to talk. It latches on with a simple, sliding motion. Or move it to the grip-to-talk position on the stand riser in just minutes, with only a screwdriver. The DPDT telephone-type leaf switch will last a million calls or more. It operates both voice and relay circuits, with optional electronic switching available at the end of the 619 (Hi-Z) and 719 cable.

All models are omnidirectional, and come complete with heavy-duty cable. Most economical is the Model 719 ceramic. Response is from 80 to 7,000 cps at -56 db output.

For top quality, choose the Model 619 dynamic models with exclusive E-V Acoustalloy diaphragms. Smooth, peak-free response from 70 to 10,000 cps at -56 db output insures highest talk power and full modulation. Choose either Hi-Z or balanced Lo-Z model.

Try one of these rugged new beauties today. You'll find that your rig never sounded—or looked—so good!

ELECTRO-VOICE, INC.
Dept. 262P, 630 Cecil Street,
Buchanan, Michigan 49107

*We cover our bet with a lifetime guarantee. If any 619 or 719 ever fails, just send it to us. We'll repair it at nominal cost. But if there's even a hint that our workmanship or materials weren't up to par, the repair is on the house—even 30 years from now! Fair enough?