BUILD ALL-PURPOSE ALARM SYSTEM

POPULAR ELECTRONICS

HI-FI STEREO THEME ISSUE

• Transistors Take Over Hi-Fi
• Build Transistor 6-Watt Amplifier
• The Last Decade in Hi-Fi
• Plastic Speaker Enclosure

ALSO:

• Convert FM Tuner to Police Band
• Stack TV Antennas for DX
• Sun-Powered Transistor Portable

AmericanRadioHistory.Com
sands Who Gained Through NRI

**TRAINING KITS XCITING, FAST**

Many of NRI graduates, Industrial Electronics and Radio Technician futures and Training men to electronics has been. NRI pioneered some instruction, equipment further-time-proved way train. With NRI letter position with you on greater attar after how much have plans.

Make $3 to $5 An Hour in Spare Time

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

Skilled Technicians Are in Demand

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

Achievement Kit Gets You Started Fast

As soon as you enroll with NRI we deliver to your door everything you need to make a fast start in the Electronics training of your choice. This new Achievement Kit is an unparalleled example of the value of NRI home-study training. No other school has anything like it. Find out about the NRI Achievement Kit, about NRI training equipment, about NRI courses, about opportunities for success in Electronics. Send for the NRI catalog. There's no obligation. No salesman will call. NRI, 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 electricity to home entertainment equipment. You learn to fix radios, hi-fi and stereo sets, black-and-white and color TV, etc. A profitable field full or part time.

2. **INDUSTRIAL-MILITARY ELECTRONICS**
   - From basic principles to computers. A comprehensive training plan that teaches you the fundamentals, then takes you into such modern-day miracles as servos, telemetry, multiplexing, pulse circuitry, data processing, other important subjects.

3. **COMPLETE COMMUNICATIONS**
   - Designed to teach you and provide you with actual practice in operation, service and maintenance of AM, FM and TV broadcasting stations. Also covers marine, aviation, mobile radio, facsimile, microwave, radar.

4. **FCC LICENSE**
   - Specifically designed short course to prepare you for your First Class FCC Radiotelephone License examinations. You begin with a thorough background in fundamental Electrical principles, advance to required subjects covering equipment and procedures.

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

6. **BASIC ELECTRONICS**
   - A concise course to teach modern Electronic terminology and components. A wealth of practical, useful information to help you better understand the field, to give you some technical knowledge. For anyone who wants basic understanding of Radio-TV Electronics.

7. **ELECTRONICS FOR AUTOMATION**
   - This course is not for beginners. Offered for men with some fundamental knowledge of Electronics who want better understanding of Auto equipment in present day use. Covers process control, ultrasonics, telemetering, and remote control, electromechanical measurements, other subjects.

8. **AVIATION COMMUNICATIONS**
   - This course prepares you to install, maintain service aircraft communications equipment. Covers direction finders, ranges, markers, Loran, Shoran, Radar, landing systems. Earn your First Class FCC License with Radar Endorsement.

9. **MARINE COMMUNICATIONS**
   - Covers transmitters, direction finders, depth indicators, radar, sonar, other equipment used on commercial ships and thousands of pleasure boats. Prepares you for a First Class FCC License with Radar Endorsement.

10. **MOBILE COMMUNICATIONS**
    - Learn to install and maintain mobile equipment and associated base stations. Covers transmitters and receivers used by police and fire departments, public utilities, construction projects, taxis, etc. Prepares you for a First Class FCC License.

*NOTE: You must pass your FCC License exam (or Communications course) or NRI refunds in full tuition you have paid.
The Oldest and Largest School of its Kind in America

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 Hi-Fi/Stereo and Audio Features

1956–1965: Hi-Fi Ten Years Later ............................................ Lawrence LeKashmon 41
Hi-Fi Stereo for '66—in Solid .................................................. Hans Fantel 47
Unique 99¢ Speaker Enclosure ............................................... John N. Ayres 52
Solid-State 6-Watt Amplifier for 10 Bucks ......................... Charles E. Fenoglio 78

Electronic Construction Projects

Super-Sens .............................................................. Louis E. Garner, Jr. 57
Protect Your Car's Electrical System ............................. Charles Erwin Cohn 66
Don't Junk Your Old FM Tuner ........................................ Charles E. Francis, K8VRX 83
Let the Sun Power Your Portable ..................................... Homer L. Davidson 85
Tonal Darkroom Timer or Metronome .......................... Frederick W. Chesson 95

Communications

Satellites on the Air .......................................................... 38
Predicted Radio Receiving Conditions ..................... Stanley Leinwoll 72
Short-Wave Listening: Safety Rules for SWL's ............. Hank Bennett, W2PNA 87
DX Canada Awards .......................................................... 88
English-Language Newscasts to North America ............. Robert Legge 89
On the Citizens Band: Project Interview on TV .......... Matt P. Spinello, KHC2060 90
Ham Hobby Clearinghouse .................................................. 92
Amateur Radio: Useful Tips on Contest Operating .......... Herb S. Brier, W9EGQ 93
Short-Wave Monitor Certificate Application .................香港 Bennett, W2PNA 127
DX States Awards Presented ............................................. 128

Electronic Features and New Developments

Zero-Beating the News ..................................................... 54
The Ham ................................................................. Walt Miller 56
How to Stack TV Antennas to Increase Signal Strength and to Reduce Ghosts ........................................ Lon Cantor 63
Electronic Math Quiz ......................................................... 67
Parts Profiles ................................................................. 76
Solid State ................................................................. Lou Garner 78
ALPHA-COM ................................................................. 81
Get That Beam Antenna Shot ........................................... 82

Departments

Letters from Our Readers ................................................... 6
Reader Service Page .......................................................... 15
New Products .................................................................. 22
Tips & Techniques ............................................................. 27
Electronics Library ............................................................. 30
Operation Assist ............................................................... 100

Copyright © 1965 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. November, 1965. Volume 23, Number 5. (Ziff-Davis also publishes Skiing, Flying, Business/Commercial Aviation, Popular Boating, Car and Driver, Popular Photography, HiFi-Stereo Review, Electronics World, Modern Bride, and Skiing Trade News.) One year subscription rate for U.S., U.S. Possessions and Canada, $4.00; all other Foreign, $5.00. (Schedule for payment in foreign currencies may be found elsewhere in this issue.) Second Class postage paid at Chicago, Illinois, and at additional mailing offices. Authorized as second class mail by the Post Office Department, Ottawa, Canada, and for payment of postage in cash.
5,000 FIRMS HAVE EMPLOYED DE VRY TECH ELECTRONICS GRADUATES...

There Must Be a Reason!

Let Us Prepare You at Home or In One of Our Two Big Resident Schools for a Profitable Career in ELECTRONICS

Across the continent, leading employers of personnel trained in electronics tell us that De Vry training is "Tops." Get the full story of De Vry Tech and the advantages it offers, by filling in the coupon below. The two free booklets pictured below tell of many fine opportunities for trained men in electronics: the great variety of jobs, from research, production, operation, maintenance and servicing of electronic equipment — to a neighborhood TV-radio sales and service business of your own. They'll tell you too, how De Vry has prepared men for good jobs at outstanding firms: or practical, "brass-tacks" problems with actual electronic equipment.

Here's good news: you don't need advanced education or previous technical experience to get started. If you can follow simple directions, you should be able to prepare with De Vry's help for real money in a field that may offer the opportunity of your lifetime.

Employment Service: With many employers so enthusiastic about De Vry Tech graduates, it's no wonder our Employment Service can help our graduates get started in electronics, or can assist them toward promotions later.

De VRY TECHNICAL INSTITUTE
4141 Belmont Ave., Chicago, Ill. 60641, Dept. PE-11-V

□ I AM INTERESTED IN ELECTRONICS. Please give me two free booklets, "Pocket Guide to Real Earnings" and "Electronics In Space Travels," also include details on how to prepare for a career in this field. The following opportunity fields (check one or more) interest me:
  □ Space & Missile Electronics
  □ Television & Radio
  □ Microwaves
  □ Automation on Electronics
  □ Radar
  □ □ I AM INTERESTED IN AUTOMOTIVE AND MAINTENANCE ELECTRICAL ENGINEERING. Please supply further information.

NAME

ADDRESS

CITY

STATE

ZIP

□ Check here if you are under 16 years of age.

2095A Available in Canada.

FREE!

SEND COUPON FOR BOOKLETS ON ELECTRONICS AS A CAREER

ACCREDITED MEMBER OF NATIONAL HOME STUDY COUNCIL

De Vry Technical Institute
Chicago - Canada
**MARK HW HELIWIP®**

Allows you to use a shorter antenna with greater efficiency and convenience. Flexible, high-strength, molded fiberglass core with exclusive Static Sheath®. Great for all coaxial receivers. IMPROVE NO. 9-210.

**MARK II SERIES II**

Wide use has proved the ability to eliminate precipitation static. Aperture of 19 ft. below 1510 LPDIP, DIP, and precipitation static*. Helical radiator with uniform current distribution, top loading, and pre-molded fiberglass core. Can be used with whip or slitting. Improves performance over all coaxial and ground plane antennas. Extremely rugged and easy to install.

**MARK HW SUPER BEACON BASE STATION ANTENNA**

Wide use has proved the ability to eliminate precipitation static. Aperture of 19 ft. below 1510 LPDIP, DIP, and precipitation static*. Helical radiator with uniform current distribution, top loading, and pre-molded fiberglass core. Can be used with whip or slitting. Improves performance over all coaxial and ground plane antennas. Extremely rugged and easy to install.

**MARK HW-11 SERIES**

The patented MARK Static Shield® is a tough durable, flexible, high-strength, molded fiberglass core that eliminates the static interference. Flexible, high-strength, molded fiberglass core with exclusive Static Sheath®. Great for all coaxial receivers.

**MARK III SERIES III**

Wide use has proved the ability to eliminate precipitation static. Aperture of 19 ft. below 1510 LPDIP, DIP, and precipitation static*. Helical radiator with uniform current distribution, top loading, and pre-molded fiberglass core. Can be used with whip or slitting. Improves performance over all coaxial and ground plane antennas. Extremely rugged and easy to install.
After we put our new line of walkie-talkies together, we take them apart.

Tough on our talkies? You bet we are.

Maybe 99 out of 100 are ready to leave the Fanon plant in perfect condition, but we know there's always the chance of a fluke slipping through. That's why we don't believe in "quickie" shipments to your electronics dealer. We prefer to take an extra look into things first. So we take every single Citizen's Band transceiver apart and give it a rigorous going-over: instrument testing, air testing, the works. Want to do a little investigating of your own? We'll gladly provide the screwdriver.

Start at the top of our line. The Fanon "Commander" offers 4-watt power from 13 powerful transistors, with our exclusive "Free-call" standby circuit to save battery power when the unit isn't in use. Next in line is the 11-transistor "Pathfinder", with 240 milliwatt power, in a rugged, die-cast housing. Or you may want to take a look at our budget 11-transistor model, the 100-mw. output "Outrider", with its own built-in squelch circuit. There's also our new "Scout" model, ruggedly built to take outdoor abuse, with a 100-mw., 9-transistor circuit; and the popular "Trail-Blazer", our 9-transistor best-seller for the past three years. In the economy price range are the "Range", a 5-transistor superhet with an excellent signal-to-noise ratio, and our 3-transistor "Explorer", the perfect talkie for family fun.

For outdoor sports, construction work, or general family use, there's a Fanon CB walkie-talkie to fit your needs—and your budget, too. They're priced from $9.95 to $64.95.

Isn't it comforting to know that whatever your needs in a walkie-talkie, you can rely on a manufacturer who takes extra pains to inscribe quality?

We think so.

But don't take our word for it. See for yourself.

The next time you drop by your electronics dealer, bring a screwdriver.

Fanon Electronic Industries, Inc.
439 Frelinghuysen Avenue, Newark, New Jersey

November, 1965
The Garrard LAB 80
Automatic Transcription Turntable
is the only automatic

that performs on cue!

Today's lighter tracking forces and more delicate stylus assemblies have increased the danger of record damage from manual handling. To eliminate this hazard, the Garrard Lab 80 now incorporates an ingenious tone arm cueing control. It works in three ways:

1. To play a single record: Press the Manual tab. This starts the motor and activates the tone arm cueing control. The arm stays suspended a safe half inch over the record. Position the tone arm over the first (or any) groove. Now, press the cueing control and the stylus lowers gently into the groove. This cueing feature also enables you (2) to cue a record or (3) to pause during manual or automatic play.

The Lab 80 is $99.50, less base and cartridge. The same great Garrard plant that builds the Lab 80 also builds three other fine automatic turntables. There is a Garrard for every stereo system. For your complimentary copy of the new 32-page Comparator Guide, use the coupon below.

Garrard, Dept. 62-395
Westbury, New York 11590
Please send me the new Comparator Guide and a list of dealers.

CIRCLE NO. 50 ON READER SERVICE PAGE

LETTERS
FROM OUR READERS

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

IN THE BEGINNING THERE WAS AN "AM"

Mr. Loniak's explanation "Letter" (June, 1965) of the origin of the term "ham" was very interesting and is certainly more credible than many other explanations that I have read. However, I believe radio amateurs have always been called "amateurs," and since there is a tendency in our language to shorten often-used words of more than one syllable, it seems reasonable to assume that the term "amateur" might have been shortened to simply "am." For a short time, amateurs might have been calling themselves radio "ams." Then, somewhere along the line, the word "am" could have picked up the aspirate "h," resulting in the familiar term "ham."

DAVID G. LEEPER, K1YST
Longmeadow, Mass.

REMEMBER WHAT THE SPIDER DID

"Plan Now For Your License" (July, 1965) has encouraged me to try again. I have studied many times for my ham radio license, but have been easily discouraged. If I don't get it now, I never will.

RICHARD BALL
Bronx, N. Y.

Richard, it's worth another try.

GRANDMA'S BREADBOARD UPDATED—UPDATED

Having been instrumental in the development of the DeVry modular breadboarding components, I quite naturally read the September, 1965 issue with much interest. Judging from our recent mail, however, the article which accompanied the cover picture ("Grandma's Breadboard Updated," p. 67) caused some confusion in the minds of some of your readers. The confusion apparently stems from the fact that we have developed two breadboard systems.

The modular system illustrated on the September cover is the newer and more flexible system. The components pictured can be purchased either separately or as a kit. The most popular kit includes a good quantity of white Celcon connectors, red Cyclocel panels and nylon stacking rods in a plastic case for $18.50 complete. Individual components can be purchased for as little as 30 cents each.

The original system developed by DeVry does list for $37.50 as indicated in the article, but is completely different in appearance. It is marketed by DeVry Industries Inc. (formerly Paromel Electronics), and features a large "see through" base of clear plastic. The original system is used...
INSTANT MIRACLE HOME PRODUCTS YOU BUILD AT A FRACTION OF THEIR USUAL COST WITH ONLY A SCREWDRIVER

Deluxe Intercom  Telephone Amplifier  FM Radio  AM Radio  Amplified Babysitter  P.A. System

Usual cost of 6 similar products: about $260.00
IRectronic cost: $ 80.00

Other IRectronic products: Garage Door Opener, Guitar Amplifier, Wireless Intercom, Electronic Metronome, Telegraph Code Sender, Remote Control Devices. This is a new, space-age adventure in pre-fabricated electronics. Simple, multi-purpose blocks (IRect-o-paks*) enable anyone to build 20 different electronic products for home and outdoor use. No mechanical or electronic skills needed. It's easy. It's fun. For outdoor use, instant, battery-operated IRectronic Portables: Walkie-Talkie, Electronic Megaphone, Boat Horn, Guitar Amplifier, P.A. System, Remote Photo Flash Slave, and Danger Blinker. All powered by a single 6 volt battery.

PATENTS PENDING

INTERNATIONAL RECTIFIER
233 Kansas Street  •  El Segundo, California

WRITE FOR MORE INFORMATION AND NAME OF NEAREST DEALER
CIRCLE NO. 22 ON READER SERVICE PAGE

November, 1965
LETTERS

(Continued from page 6)

extensively by schools where wiring templates are positioned underneath the board to guide students in circuit construction.

MALCOLM HOUGHTON
Director of Education
DeVry Technical Institute
Chicago, Ill.

MORE ON "HAMS WITH OTHER HOBBIES"

I was glad to see that Popular Electronics has agreed to serve as a clearinghouse for hams with other hobbies. I'm now anxiously awaiting the results— with optimism. However, there are bound to be some problems in getting people to- gether at any one given time, on a given band, and with a specific hobby interest. Perhaps experimental pathfinder type groups would help to overcome these problems. The experience of these experimental groups could then be written up for the guidance of others. I would like to set up one such group, within the limits of my rig and antenna system, and perhaps other hams who feel as I do, will set one up also.

ART TAYLOR, WOEYC
Lincoln, Neb.

Go to it, Art; and we offer the same encouragement to any other ham who would like to set up a net. See page 92 for the first edition of the "Ham Hobby Clearinghouse."

COLOR ORGAN BREAKS SOUND BARRIER

I have just built the "Color Organ" (March, 1965) but I cannot get it to work without a lot of volume. I am driving a pair of University

"Senior II" speakers with a 70-watt Allied transistor amplifier. Can you recommend a bulb that would light up at normal volume levels?

JOHN F. GIBSON
Barstow, Calif.

I built a color organ. Could you please tell me how I can turn down the volume and still have the colored lights.

SERI KITT
Los Angeles, Calif.

John and Seri, just insert an L-pad between the speakers and the amplifier to quiet down the speakers to a comfortable listening level. Connect the color organ directly to the amplifier. The #47 bulbs have tested out quite well. Smaller bulbs are susceptible to quicker burnout and do not emit enough light to properly illuminate the photocell. Another solution is to add a separate amplifier between the color organ and your regular amplifier or preamp. The only justification

John and Seri, just insert an L-pad between the speakers and the amplifier to quiet down the speakers to a comfortable listening level. Connect the color organ directly to the amplifier. The #47 bulbs have tested out quite well. Smaller bulbs are susceptible to quicker burnout and do not emit enough light to properly illuminate the photocell. Another solution is to add a separate amplifier between the color organ and your regular amplifier or preamp. The only justification
Use this checklist before you install a home TV distribution system

<table>
<thead>
<tr>
<th>Channels received</th>
<th>COAXIAL VHF</th>
<th>TWINLEAD* VHF</th>
<th>COAXIAL UHF/VHF</th>
<th>TWINLEAD* UHF/VHF AND UHF ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color reception when properly installed</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>2.83 (14-83 for UHF only)</td>
</tr>
<tr>
<td>Cable loss; @ channel 13 for VHF only; @ channel 83 for UHF/VHF</td>
<td>4 db (foam filled)</td>
<td>1.8 db/100 ft. @ Channel 13</td>
<td>9 db (foam filled)</td>
<td>5.6 db/100 ft. @ Channel 83</td>
</tr>
<tr>
<td>Loss increase when wet</td>
<td>Nil</td>
<td>Negligible</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>Reception when run near or through small metal areas</td>
<td>Excellent</td>
<td>Excellent when properly installed</td>
<td>Excellent</td>
<td>Excellent when properly installed</td>
</tr>
<tr>
<td>Reception when run near or through considerable amounts of metal</td>
<td>Excellent</td>
<td>Not recommended</td>
<td>Excellent</td>
<td>Not recommended</td>
</tr>
<tr>
<td>Ease of installation</td>
<td>More difficult</td>
<td>Easy</td>
<td>More difficult</td>
<td>Easy</td>
</tr>
<tr>
<td>Extra parts required</td>
<td>Connectors, matching transformers</td>
<td>None</td>
<td>Connectors, matching transformers</td>
<td>None</td>
</tr>
<tr>
<td>Performance in strong-signal areas</td>
<td>Excellent—fair**</td>
<td>Excellent—fair**</td>
<td>Excellent—fair**</td>
<td>Excellent—fair**</td>
</tr>
<tr>
<td>Performance in weak-signal areas</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Cable pickup of interference (ignition, appliances, etc.)</td>
<td>None***</td>
<td>None—slight**</td>
<td>None***</td>
<td>None—slight**</td>
</tr>
</tbody>
</table>

*A high quality, low-loss foam encapsulated cable type **Depends upon local conditions ***Poorly designed accessories will pickup interference.

Once you know the facts—there is one best choice for your home system—Blonder-Tongue. Whether you prefer 300 ohm or a 75 ohm coax system, Blonder-Tongue has the products you'll need. There is only one way you can protect your home TV system against obsolescence when new UHF stations come on the air—that's with a Blonder-Tongue all-channel UHF/VHF system.

Blonder-Tongue products designed for all-channel home systems include: All-channel signal amplifiers (V/U-All-2 indoor and U/Vamp-2 mast mounted); all-channel couplers (A-102-U/V two-set and A-104-UV four-set). Rounding out the all-channel concept are UHF/VHF matching transformers (Cablematch U/V set mounted; MT-283 mast-mounted) and the TF-331-U/V flush-mounted feed-thru.

Take your pick. Blonder-Tongue makes them all—and all are "Color Approved". Buy the line with 15 years of quality leadership. Write for free booklet "How to Plan a Color-Approved Home TV System".

BLONDER-TONGUE
9 Alling Street, Newark, New Jersey 07102
home TV accessories • closed circuit TV • community TV • UHF converters • master TV

November, 1965
LETERS (Continued from page 8)

for the low gain is the low price... normally a color organ sells for about five times more money.

"SIDEARMS" FOR CAMPER'S SPECIAL WANTED

Congratulations on the "Camper's Special" (August, 1965). I have been looking for a rig like this for some time. There's only one problem—I need an inexpensive battery-operated receiver to match.

Bob Moczylowski, WB2PWA
Lincoln, N. J.

I have completed two Camper's Specials and would like to modulate them with a suitable transistor modulator.

E. J. Antoine, VE5EA
Davidson, Sask., Canada

The Camper's Special calls for three B&W Miniductors and two 2N3053 transistors. I have not been able to get these parts.

Dayton Jones, WN3DVH

The drawing of the antenna shows the lead-in connected to TS1. Shouldn't it be connected to TS2?

Wayne J. Shoppe, K4ANL
Charlotte, N. C.

Looks like a busy day for the Camper's Special, but here goes. Wayne, don't shoot. We give up.

The antenna is supposed to be connected to TS2. The text is correct. D.J., if your local electronics parts distributors can't help you on these parts, try a mail-order house. Lafayette's 1966 catalog lists the transistors for 90 cents each and the coils for 62 and 68 cents each. E.J., you might consider the 6-watt transistor amplifier on page 73 of this issue. Bob, we saved you for last because we are still working on a Camper's Special transceiver.

POPULAR ELECTRONICS IS FOR HOBBYISTS

In one reader's opinion, you have successfully filled the gap between a technical trade publication and a layman's type of journal. The descriptions of how your circuits work have saved me more than once when it came time to trouble-shoot a project.

The following information may be useful to you in statistical compilations. I am 26 years old, have a degree in Economics and hold a position as a Systems Analyst (Data Processing Busi-
The famous RCA 5-inch scope

NOW WITH MORE FEATURES TO SIMPLIFY YOUR JOB

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

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

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

[| Option | Price  |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>WO-91B Scope:</td>
<td>$249.50*</td>
</tr>
<tr>
<td>WG-354A Probe:</td>
<td>$ 7.50*</td>
</tr>
<tr>
<td>WG-302A Probe:</td>
<td>$ 8.20*</td>
</tr>
</tbody>
</table>

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

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

*CIRCLE NO. 34 ON READER SERVICE PAGE

AmericanRadioHistory.Com
LETTERS (Continued from page 10)

ness Systems). I have been reading your magazine since 1958, and I have built about 15 kits (hi-fi, test equipment, tach, and sonar). My wife also builds kits—an FM tuner among others. My other hobbies are photography, guns, and model railroading.

Dave McBurney
Yorba Linda, Calif.

Our computer tells us that you were about 18 years of age when you started to read PE, and that it's good to have such loyal readers. Thank you for the statistics, Dave, but don't be surprised to hear that many others dwell in the same "statistical" house.

TEMPUS FUGIT, BUT—

In the "Current Stations Reports," (August, 1965), you said that Radio Luxembourg I on 233 kc. was heard in New England as early as 1820 with rock-and-roll music. Is this true? I always thought that wireless radio transmissions weren't possible until 1916 and the first radio wasn't on the air until 1921.

Robert Wvagg
Elizabeth, Pa.

Even Dr. Mahlon Loomis, the real inventor of wireless, didn't create a spark until 1894 (October issue, 1965). We raised our eyebrows about 233 kc., Robert, not 1820. Our Short-Wave Editor did say the beacon that normally operates on this frequency was not on the air. So far as "1820" is concerned, it stands for 6:20 P.M., Eastern Standard time, as all SWL's know. We guess you're not a short-wave listener yet.

QSL BUREAU, LONDON

We have read with interest the letter from S. J. Stansfield, WA8GDR, entitled "QSL's From Iron Curtain Not Propaganda" (August, 1965) referring to QSL Bureau services maintained by the International Short Wave League. We would like to point out that our headquarters address is 12 Gladwell Rd., London, N.8—not 86 Barrenger Rd., as stated in Mr. Stansfield's letter. The use of the QSL Bureau is free to members, and the Bureau handles both amateur and broadcast QSL's and reports. Membership details are available upon request.

Peter Bysh, Hon. Secty./Treas.
International Short Wave League
London, England

"WATCH OUT" FOR THE LIGHT WATCHMAN

In your article on the "Li'l Dusker—the Light Watchman" (September, 1965) you have a Sigma 5HC2 photocell, Allied stock number 9 E 307, in the Paris List. We have not been supplying this photocell since last November because it was dropped by the manufacturer. However, we can (Continued on page 20)
Why use three (VHF, UHF, FM) when one JFD LPV will do—perfectly?

INSTALL THE NEW...

JFD COLOR LPV Log Periodic

for brilliant 82-channel TV performance—COLOR or black & white, plus FM/Stereo

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. 53 ON READER SERVICE PAGE

November, 1965
Perfection results from

CHOICE...NOT CHANCE

MUSICAL
BEST-BUY

MODEL
M7/N21D

Top-rated cartridge featuring the highly compliant N21D tubular stylus. Because of unusually clean mid-range (where most music really "happens") it is especially recommended if your present system sounds "muddy." For 2-gram optimum tracking (not to be used over 2 1/2 grams). Only $17.95 (Also, if you own an M3D or M7D, you can upgrade it for higher compliance, if tracking force does not exceed 2 1/2 grams, with the N21D stylus for only $12.50.)

ALL THE MOST
WANTED FEATURES

M55E
15° TRACKING, ELLIPTICAL STYLUS

Professional performance at a modest price. Compares favorably to the incomparable Shure V-15, except that it is produced under standard Shure quality control and manufacturing techniques. Remarkable freedom from IM, Harmonic and tracing distortion, will definitely and audibly improve the sound of monaural as well as stereo records. A special value at $35.50. Upgrade M44 cartridge (if you can track at 1 1/2 grams or less) with N55E stylus, $20.00

THE “FLOATING”
CARTRIDGE

M80E
GARD-A-MATIC®
WITH ELLIPTICAL STYLUS

Bounce-proof, scratch-proof performance for Garrard Lab 80 and Model A70 Series automatic turntables. Especially useful for applications where floor vibration is a problem. Spring-mounted in tone arm shell. Unique safety feature retracts stylus and cartridge when force exceeds 1 1/2 grams... prevents scratching record and damaging stylus. $38.00

THE ULTIMATE!

V-15
WITH
BI-RADIAL ELLIPTICAL STYLUS

For the purist who wants the very best, regardless of price. Reduces tracing (pinch effect), IM and Harmonic distortion to unprecedented lows. 15° tracking. Scratch-proof, too. Produced under famed Shure Master Quality Control Program literally hand-made and individually tested. In a class by itself for mono as well as stereo discs. For manual or automatic turntables tracking at 3/4 to 2 1/2 grams. $62.50

High Fidelity Phono Cartridges . World Standard. Wherever Sound Quality is Paramount
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Illinois
CIRCLE NO. 40 ON READER SERVICE PAGE
You can get additional information promptly concerning products advertised or mentioned editorially in this issue.

1

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

2

Mail the coupon to the address indicated below.

3

Please use this address only for Product Service requests.

POPULAR ELECTRONICS
P. O. BOX 8391
PHILADELPHIA, PA. 19101

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

NAME (Print clearly)

ADDRESS

CITY_________________STATE_________________ZIP CODE

VOID AFTER DECEMBER 31, 1965
"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. 1211C 3224 Sixteenth Street, N.W., Washington, D.C. 20010

November, 1965
supply a somewhat superior photocell to work in this circuit: Special Clairex 5M5, for $2.00. The Clairex unit would have to be obtained on special order, but if there is a substantial demand for it we will stock it.

J. W. Rubin
Allied Radio Corp.
Chicago, Ill.

While we are on the subject, here's some data on relay K1 in the "Li'l Dusker." It's made by Philips-Advance, part number 15-24-1C. The coil is rated at 24 volts, 1100 ohms. Contacts are 1 amp. Price, $1.50.

DARLINGTON PAIR NOT LOVEBIRDS

Not long ago I ran across a reference to a "Darlington pair" in connection with an article on transistors, but there was no explanation. Can you tell me what they are? E.A. Heath
Palo Alto, Calif.

Sure thing, E.A. See the How It Works section of "Super Sens," on page 57 of this issue.

REAL POWER WANTED, NOT STEAM POWER

I enjoyed the "Steam-Powered Ham Rig" (July, 1963). Now, how about using real power, but still in the milliwatts? Mike Martz
Sidney, Ohio

The Stanley Steamer must have been before your time, Mike, or you would have more regard for the power of steam. If you wish, you can try a 3-volt battery hookup instead of the steam engine.

DOES IT PAY TO BUY CB EQUIPMENT?

I would like to know if it is wise to buy a CB set at this time, in view of all the new rules and regulations to knock out the CB'er. Charles Grotticelli, Jr.
Brooklyn, N. Y.

Charles, a great number of CB'ers share our view that the FCC regulations are designed to provide maximum practical use of the airways. We don't think the FCC wants to knock out the CB'er. Whether or not it pays for you to buy a CB set depends upon what you intend to do with it.
A Microwave Christmas for a New Year's Delight

American Basic Science Club's Master Lab...a HOME SCIENCE LAB AND COURSE

You Get ALL the Equipment for ALL the Above...only $37.55

MULTI-USE DESIGN — A MASTER LAB FEATURE

All the above equipment, as separate units, adds up to over $1400.00.

How can the 9 kit Master Lab cost it all for only $37.55?

Multi-use design is the answer. For example, the Slide Projector quickly and easily converts into the Photo-Enlarger, Spectroscope, Cloud Chamber Illuminator. Similarly, the Transist Heli doubles as a Telescope Mount. Each multi-purpose design makes possible an all-science lab at an unheard-of low price. Multi-purpose design is used only where it is advantageous, and not for such activities as the permanently mounted weather instruments, where it would not be practical.

KIT-MONTH — OR ALL AT ONCE

Get Master Lab on either plan (see coupon). You may start with the Kit-a-Month plan, and at own time get the balance of the 9 kit series in one shipment by sending $3.95 for each of the unshipped kits.

NO EXPERIENCE NECESSARY — IT'S EASY! IT'S FUN!

You will enjoy the easy-to-use equipment and the exciting learn-by-doing course. The 9 instruction and idea manuals contain come 406 pages fully illustrated. Over 490 pages. Over 280 illustrations. A real science course for a solid science background.

ACCLAIMED BY EDUCATORS

Everyone interested in science should have his enjoyable kits. You are doing a wonderful job.

Allen T. Ayres, Physics Dept.
Jamestown High School, Jamestown, N.Y.

FREE WITH kit: MYSTERY SHOCK BOX

You'll never know what may happen to your lab if you return the kit for full refund

AMERICAN BASIC SCIENCE CLUB, INC.
301 East Crockett St., San Antonio, Texas 78202

KIT-MONTH...THE EASY WAY TO YOUR PERFECT LAB!

You take only as many kits as you wish — no obligation.

You may return any kit and get your money back.

Those "No Risk" assurances because we know —

...you'll be amazed and delighted. The first kit will convince you that you want the Master Lab.

Send $2 today — get your first kit on its way!

All Orders on 10 Day Approval — Your Satisfaction or Your Money Back

Start sending the me the MASTER LAB in 9 monthly kits, I enclose $2.00 and will pay $3.95, Full Payment, Postage Paid

Start me complete MASTER LAB (all 9 kits) in one shipment, I enclose $37.55, Full Payment, Postage Paid

Send me only the — Unit.

I enclose $____, Full Payment, Postage Paid.

Name:
Address:
City & State:

ZIP CODE:

- American Radio History
- American Radio History
- American Radio History
"KWIK-START" IGNITION SYSTEM

When points or "condensers" fail, your car's engine will still run with a "Kwik-Start" emergency ignition system. You won't have to push your car or have it towed to the garage—you can drive there. Produced by Kwik-Start Enterprises, the system is easy to install—you just disconnect the primary wire between distributor and coil and attach the Kwik-Start unit. In addition, if the points or "condensers" are okay, Kwik-Start will tell you so and try to diagnose the trouble. It's available in both 6- and 12-volt models.

Circle No. 75 on Reader Service Page 15

SUPERHET CB WALKIE-TALKIE

The Model HA-130 introduced by Lafayette Radio Electronics is a low-cost superheterodyne walkie-talkie for the Citizens Band. Housed in a durable black-and-silver simulated leatherette plastic case, its five-transistor, two-diode circuit employs a crystal-controlled receiver and a 100-mw. transmitter, each using plug-in, easy-to-change crystals. Simple to operate, the HA-130 has only a push-to-talk switch and an on/off volume control. The collapsible 34" antenna radiates power effectively for up to one mile. Channel 10 transmit and receive crystals, an earphone jack, and a 9-volt battery are supplied with the unit.

Circle No. 76 on Reader Service Page 15

MAGNET VARIETY KIT

Ever consider using a magnet as a tool or knife holder? As a dashboard retainer fitting for your car? As a holder for pipe or flashlight brackets? If you'd like to put magnets to practical use around your home, office, or recreation area, you'll be interested in the low-cost variety kit available from Edmund Scientific Company. It contains 16 magnets, in nine different shapes, and of several com-positions—including a rubber strip and flexible material containing thousands of tiny individual magnets.

Circle No. 77 on Reader Service Page 15

POCKET WIRING TOOL

Cutting jumper wires and component leads to measured length, stripping insulation, and tailoring lead bends are the main functions of the new James "Snip-N-Strip" tool. Constructed of tough, lightweight, glass-filled Nylon plastic, it contains a retractable surgical steel knife blade and comes with a convenient, removable pocket clip. A trigger-actuated set of quadrilateral shear blades cleanly cut conductors without distorting stranded types, and a sliding scale on the side of the tool provides an accurate, quickly adjustable length gauge.

Circle No. 78 on Reader Service Page 15

UNI-SUSPENSION TURNTABLE

New from Thorens is the TD-150 AB two-speed (33⅓ and 45 rpm) turntable. The tone arm board and turntable platter are on a single adjustable spring-loaded suspension. Balanced in horizontal and vertical planes, the tone arm incorporates a low-mass plug-in cartridge shell with an exclusive patented system for adjusting vertical tracking angle. The motor is a 375-rpm double-synchronous type. Rumble, wow, and flutter are said to be below NAB stereo standards.

Circle No. 79 on Reader Service Page 15

"PLATTER PUSSIES"

"Platter Pussies," made by Robins Industries Corp., are felt-flocked leatherette discs which are designed to keep fingerprints off your hi-fi records. You just fold one in your hand and pick up a record without touching it with your fingers. The inexpensive "Platter Pussies" are packaged in lots of 12.

Circle No. 80 on Reader Service Page 15

TEST LEAD HOLDER

A test lead rack designed to store patch cords and cable assemblies has been announced by Pomona Electronics Co., Inc. The rack simplifies the job of locating a particular test lead by making it readily accessible. Fabricated from cold rolled steel, with baked enam-
What most people don’t know about hi-fi kits could fill a book.

This one. (And it’s free!)

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

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

Fisher Radio Corporation
11-40 45th Road, Long Island City, N.Y. 11101

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

Name_________________________________________________________

Address_______________________________________________________

City________________________________State_______________________

OVERSEAS RESIDENTS PLEASE WRITE TO FISHER INTERNATIONAL, INC., LONG ISLAND CITY, N.Y. 11101.
SOLID-STATE CB TRANSCEIVER

Could your car use a 25-channel transceiver that takes less current than an ordinary dashboard clock and still function even when the car battery is so low that it won’t turn over the engine? According to Pearce-Simpson, Inc., its solid-state “DIRECTOR” will do both of those things. The “DIRECTOR” requires no warm-up period, and features a dual-conversion superhet receiver and a special high-gain audio power amplifier. It comes complete with crystals and a universal, all-angle-mounting bracket on a slide rail.

Circle No. 82 on Reader Service Page 15

COMPACT SPEAKER SYSTEM

Only 6¾” high x 13½” wide x 4” deep, the Jensen X-11A two-way speaker system is intended for use as an extension speaker. High frequency response is 14,000 cycles, and full room volume is possible with low-power amplifiers. Features include a volume control and built-in hangers for easy wall mounting. Having an impedance of 8 ohms, the X-11A can be used with amplifiers having 4, 8, or 16 ohms output.

Circle No. 83 on Reader Service Page 15

INTERCHANGEABLE TV ANTENNA

The “Starfire” is claimed to be the only antenna on the market that can be used with either 75- or 300-ohm transmission line—without matching transformers. Announced by Kay-Townes Antenna Company, it’s a high-gain, 11-element, gold-anodized unit for local and fringe reception, and especially designed for color reception.

Circle No. 84 on Reader Service Page 15

CALIBRATION STANDARD CARTRIDGES

Built right into the stylus of each Stanton 581 calibration standard cartridge is a completely integrated dust-removing device. The 581—otherwise known as the “LONGHAIR” cartridge—has a free-riding long-haired brush extending from the front of the plastic stylus V-guard. It engages the grooves in advance of the stylus and prevents any collection of lint or dust on the stylus tip—without affecting delicate tracking forces. The 581 is available in three models.

Circle No. 88 on Reader Service Page 15
Now, from Turner comes the very finest base station microphone ever designed. The +2 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 +2 puts the zip back into your set and keeps it up to full strength at all times!

The +2 has tailored frequency response of 300-3500 c.p.s. This means the best and clearest voice transmissions with knocked down local noise interference.

Exclusive touch-to-talk or lock on-off switching — the +2 works with all tube or transistor sets regardless of switching requirements or type.

Ask your dealer about the new +2. LIST PRICE $49.50

THE TURNER MICROPHONE COMPANY
901 17th Street N.E.
Cedar Rapids, Iowa

Available in Canada
Export: Ad Auriera, Inc., 85 Broad Street, New York 4, N.Y.
“New set of wheels? I hit the jackpot!”

“Ever since I can remember I've been hung up on anything that rolls. From skates to scooters to my own home-made custom job. And I've always wanted more wheels.

“So I joined the Army. Jackpot! I found more wheels, more different kinds of wheels than I ever thought existed. Wheels. Treads. Science-fiction rigs running on rubber pillows. Even a mechanical mule. And I get a chance to work on all of them. That's part of being an Army mechanic.

“Next month I'm off to see the world. And some of the wildest jobs that ever rolled.”

An Army enlistment has been the turning point for many men. And 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.
DRILL HOLES IN VTVM FOR EASY CALIBRATION

To calibrate the EICO 221 or similar type VTVM, you must first remove the unit from its carrying case, since the calibration controls are mounted inside the case. However, if you drill holes through the top of the case in line with the controls, you will be able to leave the unit in place when you calibrate. The holes should be large enough to pass a small screwdriver after grommets are inserted for a finished appearance. Calibration for d.c. can be readily accomplished by using a mercury battery as a reference; each cell puts out 1.35 volts, even after it has aged greatly. For a.c. adjustments, use an accurate a.c. meter for comparison. The line voltage, while nominally 117 volts, does vary from time to time.

—Walter Robson, Jr.

RELAY GATHERING DUST? BOTTLE IT UP FOR PROTECTION

Relays that must be used in dusty locations are subject to failures resulting from dirty contacts. To prevent such failures, enclose your relay in an airtight housing. Suitable housings can be made from a variety of containers such as screw cap jars, coffee cans with plastic snap-on covers, or for the really small relay, small vials. The lid, or cap, of the container with relay attached is mounted on the chassis, and the wiring for the relay is run through a hole in the cap which is then sealed. Finally, the container is screwed or snapped.

Here's how to find out what the Army can do for you

The quickest way is to go see your local Army Recruiter. He'll answer any questions you have about your opportunities in the Army. If he doesn't have an answer right there, he'll get it for you. And it'll be a straight answer. After all, it's his job to be sure the Army's the right place for you. He knows where the opportunities are...and can tell you where you'll fit in.

You can easily find your local Army Recruiter listed in your telephone book. Call him today. And, in the meantime, fill out this coupon and you'll receive a copy of the helpful and informative 40-page booklet, The Secret of Getting Ahead. No obligation on your part, of course.

November, 1965
More heat where it counts for greater soldering efficiency

It's impossible to get the performance you expect from a soldering gun unless it converts its rated watts into heat at the tip. Weller guns deliver the most heat per rated watt. They melt solder faster, and assure more reliable soldered connections than any other soldering guns.

For the most efficient heat, fastest heat, and exclusive trigger-controlled dual heat—insist on Weller.

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

Weller®
WELLER ELECTRIC CORP., EASTON, PA.
WORLD LEADER IN SOLDERING TECHNOLOGY
CIRCLE NO. 47 ON READER SERVICE PAGE

TIPS (Continued from page 27)

onto the cap to effectively seal the relay against dust. —Wm. B. Rasmussen

TRANSISTOR ADAPTER SPEEDS TESTS AND ELIMINATES SOLDERING

To avoid soldering and unsoldering in an experimental circuit or when you are trying to find a transistor that will work in your circuit, you can build this inexpensive adapter. It will enable you to quickly plug in your transistors. Simply take a $\frac{3}{4}$-thick block of wood measuring approximately 3½” x 3” and attach it to a metal plate of the same size. Mount a transistor socket on the plate and connect the socket terminals to three Fahnestock clips on the block as shown. Material and dimensions are not critical.

—James O. Fishbeck

GELATIN MOLDS AND RUBBER BALLS SHOCK-MOUNT HI-FI EQUIPMENT

Make use of several homemade air suspension mounts to isolate your record player or other hi-fi equipment from annoying vibrations—particularly those which travel along the floor and hi-fi furniture. Each mount consists of a small gelatin mold, a wood screw, a washer, and an air-filled rubber ball just large enough to fit into the wide end of the mold. Drill a hole in the bottom of the mold just large enough to accommodate the screw. Place the washer between the screw head and mold, and screw the mold into place on a side of the base. Then cement the rubber ball in place inside the mold. If the sides of the base are too thin to hold the screws, you can build up the cabinet with a block of wood.

—Harry Goldman
Zip through Scott’s new solid state FM stereo tuner kit in one afternoon

Four to six hours! That’s all you need to zip through Scott’s new LT-112 FM stereo tuner kit. Start after lunch—enjoy superb stereo at dinner.

Scott solid state circuitry is the key to the LT-112’s superior performance. Costly silicon transistors give performance unapproached by any other kit on the market. The LT-112 is kit-brother to Scott’s best-selling 312 solid state stereo tuner, of which Audio said, “...one of the finest tuners anywhere.”

Your LT-112 arrives with all critical circuitry pre-wired, pre-tested, pre-aligned, and mounted on heavy-duty printed circuit boards. Scott’s exclusive life-size, full-color construction book details every step... makes perfect wiring almost automatic.

You’d never believe a kit so easy to build could be so packed with features. Built into the LT-112 is a new Scott invention... the Tri-modulation meter, used for a Signal Strength Indicator, Zero Center Indicator, and Alignment Meter.

See your Scott dealer today, and pick up an LT-112 tuner kit... $179.95 plus one enjoyable afternoon will net you a lifetime of listening pleasure.

For complete information on Scott’s kits & components write: Dept. 620-11, H. T. Scott, Inc., 111 Powdermill Road, Maynard, Mass.

Export: Scott International, Maynard, Mass. Cable HIFI. Prices slightly higher west of Rockies.

Prices and specifications subject to change without notice.

CIRCLE NO. 39 ON READER SERVICE PAGE

November, 1965
PERFECT PAIR...
SOLID STATE...
SOLID STATEMENT

QUOTE:
Ray-tel, all-transistor C-B radio line, broadest of any in scope, priced to reflect full value at all equipment levels.

This fine line ranges from the sophisticated, full-feature 11-channel TWR-5 intended for personal and business communication systems, to the diminutive 5-channel TWR-7, price and performance peer of all the solid-state mobile radios.

We will be pleased indeed to send you complete details.

Please send details on Ray-tel TWR-5 and TWR-7.

Name
Number
Street
City State Zip Code

ELECTRONICS LIBRARY

RECEIVING TUBE SPECIFICATIONS & SUBSTITUTIONS
Having made a "name" for itself by publishing several cross indexes of transistors, Techpress, Inc., has now invaded the vacuum-tube field. This book lists the specifications of more than 2000 American and foreign tubes. The style of the listing is similar to that successfully employed by Techpress in its previous books. Details on tubes are tabulated according to type number and according to general family characteristics (diode, triode, etc.). Special codes and symbols are used in the tables to simplify the presentation. This book is likely to be of great value to designers, or experimenters wanting to upgrade equipment.

Published by Techpress, Inc., Brownsburg, Ind. 46112. Soft cover. 140 pages. $1.95.

SOLAR CELL & PHOTOCELL EXPERIMENTERS GUIDE
by Stu Haberman

The basic objective of this latest book in the Howard W. Sams "Photofact" series is to demonstrate the theory and application of light-sensitive devices by actually constructing projects that rely on them for their operation. How and why these devices operate as they do is explained, and you are told what type to choose for particular applications, and whether to use sunlight, artificial light, or other light sources to activate the devices. Many variations of the projects covered here are possible; this guide furnishes the basics, and you provide the innovations.

Published by Howard W. Sams & Co., Inc., 4300 West 62 St., Indianapolis 6, Ind. Soft cover. 128 pages. $2.95.

BASIC ELECTRONICS (Second Edition)
by Bernard Grob

Every once in a while a textbook on electronics is published that is really outstanding. Such a book may be different because of the material preparation, art layout and...
FINCO COLOR-VE-LOG

FOR UHF, VHF, FM RECEPTION

ALL-BAND UHF-VHF-FM ANTENNA

The one antenna that does the work of 3! Gives startlingly clear black and white pictures and beautiful color on both UHF and VHF television channels — plus the finest in stereophonic and monophonic sound reproduction.

FINCO Model UVF-24
$59.95 list

FINCO Model UVF-18 — $42.50 list
FINCO Model UVF-16 — $30.50 list
FINCO Model UVF-10 — $18.50 list

SWEPT-ELEMENT VHF-FM ANTENNA

FINCO's Color-Ve-Log challenges all competition! Its swept-element design assures the finest in brilliant color and sharply defined black and white television reception — as well as superb FM monaural and stereo quality.

FINCO Model VL-10
$34.95 list

FINCO Model VL-18 — $54.50 list
FINCO Model VL-15 — $46.95 list
FINCO Model VL-7 — $23.95 list
FINCO Model VL-5 — $16.95 list

Featuring FINCO's exclusive Gold Corodizing

FINCO COLOR-VE-LOG

Prices and specifications subject to change without notice

THE FINNEY COMPANY • 34 W. Interstate Street • Bedford, Ohio

Write for beautiful color brochures Number 20-322, and 20-307, Dept. PE

CIRCLE NO. 16 ON READER SERVICE PAGE

November, 1965
handling of illustrations, or because the idea is novel. Author Grob has arrived at just about the ideal combination of the above ingredients in the second edition of Basic Electronics. Obviously a classroom text, the organization of the material, illustrations, etc., is so complete that this book can be safely recommended to any beginner. Your reviewer was particularly impressed by the clever use of gray tones in circuit diagrams and formulas to identify essential components or answers to problems. Very highly recommended.

Published by McGraw-Hill Book Co., 330 West 42 St., New York, N.Y. 10036. Hard cover. 588 pages. $7.50.

BASIC ELECTRONICS: "AUTOTEXT"—A PROGRAMMED COURSE IN CIRCUITS

by RCA Institutes, Inc., and edited by Jack W. Friedman, Harry G. Rise, and Gerald McGinty

A programmed course in basic electronics for beginners with no previous knowledge or experience in electronics, this book covers d.c. and a.c. circuits, principles of resonance and filters, and prepares the student for the study of tube and transistor circuits. It is actually a work book—the text consists of a comprehensive series of questions to be answered right in the book. The student can then compare his response immediately with answers which appear on tear-out sheets in the back of the book. The home-study student should find both text and illustrations easy to understand, and with an average amount of application should be able to learn how to read schematics, and to have a working knowledge of capacitors, resistors, coils, transformers, etc. Very highly recommended.

Published by Prentice-Hall, Inc., Englewood Cliffs, N. J. Hard cover. 534 pages. $13.00.

FREE LITERATURE

More of everything for everyone is claimed for Allied Radio's new 1966 catalog, including what's new in the world of Knight-Kits. It contains 508 value-packed pages. For your copy, write to Allied Radio, Dept. 3-J, 100 N. Western Ave., Chicago, Ill. 60680... New-Tronics Corporation, 3455 Vega Ave., Cleveland, Ohio 44113, has just issued a new catalog on its expanded line of CB antennas and accessories. A number of new mobile antennas are illustrated and described as well as base station models...
The **BIG** Difference in Citizens Band Units is...

**JOHNSON'S**

**UNMATCHED RELIABILITY!**

For personal or business use, no other equipment equals the day-in day-out dependability of Johnson "Messenger" Two-Way Radios. "Messengers" are designed to deliver maximum performance, even under extreme operating conditions. Before you buy—take a long look at the Johnson quality line—or better yet, talk to any "Messenger" owner. You'll see why dollar for dollar, Johnson is your best buy! Easy to install, easy to operate, license issued on request.

See your nearest Johnson Dealer / Distributor or write for complete information.

E. F. JOHNSON COMPANY
2452 TENTH AVE. S.W. • WASECA, MINN. 56093

November, 1965
SOMEONE SHOULD DEVELOP AN EASY WAY TO LEARN ELECTRONICS AT HOME

RCA INSTITUTES DID!

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

Start to learn the field of your choice immediately!

No previous training or experience in electronics needed!

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

And each Career Program begins 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.

CHOOSING A CAREER PROGRAM NOW

Your next step 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/Serviceeman; Master Antenna Systems Technician; TV Laboratory Technician; Educational TV Technician.

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

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

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

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

Telecommunications. For a job as TV Station Engineer, Mobile Communications Technician, Marine Radio Technician, Industrial Electronics. For jobs as Industrial Electronics Technicians; Field Engineers; Maintenance Technicians; Industrial Laboratory Technicians.

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


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-N5
A Service of Radio Corporation of America
350 West 4th St., New York, N.Y. 10014

The Most Trusted Name in Electronics

November, 1965
You earn your FCC First Class License

or your money back!

THERE'S A WORLD OF OPPORTUNITY FOR THE MAN WITH AN FCC LICENSE

All it takes is a few spare hours a week and NRI's FCC License Course to open the way to increased opportunities in Communications. With an FCC License, you're ready to operate, service and install transmitting equipment used in aviation, broadcasting, marine, mobile and Citizens-Band communications.

What does it take? Men with absolutely no training or experience in Electronics complete the course in 10 months. A Technician or man with some background can easily cut that time in half. And because NRI has a greater enrollment than any other school of its type, training costs you less than comparable courses offered by other schools. Further, YOU MUST PASS your FCC exams or NRI refunds your tuition in full.

Get full details today about NRI FCC License Course plus 9 other home-study instruction plans offered by NRI, oldest and largest school of its kind. Mail coupon for free catalog. There's no obligation. No salesman will call. NATIONAL RADIO INSTITUTE, Washington, D.C.

MAIL NOW for FREE CATALOG

NATIONAL RADIO INSTITUTE
Electronics Division
Washington, D. C. 20005

Please send me complete Information on FCC License Training and other NRI courses, as checked below. (No salesman will call.)

FCC License
Complete Communications
Aviation Communications
Marine Communications
Mobile Communications
Radio-TV Servicing
Industial Electronics
Electronics for Automation
Basic Electronics
Math for Electronics

Name ___________________________ Age ______
Address _________________________
City ___________________ State _______ Zip ______

ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL

The following satellites were in orbit and transmitting as this issue closed.

Echo 2 .................................. 136.020 mc.
Alouette** .................................. 136.077 mc.
Explorer 23** .................................. 136.080 mc.
Explorer 28 .................................. 136.125 mc.
Relay 1** .................................. 136.140 mc.
Relay 2 .................................. 136.142 mc.
Explorer 21 .................................. 136.145 mc.
Echo 2 .................................. 136.170 mc.
Explorer 22** .................................. 136.171 mc.
OGO 1** .................................. 136.200 mc.
Tiros 8 .................................. 136.231 mc.
Tiros 9** .................................. 136.231 mc.
Tiros 10 .................................. 136.232 mc.
Tiros 7 .................................. 136.233 mc.
Explorer 26 .................................. 136.275 mc.
Explorer 20** .................................. 136.350 mc.
Pegasus 1** .................................. 136.410 mc.
Pegasus 2 .................................. 136.410 mc.
Pegasus 3 .................................. 136.410 mc.
Syncom 2** .................................. 136.468 mc.
Syncom 3** .................................. 136.470 mc.
Ariel 2 .................................. 136.558 mc.
Alouette** .................................. 136.593 mc.
Relay 2** .................................. 136.620 mc.
Relay 1 .................................. 136.621 mc.
1964 83C .................................. 136.650 mc.
1963 38C (USA) .................................. 136.651 mc.
Explorer 20** .................................. 136.680 mc.
Explorer 24 .................................. 136.710 mc.
OSO 2 .................................. 136.712 mc.
Explorer 27 .................................. 136.740 mc.
1965 58C (USA) .................................. 136.768 mc.
Gravity Gradient (USA) .................................. 136.800 mc.
EGRS III .................................. 136.840 mc.
Solar Radiation .................................. 136.886 mc.
Pegasus 1 .................................. 136.890 mc.
Tiros 7 .................................. 136.924 mc.
Tiros 8 .................................. 136.923 mc.
Syncom 2** .................................. 136.980 mc.

**Transmits only upon ground command

This listing does not include all of the satellites in orbit—many of which no longer are transmitting, or transmit erratic, very weak signals. Satellites of the Soviet Union generally use tracking and telemetry frequencies in the band between 19,990 and 20,010 mc. Exact frequencies of some Soviet satellites are broadcast by Radio Moscow immediately after launching. In orbit are Cosmos 41, 42, 43, 44, 49, 51, 53, 54, 55, 56, 58, 61, 62, 63, 70, 71, 72, 73, 74, 75, 78.

POPULAR ELECTRONICS
INTERNATIONAL Model MO TRANSCEIVER
For CITIZENS RADIO SERVICE

- New Compact Size
- New Solid-State Crystal Switching Circuit
- New Photo-Control Volume Circuit
- New Remote Control With Matching Microphone

The International Model MO Citizens Radio transceiver, custom designed for mobile installation, provides instant push-to-talk crystal controlled operation on any 6 channels with full 5 watts power input. The new compact control head provides complete remote controlled operation. All circuits are dc using solid-state crystal switching. The operating channel is indicated by an illuminated button on the control head. Tubes and silicon transistors are combined to provide a rugged trouble-free circuit.

The complete transceiver includes: a remote control head (about the size of a cigarette package), matching white microphone, new compact transmitting/receiving unit which may be conveniently installed in the trunk, and a matching white speaker which mounts under the dash. Operates from 12 vdc negative ground power source. Other power input units are available on special order.

See the "all new" International Model MO at your dealer today.

FCC Citizens Radio license required. All use must conform with Part 95, FCC Rules and Regulations.
NEW! 3 RCA EXPERIMENTER'S KITS

- BUILD A MODEL RACE CAR MOTOR SPEED CONTROL
- 13 OTHER EXCITING SCR CONTROL CIRCUITS WITH HUNDREDS OF USEFUL APPLICATIONS

Here's what you've been waiting for...now, you can build your own silicon controlled-rectifier control circuits. Start with RCA's Basic Experimenter's Kit (KD2105). With it, you can build a model race car speed control, a universal motor speed control, or eight other interesting circuits. Add-on Light Sensor and Heat Sensor Kits (KD2106 and KD2110) enable you to build 4 more electronic control circuits for hundreds of useful applications around the house, hobby shop, and garage.

The 80-page, illustrated RCA Experimenter's Manual (KM-70) will familiarize you with the theory and operation of solid-state components in the kits. At the same time, it will give you complete detailed information on all 14 circuits including schematic diagrams, circuit descriptions, and construction details, as well as photographs of the circuits as easy-to-follow assembly guides.

Here is what you can make...

Here is what You Need...
- RCA Basic Experimenter's Kit (KD2105) One Silicon Controlled-Rectifier; Two Transistors; Five Rectifiers.
- RCA Experimenter's Manual (KM-70) 80 Illustrated Pages; 14 Circuits and How to Build Them.
- RCA Add-On Light Sensor Kit (KD2106) One Photocell for light-operated switches.
- RCA Add-on Heat Sensor Kit (KD2110) Three Thermistors, special solder for heat-control circuits.
- Plus readily available standard components.

If you want to build one circuit or all 14, check with your RCA Distributor where kits and RCA Experimenter's Manual are on display. He'll be glad to help you select the kit or kits for the solid-state circuit you have in mind. Do it today!

Available from your RCA semiconductor distributor
RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N.J.

The Most Trusted Name in Electronics
By LAWRENCE LEKASHMAN
Vice President, Sales
Electro-Voice, Inc.

A QUICK SUMMARY
OF THE LAST DECADE
IN HI-FI AND
THE IMPACT OF STEREO

November, 1965

BETWEEN 1956 and 1965 all the sciences and technologies exposed to the public view have advanced by Herculean leaps. While all pale in comparison to space exploration, too frequently the yardstick for progress is the dramatic or awesome achievement. Obviously, the entire field of electronics has progressed throughout the past decade. Electro-acoustics—the conversion of sound into electricity or electricity into sound—traverses many applications including military communications, long-distance telephone, sonar, seismology, etc. Less sophisticated, but most important for the pleasure it brings to so many, is the reproduction of music with optimum fidelity.

Links in a Chain. If each link in the chain of hi-fi sound reproduction could be isolated one from the other, a ten-year review would be relatively simple. But each link in the hi-fi chain is related to the others and the development of one affects all.

The most obvious example is the emergence of the transistor as a medium-priced practical device holding out the greatest number of advantages to the hi-fi sound engineer. The transistor was not developed for hi-fi, yet it is in this very field that the transistor will achieve its most notable and significant application for the average consumer.

On the other end of the scale, subtle
developments have taken place gradually over the past decade to which all but the most sophisticated technician might be oblivious. Look at, for example, the automatic record changers and transcription players. At the end of a decade of progress, these units still change records, they track the grooves, and they shut themselves off automatically. But mechanical engineers have met the demands of hi-fi sound reproduction and have developed better materials, more precise machine fit, ingenious designs, and quality control that easily permits a record changer to perform as well, or better than, the transcription player of 10 years ago.

The Speaker. Certainly the most critical element in any hi-fi system is the loudspeaker: critical, because it is impossible for any system to reproduce sound one iota better than the speaker to which it is attached; critical, because the speaker is a component selected by subjective evaluation; and critical, because of the misinformation circulated about the performance of loudspeakers.

In the scramble to advance from mono to stereo (in 1958), there were numerous attempts to combine the old and the new. This Fairchild 248 stereo preamplifier sold for a whopping $239.50. It obviously consisted of two separate preamplifiers housed in the same wraparound. Controls at right-hand side of unit were for Master Volume and selection of output functions.

Almost every speaker has some directional characteristics, but Jensen's SS-100 was a bona-fide attempt to use "direction" to solve the stereo listening area problem. In the SS-100, the mid-range and treble speaker were mounted on a platform and could be aimed at the audience.

This is the speaker system that never was—the "Integrand." Designed around a servo response mechanism, it was supposed to adjust itself to room acoustics for better reproduction. It didn't.
Miniature loading slots at the bottom of this system helped produce reasonably good sound bass. A product of one man, Stewart Hegeman, this EICO HFS-2 also featured a free-floating tweeter for near 360° treble dispersion. The HFS-2 was years ahead of its time (1957), but those that liked its sound were unrestrained in their praise.

The "Ionovac" has had a colorful history, but little public acceptance. This version was offered to hi-fi enthusiasts about five years ago by the DuKane Corporation. Capable of crystal-clear treble note reproduction from 3500 to 20,000 cycles, the Ionovac is now being sold in England and France.
The Stromberg-Carlson PR-498 was the antecedent of many similar lightweight, statically balanced, single-pivot, and viscous-damped tone arms. Permanently attached to a PR-500 turntable, this combination was once considered one of the best integrated arm/turntable units.

Practically every hi-fi enthusiast has forgotten this all-transistorized Vico 77 mono amplifier. Introduced in 1957, the 77 left much to be desired, but was a harbinger of things to come.

decade ago, the acoustic-suspension, shelf-type speaker was just emerging, and small speaker systems were poor sound reproducers. Today's shelf-type speaker system is the result of a careful application of known principles—a fact established in a landmark patent suit in 1962.

Gone, but not completely forgotten, are the many speaker systems designed to "save" conversion costs from mono to stereo. "Gimmick" speakers for stereo are now a thing of the past and not likely to reappear in the next decade.

The Phono Cartridge. No single piece of a hi-fi system has had to undergo a more revolutionary change with the advent of stereo than the phono cartridge. While speakers and amplifiers simply doubled up, the cartridge with its single stylus now had to track grooves vertically and horizontally—or any combination of motion in between.

In this brief review, it is impossible to thoroughly cover the evolution from the "magnetic reluctance" cartridge of 1956 to today's superb transducer. Suffice it to say that the first stereo cartridges left much to be desired and that step-by-step improvement by many manufacturers now permits record reproduction comparable to the flatness and separation of channels of magnetic tape.

Frequency response, uniformity of manufacturing, excellent compliance, and stereo separation have been refined to the point where the phono cartridge—magnetic or ceramic—offers little opportunity for significant improvement. There will be a continuing search for transducing methods other than that used by the present cartridge, but all of these devices must employ a stylus—the single element that has seemingly reached the limit of the art. Possibly in the next decade we will see better sound-to-noise ratios and better impedance matching to transistorized circuits. The benefits of these improvements will be subtle and not earthshattering.

The Record Changer. During the past decade, the record changer has under-
gone pronounced improvements. By today's standards, a 10-year-old changer is a relic comparable to a "Model T." Among the lesser evils of the old changers were rumble—now intolerable in stereo reproduction—and high stylus tracking pressures. Rumble and flutter have both disappeared from the 1965 changer.

Stylus pressures are a fraction of those required 10 years ago and changer mechanisms no longer introduce lateral friction to wear down stereo record grooves. In fact, the greatest argument today for single-plate turntables is more one of convenience to the individual who plays single records, rather than the technical performance advantages. Oddly enough, Americans have yet to manufacture a changer equal in performance to those imported from Europe.

**Tape Decks and Recorders.** It would be improper to discuss changers without acknowledging the growing popularity of tape decks and tape recorders. In a manner similar to the changer, tape decks and recorders have been undergoing refinement in the past decade. The 15-ips tape speed is almost a thing of the past and 7½ ips is giving way to 3½ ips. Though tape does not have the wide public acceptance of the record changer, the cost of prerecorded tape is now competitive with stereo records. Lack of

The Heath Company had been instrumental in getting hi-fi off the ground with the famous Williamson power amplifier. The AA-50 was one of the true integrated stereo amplifiers in the middle ground between tubes and all solid-state units.

public acceptance is probably due to the continuing search for the ideal tape packaging method—cartridge versus reel-to-reel.

The greatest and most significant improvements in tape playback have been in the design and fabrication of heads. A good tape deck with high-performance heads is a perfected instrument, capable of reproducing clean source material equivalent in sound to the original performance.

**Electronics Hardware.** Least vulnerable to subjective analysis and most easily defined in the engineering laboratory is the electronics portion of the hi-fi system. The transition in the past decade from mono to stereo placed great burdens on the manufacturer to deliver far more electronics hardware to the consumer at reasonable and competitive prices.

Today the typical stereo arrangement requires two preamplifiers, two power amplifiers, or two integrated amplifiers, all in one cabinet. With the advent of FM multiplexing and the retention of AM broadcasting, the receiver sections of stereo tuners and receivers have become alarmingly complex. These technical problems and how they were resolved would make a separate story, even though the impact of multiplexing upon the consumer has been modest.

The "revolution" in hi-fi, now upon us, is in the application of solid-state devices (transistors, diodes, etc.). The insistence by component manufacturers on the use of tubes at a time when "package" set manufacturers were widely converting to transistors with their highly touted advantages of infinite life and minimum heat was most difficult to reconcile. The truth of the matter is that the use of transistors with characteristics of uniformity and performance suitable for incorporation in hi-fi equipment was simply prohibitively expensive until recent years. The story by Hans Fantel (page 47) explores the transition from tubes to transistors in 1964-66.
Continuing Evolution. It will be apparent to the discerning reader that the 10 years of progress in the hi-fi field have been those of progress by "evolution" rather than by "revolution"—with the sole exception of the transistor. These 10 years have underscored a number of extremely significant facts.

One of the great advantages professed by the manufacturers of hi-fi equipment is the enormous flexibility they can offer. It is interesting to note that it would have been possible to update any hi-fi system throughout this 10-year period without obsoleting all of the components. The gradual insertion of new and better products as the needs of the user dictated was practical at all times. The increase in popularity of hi-fi equipment has resulted in the manufacturing of finer components at less cost than in 1956.

While the prognosis for the future is hazardous, we can safely expect to see continuing evolution. There is little likelihood of radical developments in the method of sound reproduction or in the chain of equipment that should make you hesitate to purchase or build a hi-fi system of your choice. Only the degree of sound perfection need determine how much you want to spend.
IT'S BEEN a long time coming, but stereo/hi-fi has finally turned the corner and entered a new design era. From 1966 on, "solid state" will be the key to solid sound. Nearly every new tuner, hi-fi amplifier, stereo receiver or tape recorder introduced at this year's High Fidelity Show in New York City—the annual new product parade of the industry—was fully transistorized.

"Tubes have had it," commented one engineer after passing row after row of solid-state stereo equipment. And that about sums it up.

"So what else is new?" you might ask, if you are the skeptical type. After all, transistors have been around for years. Ordinary pocket radios, cheap phonographs, and even TV sets became transistorized long ago. Why did hi-fi lag behind?

Granted, some transistorized hi-fi gear has been on the market for almost five years. But most of the pre-1964 amplifiers sounded shrieky and had the inconvenient habit of dying young. By con-
trast, today's transistor designs equal or outperform any tube-type hi-fi. So the logical questions are: Why can they do it now when they couldn't before? Why did it take so long? And what's the advantage for the buyer?

Part of the overall answer is that hi-fi design engineers had to wait for the right type of transistors to become available at the right price. And then they had to learn how to design circuits around those transistors.

**Design Problems.** Up to now, few transistor types have been capable of satisfying the exacting demands of true high fidelity sound reproduction. Transistor manufacturers, with their eyes on the top dollar, concentrated their efforts at making transistors for spacecraft and computers, paying little attention to the needs of the hi-fi fan. Most medium-price transistors were inherently too noisy for critical audio applications and they tended to lose much of the treble above 5000 cycles. Besides, they couldn't handle the power required for realistic hi-fi sound.

"They'd blow faster than fuses," recalls Stewart Hegeman, who did pioneer work in transistorized audio. "The good-sounding transistors weren't rugged enough, and the rugged ones sounded awful."

This didn't matter much with pocket portables or tin-voiced low-fi phonographs, but for a long time it kept transistors out of genuine hi-fi applications. Most manufacturers stuck with tubes.

Several years ago a handful of hi-fi companies tried to scoop the audio market with marginal transistor products. But they discovered that fancy claims and sleek styling couldn't fool the ear. Most were soon out of business.

All this changed when the semiconductor manufacturers finally came up with new transistors capable of meeting the stringent specs of genuine high fidelity. Thanks to automated manufacturing techniques, the new transistors were more uniform in quality, more reliable in operation, and cheaper, too. Silicon transistors—offering much greater audio frequency bandwidth and power capability—had begun to replace the older germanium transistors.

But one more roadblock had to be overcome before the transistor's final takeover in audio. That obstacle existed in the minds of audio engineers. Too many still looked at the transistor merely as a substitute for a tube and tried to fit transistors into conventional circuits. In doing so, they threw away nearly all the advantages the transistor offers. It took time for engineers to learn to "think" in terms of solid-state circuitry.

**De-Bugging Transistor Circuits.** Off-hand, the advantages of the transistor seem obvious. Compared with tubes, the transistor is smaller, draws less power, develops practically no heat, takes no time to warm up, doesn't change characteristics with age—in fact, it doesn't wear out. Unlike tubes, transistors don't produce noise when exposed to vibration.

Knight is the brand-name for equipment sold by Allied Radio. The Knight KN-376 stereo receiver features AM coverage as well as the usual FM/FM multiplexing. Rated at 35 wpc of music power, this 32-transistor receiver goes for $270.00.

Scott's 388 solid-state AM/FM receiver is reported to be the first hi-fi component to use field-effect transistors in the FM tuner section. Use of such transistors eliminates cross modulation on weak signals. The 388 is rated at 40 wpc, and sells for less than $500.00.
—they are not microphonic—and shrug off accidental knocks. Besides, transistors are virtually hum-free, so that the music sings out against a background of almost complete silence.

Best of all, transistor amplifiers need no output transformer. Being low-impedance devices, transistors can feed their output directly into loudspeakers. By getting rid of the output transformer, transistors bypass one of the main bottlenecks to fidelity. As a result, transistorized hi-fi equipment usually sounds crisper and clearer than the older tube designs.

But before these advantages could be realized, transistor circuits had to be thoroughly de-bugged. Transistors were sensitive and had to be protected from overloads. Otherwise, their potentially long life would be cut short by the first loud bang in the music. And since some low-signal transistors react badly to heat, special circuits had to be devised to compensate for temperature variations.

None of this know-how came easy. Engineers discovered, for example, that it sometimes takes about four transistors to do the job of one tube. They tried shortcuts to make the product cheaper, but attentive listeners could always tell the difference.

One trouble that plagued early transistor designs was exactly the opposite of what bothered tube circuits. While tubes would distort at musical climaxes, the transistor jobs did fine on fortissimi. But at soft volume levels, the sound tended to become harsh. This was especially noticeable during solo passages of sweet-voiced instruments, such as violin, cello, and clarinet.

For a long time, engineers were flummoxed by this trouble. Finally, they tracked down its source. It was distortion produced by the "Class-B" operation of push-pull output transistors. In this circuit, two transistors work in tandem, each taking turns in developing power. Splitting up the work in this way prevents the transistors from overheating and burning out. But the trick is to time each transistor's duty cycle so precisely that the alternate cycles match properly. Inaccurate timing of the Class B circuits results in either a momentary gap or a momentary overlap between the cycles. That's what was causing the curious harshness of the early transistor designs. Engineers finally devised special feedback correction to cancel out this type of distortion.

All this does not mean that tube equipment has been swept from the market entirely. Even such top-rank firms as Dynaco and Marantz still stick with tubes. Their attitude is that their present models offer outstanding performance and they see no reason to change them. Many manufacturers, in fact, offer both tube and solid-state equipment, but there is little doubt that the significant engineering advances are now being made in the transistor field.

Compact Quality. Ed Miller, who supervises electronic design at Sherwood Elec-
tronic Laboratories in Chicago, says: "Now we can pack more power into compact equipment. With cool-running transistors, we needn't worry about heat dissipation in high-power amplifiers, and lower operating temperatures make other components last longer." Miller also feels that the low hum levels attainable with transistors are an important design improvement.

Bob Furst, who designed Harman-Kardon's "Stratophonic" series of stereo receivers, points to the outstanding stability of transistorized tuner circuits. "With solid-state r.f. circuits," he says, "we have virtually eliminated FM drift. I can turn the receiver off at night, and when I turn it back on in the morning, the station comes in right on the nose."

Speaking for KLH, a company that has always stressed compactness along with quality performance, John Milder says: "Solid-state design has enabled us to produce the first fully portable stereo system in a single suitcase—amplifier, speakers, turntable, FM stereo tuner—and all in a package you can lift with one hand."

The real payoff, however, is in the sound. Across the board, from budget models to deluxe designs, solid-state equipment offers an astonishing clarity that only the most expensive tube equipment has ever matched in the past. The term "transistor sound" has been coined to describe the sparkle, the crispness, and the tightly controlled bass typical of well-designed solid-state components.

With nine out of every ten hi-fi manufacturers introducing new solid-state equipment, we can but sample the wide variety shown at the recent hi-fi shows. This sampling is to give you an idea of the types and prices of the new gear. For a detailed up-to-the-minute buyer's guide, look for the 1966 edition of "STEREO/HIFI DIRECTORY" on your newsstand. This excellent guide itemizes all the performance specifications, models, and prices—for only $1.25.

**Amplifiers.** Solid-state amplifiers are being sold this very month in every price category from $59.95 (Knight-Kit KG-320 at 16 watts per channel of music power) to $300 (James B. Lansing SA600 at 40 wpc r.m.s.). Kits are particularly popular including the integrated Heath AA-21D tagged at $137 for 50 wpc (music power). If you're satisfied with less power, try the Heathkit AA-22 (33 wpc for $99.95). Acoustathe offers a preamp and power amplifier at $199 and $149, respectively; the power amplifier is rated at 45 wpc. Scott offers the LK-60 with 60 wpc at $189.95.

Budget-priced amplifiers with factory
Music power output of the Sherwood S-9900 is rated at 45 wpc. Power bandwidth at 1% harmonic distortion is 12 to 35,000 cycles. This solid-state amplifier sells for about $230.00.

This small amplifier was designed by Shure Brothers for private head-phone listening to records, tapes, or FM tuners. Called the "Solo-Phone" (Model SA-1), the amplifier may also be used as a tape monitor. It sells for only $45.00.

The Electro-Voice 1177 stereo FM receiver stands just 3 ½" high. Rated at 25 wpc, it sells for $280.00. A big brother (Model 1178) has AM broadcast coverage in addition to FM/FM multiplexing for $315.00.

wiring include the Lafayette LA-340, putting out 20 wpc for $79.95. Knight's KN-966 with 33 wpc and fetching $119.95, and the high-style Electro-Voice 1144, 25 wpc, for $124.50. For a 35 watts or more per channel amplifier, take a look at Sherwood's S-9000 (75 wpc at $299.50), Fisher's TX-300 (50 wpc at $280) and the Altec Lansing 360A (35 wpc, tagged at $389).

Tuners. Although "solid state" has not captured a major share of the tuner market, it is nevertheless making serious inroads on tubes. Actually the difference between tubes and transistors in FM tuners is not as apparent as in amplifiers. Some manufacturers combine the best of tubes and transistors, as exemplified by Grommes (Model 2000 tagged at $249.95) and Kenwood (Model TK-500 at $174.95).

Of course, the big problem in selecting a tuner is making a decision about the necessity for AM as well as FM and/or FM/FM multiplex. Tuners run the gamut of prices from the low-cost Eric (Model ST-100 at $99, list) for FM only, to the Scott 312B with FM/FM multiplex provisions at $249.95. Kits are also available, with the Heathkit AJ-43D selling for $109 being a noteworthy example. The AJ-43D has AM/FM/FM multiplex reception. Allied Radio offers a similar setup known as the KG-765, for $94.95 as a kit and $139.95 prewired.

Receivers. Several years ago these units were called "stereo receivers" because they generally consisted of two complete amplifiers, FM tuner, and multiplex adapter. The word "stereo" is being dropped, but the "receivers" still need only to be connected to a phono player and speakers to be a complete stereo hi-fi setup. Of course, transistors have been tremendously important to the receiver manufacturers. Back in the tube days, the stereo receiver threw off heat like a blast furnace and some of the more poorly designed receivers soon cooked themselves to death.

If you're cost-conscious, take a look at the EICO 3566 with 35-plus wpc sold in kit form for $219.95. Health has the AR-13A kit with 20 wpc (Heath rating) for $184; this Heathkit has a built-in (Continued on page 113)
WANT a cheap, effective, and reasonably attractive enclosure for an 8” speaker? Although the “99¢ Enclosure” grew out of the need for a temporary setup, the unit is quite appropriate for permanent home hi-fi systems, especially where positioning of conventional enclosures for best stereo listening is hampered by furniture placement or peculiarities of the room’s general layout. The portability and durability of this unit makes it practical to store a couple of them out of the way, then move them into position each time they are used.

The speaker used by the author was a Lafayette SK-128, but any other full-range 8” speaker would be equally appropriate for use in this unique enclosure. Construction can be completed in five or ten minutes with the aid of a drawing compass, measuring tape, and penknife.

Construction. The “enclosure” is available, practically ready for use, in almost any department or variety store, in the form of a “Steri-lite” 44-quart polyethylene wastebasket (U. S. Plastic Company Model #1040). Prices may vary but the pilot model was obtained at a cost of 99 cents. This container is approximately 20” tall and tapers from a diameter of about 14” at the top to a little over 11” at the bottom. It comes in three colors: beige, turquoise, and yellow. The material is sufficiently soft so that undesirable resonances are avoided, yet firm enough to easily support the heaviest 8” speaker.

The general idea is to place the wastebasket on the floor, upside down, and mount the speaker in the bottom. To prepare the basket, first determine the actual diameter of the speaker cone (it will be about 7”), then adjust your drawing compass to half that amount—the radius—and draw a circle on the bottom of the basket. Be sure the pivot of the compass is in the exact center. Now, using a penknife, cut the opening for the speaker following the line as closely as possible, but don’t worry about minor irregularities since the edge will not show. Punch the mounting holes using
Turn the wastebasket upside down and cut out a hole to pass the frame, but not the rim of the 8-inch speaker. Holes in bottom of inverted basket are ports to release back pressure. Dress the enclosure up with a decorative grille (shown in right hand photo).

the speaker itself as a template; a paper punch or any sharp, pointed instrument will do the job.

Using the Enclosure. Connect the speaker leads to your amplifier, and sit back and listen to a familiar record. You will find the upward firing arrangement quite desirable, for the sound spreads out in all directions—obscuring the fact that you are listening to a small 8” speaker. Use of a pair of them imparts an amazing stereo effect, totally eliminating any “hole-in-the-middle.”

A decided improvement in bass response will be observed if the enclosure is supported about two inches above the floor. But instead of rigging up an elaborate support, the same effect can be had by cutting six or eight equally spaced 2” holes around the circumference of what now serves as the bottom of the enclosure (originally the top of the basket). Keep the holes as close to the bottom as possible, using a tape measure and drawing compass for layout and a penknife for cutting as before.

This time, however, take pains to make your cuts as clean as possible, since they will not benefit from concealment as does the big opening for the speaker. Very fine sandpaper can be used to smooth off the edges.

You can also install a suitable protective and decorative cover for the speaker if you are willing to exceed your 99¢ budget. Radio stores have grilles for wall or ceiling installations that will do nicely. However, be sure the one you select has an overall diameter not exceeding 10½”, so that it will fit the basket properly. (Electro-Products’ #SG-8CO, among others, makes a good fit and is attractive as well). Four pan-head machine screws, washers, and nuts secure the works.

Bearing testimony to the value of the finished product as both a unique, attractive conversation piece and an acoustical device of commendable performance, the author’s dentist extracted his two SK-128 speakers from their factory enclosures and put them into a pair of the 99¢ wastebaskets.

November, 1965
WE KNOW YOU'RE THERE . . . BUT WHERE OH WHERE? A literal antiverse populated by stars and planets and made up of atoms of antimatter may well exist physically in addition to the known material universe, according to Dr. Leon Lederman, professor of physics at Columbia University. Dr. Lederman presented new basic evidence for the possible existence of such an "antiworld" in reporting with his associates on the discovery of a new elementary particle, the "antideuteron." The new particle is the antimatter counterpart to the nucleus of deuterium, or heavy hydrogen. In demonstrating its existence, the Columbia research team used the 33-billion electron-volt synchrotron at the Brookhaven National Laboratory.

"The antideuteron is the first compound of antiparticles ever observed, and consists of an antiproton and antineutron," Dr. Lederman explained. Knowing that the antideuteron exists means that all the properties of the nuclear force responsible for the stability of all nuclei "are closely mirrored in the antiworld." As a result, he further stated that "It is no longer possible to question the basic physics part of the cosmological conception of a literal antiworld made up of negative nuclei surrounded by positive electrons. It is not possible now to disprove the grand speculation that the antiworld could be populated by thinking creatures."

The evidence would seem to indicate that this antiworld does not only have antiparticles replacing particles, but also is a mirror image of our world, in which the flow of time is also reversed. Just where this antiworld is, though, is somewhat of a mystery. Investigators have looked, without success, for evidence that it interpene-trates the known physical universe. Dr. Lederman pointed out, however, that "in cosmological theory, if the whole thing started with an explosion, there is every reason to believe that the same number of particles and antiparticles were created."

LITTLE THINGS MEAN A LOT—Two large-scale computer memory systems able to store more than a trillion bits of digital information will be built for the Atomic Energy Commission by International Business Machines Corporation. Basic storage elements are film chips contained in plastic cells; the tiny cell held by Melva Ellis of IBM can store the equivalent of three encyclopedia volumes—about 4.5 million words. Data will be recorded by means of an electron beam which "writes" digital data on the film chips in the form of microscopic black and white coded spots. When information must be retrieved from, or stored in, the memory systems, the cells move automatically to photoelectric reading and writing stations. Retrieved data can be printed, recorded on magnetic tape, or viewed at remote data display devices. To be installed by IBM in 1967 at the Lawrence Radiation Laboratory in California, the mass memories will be used to store results of experiments processed by the laboratory's vast computer complexes.

POPULAR ELECTRONICS
ELECTRONIC WHEELCHAIR DEVELOPED—A hat-mounted electronic control system which enables people whose limbs are paralyzed or amputated to operate wheelchairs and other equipment by head movements was recently described by its inventor, Donald Selwyn, a systems analyst at International Telephone & Telegraph Corporation. The equipment permits a quadriplegic with normal head mobility to drive himself about in a motorized wheelchair. According to Selwyn, the system also has military and commercial applications, as it will permit a normal individual to perform complex tasks otherwise requiring an extra pair of hands.

Before being provided with a servo-controlled wheelchair, Bruce Lowe, a quadriplegic at New York's Goldwater Hospital, depended for nearly 10 years on the assistance of hospital personnel for wheelchair transportation. Now, however, he propels himself around without any assistance and is studying pre-law at Long Island University. He has maintained an A average and has won a scholarship.

Bruce's wheelchair is equipped with a head-controlled tape recorder for taking and reviewing spoken notes at the college. By simply nodding his head he can perform all maneuvers required for parking and navigating around obstacles. Special nodding sequences can selectively operate the tape recorder or other devices.

"OLD-FASHIONED" METAL SCORES COMEBACK—A pea-size pellet, traveling at meteoroid speeds, wrecked these sheets of aluminum during tests made by Boeing Company engineers in Seattle. The purpose of the tests was to find the best metal to use in building manned spacecraft. Despite the damage shown here, test results favored use of the "saucepan" material over space-age metals.

GEMINI 7 TO USE LASER TRANSMITTER—NASA has scheduled a communications test between the two-man "Gemini 7" spacecraft and the earth using a laser device built by Radio Corporation of America. One of the astronauts in the spacecraft will aim the laser transmitter at another laser light beamed at the spacecraft from the White Sands Missile Range in New Mexico during the 14-day flight set for early 1966. When the light-beam receiver picks up the pulses of light from the spacecraft, the ground laser beacon will flash to indicate contact made. Weighing only six pounds, the device puts out 16 watts.

ORBITING OBSERVATORY UNDERGOES TESTS—Electronic equipment for an orbiting observatory that will help scientists determine the origin of stars is being tested by Sylvania Electric Products, Inc. Here, an engineer is seen checking equipment inside a thermal-vacuum chamber where temperatures range from 70°F below zero to 160°F. The equipment includes data processing and programming devices, a guidance system, and a power supply. The observatory, to be carried aboard the largest unmanned satellite under development by NASA, will permit scientists to measure the light absorption characteristics of interstellar gas and dust clouds, from which, it is believed, stars are formed. Until now, astronomers have been unable to study this light because it is absorbed by the earth's atmosphere. The space vehicle will be launched with a circular orbit 500 miles above the earth sometime in 1967.
"WA6OXX mobile, this is WA6ZRG mobile. You've got an extremely strong signal. What's your QTH?"

"William Able 6 Oboe Zebra Zebra? I pictured you quite differently!"

"Will it bother you if I vacuum in here?"

"Oh, forget it. I can get a new suit any time."
DO YOU need a burglar alarm, a fire alarm, an automatic fan control, an automatic light switch, a liquid level control, an automatic dehumidifier control, a photoelectric counter, a radio remote control, a lawn sprinkler control, an automatic door opener, a time delay relay, an electronic latching relay, or a sound-actuated relay?

Would you like to amaze your friends and neighbors, gain the respect of your teachers or co-workers, assemble a Science Fair project that is different, or build a basic control that can be used in hundreds of applications?

If you can answer yes to any of these questions, you’ll enjoy building and using Super-Sens, an easy-to-wire, inexpensive electronic relay so sensitive that it can be tripped by a pencil line drawn on a piece of paper.

Electronic relays are not new. They have been designed and manufactured for years. You can purchase a variety of types at prices ranging from $20 to $50 or more, or you can build Super-Sens for less than $10.00.

One popular “supersensitive” electronic relay offered by a leading laboratory supply house requires a signal current of 50 microamperes at a little under 10 volts. Super-Sens, in contrast, will trip with a miniscule control current of about 0.2 µa. at approximately 1 volt. Using its built-in bias circuitry, the device can trip with as much as 50 megohms between its input terminals.

Super-Sens can be actuated by many input devices: photocells, humidity detectors, microswitches, thermostats, magnetic contacts, pressure switches, thermistors, and almost any high or low resistance type of sensor or probe, as well as the comparatively low level signals obtained from a carbon microphone or a simple radio receiver.

Super-Sens, in turn, can be used to actuate almost any type of electrically operated equipment: lamps, solenoid valves, buzzers, bells, power relays, fan motors, pumps, door openers, heating systems, etc.

HOW IT WORKS

Super-Sens is essentially a two-transistor, high-gain, direct-coupled d.c. amplifier driving a standard sensitive-type electromagnetic relay. See Fig. 1. Transistors Q1 and Q2 are connected in a modified Darlington circuit. (A Dar-
Fig. 1. As little as 0.2 µa. at 1 volt is enough to trigger relay; up to 50 megohms can be sensed.

lington circuit is a circuit having two or more transistors connected in such a manner as to have a single input, a common load and a current gain which is the product of the current gain of each transistor.

Series resistor R1 tends to limit base current to prevent accidental damage to the transistors by excessively strong input signals. Unbypassed emitter resistor R3 stabilizes circuit operation, and provides a degree of temperature compensation. Sensitivity control R4 and current limiting resistor R2 are parts of a bias and control circuit to permit the use of external resistive-type and switch-type sensors. Circuit power is supplied by B1 and is turned on and off with s.p.s.t. switch S1.

When a signal or bias voltage of proper polarity (base positive with respect to emitter) is applied to the base emitter circuits of Q1 and Q2, the transistors conduct and energize K1. Bias voltage can be taken from the internal R2, R4, B1 circuit (B terminal) or it can be derived from an external circuit.

There are essentially three basic types of input circuit control devices that Super-Sens will cater to: those that look like a voltage source, those that look like a resistor, and those that act like a switch. The voltage source devices are hooked up to I and G.

The resistor control types are given special consideration: high-resistance devices are connected across terminals I and B (in series with the internal

Fig. 2. Any one of three basic types of sensors can be used: those that look like a voltage, such as a photovoltaic cell, etc.; those that look like high or low resistors; and those that act like a switch.

Fig. 3. Controlled external load circuit can utilize almost any source of power. If power requirements exceed the relay contact's rating, a power relay can be added. One or two loads can be switched.
bias circuit) and low-resistance types are placed between terminals I and G with a jumper from terminals I and B, as shown in Fig. 2. Actually, the resistive devices are made to function like a voltage source, since terminal B has sufficient voltage of proper polarity to forward-bias the transistors.

Switch-type devices can be connected between points I and B, and $R_4$ adjusted to provide just enough voltage to pull in the circuit when the switch is closed. Conversely, these switches can also be made to drop out the circuit. A jumper between I and B, and $R_4$ adjusted to pull in the circuit, will keep the circuit on until a switch across I and G causes the circuit to drop out when it is closed.

The relay can be hooked up to provide either a normally open, or normally closed control circuit, or both, as shown in Fig. 3.

**CONSTRUCTION**

Since the basic unit is the same for all applications, let's put the thing together, and then we'll consider some of the many applications. All components are standard and readily available through most electronics supply houses.

**PARTS LIST**

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>6-12 volt battery</td>
</tr>
<tr>
<td>K1</td>
<td>Relay (JAICO GS-100 or equivalent)</td>
</tr>
<tr>
<td>Q1, Q2</td>
<td>1N416 transistor</td>
</tr>
<tr>
<td>R1</td>
<td>1000-ohm, 1/2-watt resistor</td>
</tr>
<tr>
<td>R2</td>
<td>10,000-ohm, 1/2-watt resistor</td>
</tr>
<tr>
<td>R3</td>
<td>47-ohm, 1/2-watt resistor</td>
</tr>
<tr>
<td>R4</td>
<td>1-megohm potentiometer, linear-taper</td>
</tr>
<tr>
<td>S1</td>
<td>S.p.s.t. toggle or slide switch</td>
</tr>
<tr>
<td>I</td>
<td>Etched circuit board*</td>
</tr>
<tr>
<td>I-C</td>
<td>Cabinet (MiniBox 2102)</td>
</tr>
<tr>
<td>Misc</td>
<td>Small knob, screws, nuts, hardware, wire, solder, etc.</td>
</tr>
</tbody>
</table>

*A pre-etched circuit board on an epoxy-glass base is available from DEMCO, Box 16041, San Antonio, Texas 78216 for $2.00. This firm can also supply: a "basic" kit (board, relay, transistors) for $7.50; a complete kit for $9.50; and a pre-etched moisture sensor for $1.50.

If you etch your own board, follow the actual size layout shown in Fig. 4. Wiring is not critical, but special precautions should be taken. First, be sure there is ample separation between the I, B, and G terminals. Second, use an epoxy-glass rather than a paperbase phenolic copper-clad base board, (moisture absorption in the latter material may cause erratic operation). Third, be sure to remove all of the unused copper during the etching process, for an al-
most invisible, microscopically thin layer of copper can provide sufficient conduction to actuate the relay.

To avoid accidental mechanical damage, mount the relay last. Heat-sink the transistor leads with a pair of long-nose pliers to prevent heat damage when soldering. The Sensitivity control can be mounted on either side of the board.

The completed board can be mounted in a small Minibox as a self-contained instrument, or in another piece of equipment, depending on the device's ultimate use. Mount the board on spacers to provide air space between the board and the cabinet. Power supply B1 can be built in or externally connected.

A number of component changes can be made to meet individual needs. General Electric GE-10 transistors will serve as direct replacements for the specified TI units. A Sigma 4F-1000/S-SIL relay can be used in place of the JAICO type, although a new layout and larger circuit board would be required. If maximum sensitivity is needed at all times, omit R4 and connect R2 directly to the SI, K1 junction.

A variety of power supplies can be employed. The total current drain when the relay is closed is only a few milli-amperes, permitting the use of small transistor-type batteries.

As might be expected, the instrument's ultimate sensitivity depends on supply voltage, component tolerance, and the gain of the transistors. With the components specified in the Parts List, the current sensitivity (for relay closure) will vary between 0.15 and 0.45 $\mu$A, using a 9-volt power supply.

Fig. 6. An RC network can be added to make a time-delay relay. Circuits (A) and (B) stay on for a desired time after the switch is opened. "Turn on" is delayed in circuit (C) when the switch is closed.
If higher gain transistors are used, the overall sensitivity may be as great as 0.1 (or less) μA., while lower gain units may provide a sensitivity of 0.75 μA.

APPLICATIONS

Burglar and Fire Alarm. An easily installed alarm system, suitable for a home or place of business, is shown in Fig. 5. It offers fire alarm protection during the day, and both fire and burglar alarm protection at night.

A break in any part of the external series circuit will trigger the alarm. A "push-to-test" switch (S3), when depressed, will sound the alarm if the relay circuit is in working order.

Fire protection is afforded by fusible links F1 to F4 and by thermostatic contacts T1 and T2 placed on ceilings in strategic locations. Door and window contacts C1 to C3, together with the foil patterns, provide burglar protection. Any combination of switches, contacts, or links can be used, so long as the circuit forms a closed loop and the total resistance of the loop isn't great enough to prevent an adequate amount of voltage from terminal B to be applied to terminal I. The sensitivity control can be adjusted to compensate for loop resistance and battery conditions.

Switch S2 skips the door and window detectors during the day, and S1, which can be lock-protected, serves as a master on/off control. If switching S2 from night to day or day to night causes a momentary but undesirable alarm, connect the Night side of the switch to the switch's center arm. In this mode of operation, Super-Sens is on all the time, the relay is energized, and the normally closed contacts are held open.

Occasionally, a latch or alarm-hold type of operation is desirable . . . that is, once the alarm is triggered, it sounds continuously even after a break in the loop is restored. In this type of operation, the alarm can be reset only at the main panel, which could be located inside a locked cabinet. To build in the latch feature, connect a 1-megohm, ½-watt resistor in series with terminal I and S2. Adjust the Sensitivity control until the relay just pulls in (silencing the alarm), then back off slightly. Use the test switch and control alternately, and adjust until the desired action is achieved.

Time Delay Relays. Controls which can switch a circuit "ON" or "OFF" for preset or adjustable periods of time are used extensively in experimental work, photography, laboratory tests, chemical processing and manufacturing. Super-Sens can be used in such applications by adding a relatively simple "time delay" accessory. Typical circuit arrangements are shown in Fig. 6.

A 20-megohm resistor connected in series with a 0.25-μf. capacitor in Fig. 6 (A) sets up a time delay on the order of 3 to 9 seconds, depending on the setting of the Sensitivity control. A momentary normally open contact switch connected across the capacitor allows the circuit to conduct when the switch is pressed and released. The relay closes and remains closed until Cl is charged up and stops drawing current.

The circuit in Fig. 6 (B) permits a wider range of control. When S1 is de-
pressed and released, C1 is charged by the bias supply and then discharges slowly through the instrument's input circuit, holding the relay closed until C1 loses most of its charge. The time delay varies with R1's setting, and ranges from about 25 seconds with R1 set at 0 resistance to as much as 1 minute and 45 seconds when R1 is set at 1 megohm. The timing range can be changed if you use different values for C1 and R1. The larger the time constant (R1 x C1), the longer the time delay.

In Fig. 6 (C), a delay in "turn on" time takes place after the slide switch is thrown. When S1 is switched to the "ON" position, the relay does not close until the current through R1 and C1 falls off enough to reduce the voltage drop across R1.

Liquid Level Control. Farmers, chemical engineers, food processors, electroplaters, beverage manufacturers, industrial plant operators and others need to check or maintain liquid levels in large tanks or vats from time to time. Super-Sens can do an excellent job in such applications when used with suitable sensor probes. Typical techniques are shown in Fig. 7.

A short length of rigid coaxial cable can be used as a simple liquid sensor probe if clamped to the side of a tank. If the cable's shield is connected to the instrument's B terminal and the center conductor to the I terminal, the relay will close when the liquid reaches the exposed lower end of the cable. Connections are as shown in Fig. 7 (A).

If a metal tank is used, the sensor probe may be a short length of conductor mounted in an insulated, liquid-tight bushing at an appropriate point on the side of the tank, as illustrated in Fig. 7 (B). If the liquid is highly conductive, connections can be made to the I and G terminals, with a jumper between the I and B terminals. With these connections, the Sensitivity control is adjusted until the relay just closes. The relay will open when the liquid level reaches the probe.

Other types of probes can be used, of course, including insulated metal strips cemented inside the tank or short parallel metal rods mounted on an insulating block and attached to the tank. Regardless of the probe used or the type of liquid handled, Super-Sens can control pumps or solenoid valves, or activate remote signaling devices.

Rain Alarm. A standard moisture sensor plate will make Super-Sens serve as a rain alarm. The sensor plate leads are connected as shown in Fig. 8 (A) and operate in the same way as the level control in Fig. 7 (B). Just a drop or two of rain on the sensor plate is enough to cause the relay to open.

Humidity Control. A modification of the "rain alarm" circuit is shown in Fig. 8 (B). Here, the moisture sensor plate is connected and operated in the same manner as the circuit shown in Fig. 7 (A). With this arrangement, Super-Sens' high sensitivity will respond to the slightest trace of moisture and close the relay. It can detect the small amount of moisture condensed from a person's breath and can be used, among other applications, for controlling a dehumidifier.

Lawn Sprinkler Control. If the moisture sensor plate used in the "rain alarm" and "humidity control" circuits is replaced by a pair of semi-insulated spike-type probes driven into the ground, Super-Sens will serve as an automatic lawn sprinkler control. Its output terminals (Continued on page 110)
If one antenna is good, why aren't two better? They are. Two properly stacked antennas will bring in about one-and-a-half times more signal voltage than a single antenna; a stack of four can almost double the signal voltage. Of course you can't just keep doubling the antennas indefinitely. Beyond eight, there is no appreciable increase in signal pickup.

However, increasing signal strength isn't the only reason for stacking antennas. In fact, it isn't even the best reason. If you need more signal pickup, you may be better off buying a more expensive, higher gain antenna than stacking two antennas. And, if even the best antenna you can find doesn't do the job, you should probably add a good mast-mounted preamplifier.

When should you stack antennas? When you are faced with certain reception problems that can't be solved in any other way. There are two ways to stack antennas: vertically and horizontally.

Vertical Stacking. There are three reasons for stacking antennas vertically:

(1) To reduce signal fading from distant TV stations;

(2) To reduce signal interference from other TV stations;

(3) To reduce signal interference from other electronic devices.

By LON CANTOR
Jerrold Electronics Corp.
VERTICAL STACKING  
reduces fading  
reduces airplane flutter  
increases signal pickup  

HORIZONTAL STACKING  
reduces ghosts  
reduces man-made interference  
reduces adjacent-channel interference  
reduces co-channel interference  
increases signal pickup  

(2) To reduce airplane flutter;  
(3) To increase signal pickup.

Because TV signals are so high in frequency, they are limited primarily to line-of-sight distances. However, by various means, they do manage to get to “blind” areas and regions a short distance over the horizon. While lower frequency radio waves do follow the curvature of the earth and TV signals don’t bend very well, a small portion of the TV signal does bend around obstructions to get to the antenna. This can take the form of a knife-edge type of diffraction as from the roof-edge of a building, or a gentler slope as from the top of a hill.

Television signals also reach the fringe antenna by reflection—bouncing off of atmospheric interfaces, and refraction—bending caused by atmospheric layers with different densities.

Let’s suppose you’re putting up a fringe antenna. You won’t get the most signal just by mounting the antenna as high as possible. Instead, you must carefully probe for the height that gives you the best possible TV pictures. Because of the methods of signal propagation, this height is quite critical. It is the height at which most of the diffracted, reflected, and refracted signals that are present arrive in phase. At heights at which these various signals arrive out of phase, they actually subtract from each other.

The trouble is that the signals that reach the antenna by atmospheric reflection and refraction are not stable. They change as the atmosphere shifts. This is the main reason for signal fading in fringe areas.

The solution to this problem is the vertical stack. You put the two antennas at different heights. Thus, when one antenna is receiving out-of-phase signals, the other is receiving in-phase signals. If you combine these two antennas properly, you wind up with an average signal that doesn’t vary much. This is a form of diversity reception.

When the antennas are not delivering the same signal, the out-of-phase antenna acts as a load to the in-phase antenna. Instead of getting additional signal, you actually get less than the in-phase antenna alone can deliver, unless you effectively isolate one antenna from the other.

Fig. 1. Hybrid splitter allows signals from each antenna to add to each other, and minimizes loss when one antenna acts as a load on the other. Leads to transformers and splitter should be equal.

Commercially available stacking bars won’t do the job. Stacking bars are fine when both antennas are delivering approximately the same signal. Obviously, this is seldom the case in a fringe installation.

Figure 1 shows how antennas should be vertically stacked to minimize signal fading.

There are five important things to do to make a good vertical stack.

(1) Use identical antennas.  
(2) If you use coaxial cable, such as RG-59/U, you should also use a weatherproof 300-ohm to 75-ohm matching trans-
former mounted as close as possible to each antenna.

(3) Use a hybrid type splitter. This type of unit is like a one-way valve. The output contains the sum of the two inputs, with virtually no loss. Yet the two inputs are isolated from each other. Even if the signal on one antenna goes down to zero, it cannot subtract more than about 10% of the signal from the other antenna.

(4) Space the antennas at least two-thirds of a wavelength away from each other on the mast. A full wavelength is preferred, but this is not always possible. In calculating this distance, use the wavelength of the lowest channel in your area. Figure 2 shows the wavelengths of all the VHF channels.

(5) Make the harness symmetrical. The lead run between each antenna and its matching transformer must be identical. Similarly, you must use equal lengths of cable between each matching transformer and the hybrid splitter.

**Horizontal Stacking.** It is foolish to use a horizontal stack simply to increase signal pickup. It is easier, cheaper, and just as effective to use a vertical stack for this purpose. Horizontal stacks, however, may be the only possible way to do the following things:

(1) To reject ghosts;
(2) To minimize co-channel interference;
(3) To minimize adjacent-channel interference;
(4) To reduce man-made interference.

Figure 3 shows the reception pattern of one log-periodic antenna, compared with that of two of them horizontally stacked. Notice that stacking not only increased gain, but changed the pattern considerably. The stacked pattern shows two side lobes, although there are others, with nulls in between. These nulls are important. You can use them to get rid of unwanted signals.

The pattern shown in Fig. 3 is for one particular horizontal stacking situation: when the antennas are stacked precisely one wavelength apart (center to center). Notice that under these conditions nulls are produced at 30° to the right and left of 0°.

Now, suppose you had a tall tower reflecting a ghost signal from an angle 30° away from the transmitted signal. You would simply aim the two antennas at the transmitter, the ghost would conveniently fall into the null, and you'd never see it on the TV screen. It is seldom, however, that you can count on unwanted signals coming in from precisely one of those angles. Therefore, you have to find a method of varying the angles of the nulls.

(Continued on page 113)
PROTECT YOUR CAR’S ELECTRICAL SYSTEM

By CHARLES ERWIN COHN

Forty-five-cent link provides under-the-hood fire protection

MOST VEHICLE lighting and electrical accessory circuits are well-protected by fuses or circuit breakers. However, the main feedline which connects the battery to the generator and to all circuits, except the starter, and the circuit wiring up to the fuse block or circuit breaker very often go unprotected. Should a short occur at a point ahead of the protective devices, the high currents would cause extensive wire damage, battery damage, and possible fire.

At a cost of only 45 cents, it is now possible to minimize this hazard. A fusible link introduced by Chrysler Corporation on its 1965 autos can be adapted for use in any car equipped with a 12-volt battery system. The part number is 2580389, and it can be obtained from any Chrysler dealer.

The link is a short length of 16-gauge wire which behaves like a fuse. Because the regular wiring in the car is much heavier, the link will burn out before the regular wiring has a chance to do extensive damage in the event of a short. At 30 or so amperes, the link runs hot; and at about 40 amperes, it quickly melts. Normal total current requirements in a car rarely exceed 30 amperes. For the system to operate again, once the link fuses, it must be replaced. Special heat-resistant insulation is used to safely contain the hot link.

As shown in the diagram, the link is connected as close to the battery in the electrical system as possible. It should not be inserted in the starter circuit. Usually, the link can be attached to the “hot” terminal of the starter relay. As a safety precaution, disconnect the battery before you install it, and reconnect the battery after the job is done.

Disconnect the feedline from the solenoid, and connect the end of the link with the larger terminal lug to the solenoid and the other end to the feedline. A small nut and bolt can be used to connect both wires. All connections should be firm. The junction of the link and the feedline should be taped, and positioned so that it will not accidentally cause a short circuit.

In the event the link gives way when you are miles away from a service station, reconnect the feedline as it was originally—after you have cleared the short circuit.

POPULAR ELECTRONICS
ELECTRONIC MATH QUIZ

By ROBERT P. BALIN

Many basic electronic circuits can and do perform mathematical operations ranging from elementary arithmetic to integral calculus. See if you can identify the electronic circuits (A-J) below which perform the mathematical operations (1-10) at right.

(Answers on page 115)

1 Add

2 Count

3 Differentiate

4 Double

5 Divide

6 Integrate

7 Ratio

8 Square

9 Subtract

10 Triple

November, 1965
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 advance 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.

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.
THE WINTER of 1965-66 is likely to be the last good DX'ing winter season for the AM broadcast band for some years. As the sunspot numbers increase, we can expect to see more medium-wave signal absorption in the ionosphere. Propagation of medium-wave broadcasting signals over great distances is dependent on many factors, including transmitter power, frequency, antenna characteristics, latitude of the transmitting station, sunspot activity, the time of day and, of course, the season of the year.

During the winter nighttime listening periods, when noise levels in the Northern Hemisphere will be at a minimum, DX conditions should be at their very best. The graph on this page shows the signal strength variation in DX reception versus local time at the mid-point of the path between transmitter and receiver. For European AM broadcasting stations between 500-1600 kc., the best DX period should be from approximately 2100 to 0000 EST.

The following is a summary of DX receiving conditions expected during the period from November, 1965, through February, 1966.

41 and 49 Meters. Continuing the trend of the past several years, these bands will be best for DX reception during the evening hours. Among the stronger stations heard in this hemisphere will be West Germany on 6075 kc., and the BBC on 6195 kc. Not easy to log, but worth looking for, will be Italy on 6060 kc., East Germany on 6115 kc., and RIAS on 6005 kc. The latter station operates 24 hours a day from West Berlin with transmissions aimed toward East Germany.

The BBC will be active on 7130 kc. with transmissions beamed to the South Pacific but coincidentally passing over the East Coast of North America. The Russians will be found throughout the 40-meter band with transmissions beamed to North America, particularly their block-buster signal on 7150 kc.

31 Meters. DX receiving conditions in this band will improve during the early winter months. Expect to hear DX stations starting from late afternoon local time. Reception will consist primarily of Europeans and Africans, as well as some stations in South and Central America.

Guinea will be on 9650 kc. until 1900 (Continued on page 123)


This graph, copied from CCIR Report 264, Geneva, 1964, shows the expected signal loss of AM broadcast-band signals versus time at the mid-point of the signal path. Across the North Atlantic, AM signals should be strongest between 9 p.m. and midnight, Eastern Standard Time. Strength of the AM signal drops off rapidly after about 1 a.m. EST.
SOLID-STATE
6-WATT AMPLIFIER FOR 10 BUCKS

All-purpose push-pull audio amplifier operates on wide range of input voltage and output impedance without bias adjustments.

If you would like to have a quality, low-cost amplifier for a hi-fi or public address system—one you can use at home or in your car, and can convert into a speech amplifier, modulator, or high-power intercom—then try your hand at this transistorized "Six-Watter." You can build it in less than two hours, at a cost of about $10.00. All components can be mounted on a printed circuit board, and construction is easy.

Several novel circuit features make it possible to use few parts, eliminate transformers, and achieve high efficiency. A unique d.c. bias stabilizing network eliminates the bias adjustments normally found on this type of amplifier and permits operation with a wide range of supply voltages without modification.

The excellent low-frequency response of the Six-Watter is due in part to the absence of transformers and the use of high-value coupling capacitors as well as direct coupling. High-efficiency Class B operation makes it ideal for use wherever battery life is an important consideration. Power consumption from a 12-volt battery under no-signal conditions is less than ½ watt.

While the amplifier can work on any supply voltage ranging from 3 to 15 volts, the higher the voltage source, the greater the audio power output you can get. An input signal of less than 0.2 volt is sufficient to drive the Six-Watter to full output. This is more than adequate gain for most tuners, and crystal or ceramic phono cartridges.

How It Works. Audio input is coupled to the base of transistor Q1 through capacitor C1. The amplified signal at Q1's collector is direct-coupled to the base of Q2. Here again, the signal is amplified and directly coupled to Q3 and Q4. Transistors Q3 and Q4 work in opposite directions; while one is conducting more, the other is conducting less—their output signals are 180° out of phase with each other. This type of circuit makes it possible to drive a push-pull output stage without the aid of a transformer.

The signals from Q3 and Q4 are directly coupled to Q5 and Q6 respectively. Transistors Q5 and Q6 operate as Class B power amplifiers. Balanced operation requires that the product of the current gain of Q3 and Q5 be equal to that of Q4 and Q6.

The filter network, C2 and R4, prevents audio voltage variations at point...
Fig. 1. The audio amplifier uses a novel six-transistor circuit requiring neither transformers nor bias adjustments. It operates with supply voltages of between 3 and 15 volts. An input signal of 0.2 volt is sufficient to drive it to full output. Volume control can be added if desired.

**PARTS LIST**

- C1—10-µf., 15-volt electrolytic capacitor
- C2—100-µf., 15-volt electrolytic capacitor
- C3—1000-µf., 15-volt electrolytic capacitor
- D1—1N2069 diode
- F1—2-ampere fuse
- Q1—2N1305 transistor
- Q2, Q4—2N1305 transistor
- Q3—2N1304 transistor
- Q5, Q6—2N3534 or 2N2148 transistor
- R1, R2—39,000-ohm, 1/2-watt resistor
- R3, R4, R5—1000-ohm, 1/2-watt resistor
- R6—680-ohm, 1/2-watt resistor
- R7, R8—47-ohm, 1/2-watt resistor

1. Printed circuit board, available from Hazleton Scientific Co., Box 163, Hazel Park, Mich. 48030 for $2.85 postpaid with all holes drilled and for $1.95 postpaid undrilled
2. 1/4" x 21/4" x 1/16" heat sinks, copper or aluminum

A in Fig. 1 from reaching Q1's emitter. This results in a high degree of d.c. stability without affecting the a.c. gain of the amplifier.

Any speaker impedance ranging from 1.6 to 16 ohms can be used. Because power output is a function of speaker impedance, and source voltage, stick to a 3.2-ohm speaker and a 12-volt source, if possible.

**Construction.** You can make your own circuit board, or purchase one for $2.85

Fig. 2. Carefully locate and solder all of the components onto the printed circuit board as shown.
Fig. 3. Use this full-size guide in making your printed circuit board. Space the transistors about 1/2" above the board and hold transistor leads on top side of board with a pair of long-nose pliers when soldering.

(see Parts List), or you can mount and wire the components on a small (approximately 4" x 6") conventional type chassis. If you use the board, locate and solder the parts in place as shown in Fig. 2. Space the transistors about 1/2" above the board and hold the transistor lead on the top side of the board with a pair of long-nose pliers while soldering.

Heat sinks for Q5 and Q6 can be cut from a 1/16" copper or aluminum sheet, and should measure 1 3/8" x 2 1/2". Drill holes as shown in Fig. 3. Two holes are used to mount each heat sink on the board, and two are used for the transistor pins. Paint the heat sinks black to increase thermal dissipation. If you plan to use the amplifier continuously at high power levels and high ambient temperatures, increase the size of the heat sinks.

Final Check. After completing construction, feed a 6- to 12-volt d.c. source to terminals 2 and 4 (positive voltage to terminal 2) and measure the d.c. voltage between point A and terminal 4. It should be one-half the supply voltage. If it is not, R1 and R2 may not be matched closely enough. In this case, temporarily replace R1 with a 100,000-ohm potentiometer and adjust the pot until the voltage at point A measures one-half the supply voltage. Then measure the resistance of the potentiometer and replace it with a fixed resistor of that value.

Modifications. You can add a volume control to the amplifier by connecting a potentiometer to the circuit between the

(Continued on page 111)
CERAMIC FILTERS REPLACE I.F.'S

Is an i.f. transformer a must in every superhet receiver? Not any more. You can now use a new resonant mechanical filter by Clevite that tunes automatically to the 455-kc. i.f. in any transistor radio. It comes in two series (TO-01 and TO-02).

"Transfilters," as they are called, are tiny ceramic devices no bigger than your thumbnail, and they never need alignment. Features include: low cost ($1.70 each); small size (3/4" x 1/8" x 3/16", maximum); low insertion loss (less than 3 db); wide bandwidths (4 to 10 kc.); and availability of all standard input and output impedances.

The same manufacturer has also put out a resonant trap (TF-01) that can be used in place of the conventional emitter bypass capacitor in transistor circuits to increase the i.f. selectivity. Figure 1 shows typical frequency response of a transfiltered i.f. stage in which both TO and TF transfilters are used. For a typical transistor i.f. circuit using the transfilters, refer to Fig. 2.

But transfilters are not limited to i.f. circuits; they have other applications. You can use one to make a test oscillator if you don't own a signal generator, or would like to have another signal source. Figure 3 shows a simple oscillator employing the TO-01 unit. This oscillator can be assembled and put into a pocket flashlight case, complete with penlight batteries, and can be used for signal injection or other test purposes.

You can get data sheets and application notes direct from the manufacturer, Clevite Electronic Components, 232 Forbes Rd., Bedford, Ohio. The retail outlet is Semiconductor Specialists, Inc., 5700 West North Avenue, Chicago, Ill. The TO types retail at $1.70 each, and the TF at $1.50.
Fig. 2. This transistorized circuit uses transfilters in place of conventional i.f. transformers. Insertion loss is less than 3 db, and bandwidths of from 4 to 10 kc. provide a selective or high-quality i.f.

Fig. 3. Test oscillator using a TO-01 transfilter and a single transistor. The unit can be built and housed in a small pocket flashlight case, complete with penlight batteries and all, at a very low cost.

NEW SEMICONDUCTORS REPLACE TUBES

Here, at last, are the long-awaited equivalents of the popular 35W4 rectifier and the 50C5 power amplifier vacuum tubes: the new RCA 40265 silicon rectifier and 40264 silicon transistor. With this double-barreled bombshell, RCA has tolled the death knell for the vacuum tube in circuits commonly used by the experimenter or hobbyist.

With these semiconductors, you don’t waste the 13 watts of heater power that vacuum tubes consume, and which does nothing more than heat up the inside of your radio, phonograph, or what have you, and cook the life out of your capacitors and other components. What’s more, the silicon units cost less than the tubes.

We are not saying that these semiconductors are precisely interchangeable with their tube counterparts. What we are saying is that they will perform every circuit function that the tubes will, and at the same voltage levels. RCA plans to use these two semiconductors (plus three more you’ll learn about when you write for data sheets) as the basis for a line-operated all-solid-state AM radio, as well as in other consumer items.

Let’s take a look at the 40265 rectifier first. When working with this baby, remember that you are playing with an a.c.-d.c. circuit (Continued on page 116)
LAST MONTH we suggested that hobbyists and experimenters consider using some of the low-cost silicon transistors on the market. And we listed some of the types that are available. Now let's go into them in a little more detail.

Texas Instruments' TI-411 through TI-414 are medium-power, high-frequency amplifiers, while TI-415 through TI-419 are low-level, low-noise amplifiers. General Electric's 2N2921 through 2N2928 and the GE-10 are all audio amplifiers. Of these, the GE-10 is the most readily available; this unit can be used as a general-purpose replacement for nearly all other low-cost silicon transistors. Motorola's MPS706 and MPS834 are switching types, and are quite suitable for use in r.f. or audio circuits.

All these transistors are encapsulated in molded epoxy with one side flattened, as shown in Fig. 1, to facilitate lead identification. As shown, currently available units feature in-line lead connections. These differ from the usual spaced lead arrangements used in such popular types as the 2N107 and 2N170.

Remember that all currently available silicon transistors are npn types, so if they are being used as direct replacements for pnp germanium types, the circuit power supply and electrolytic capacitor polarities must be reversed. Figure 2 shows a typical biasing arrangement you can use for an npn amplifier stage.

In general, silicon transistors have lower internal leakage than corresponding germanium types. Moreover, many of the newer silicon jobs have very high beta (gain) ratings. For example, the TI-416 has a gain of over 600. If you put a silicon transistor in a circuit designed for operation with a germanium job, you may have to readjust the base bias to achieve optimum circuit performance. In the circuit shown in Fig. 2, the base bias can easily be readjusted by simply changing the $R_1/R_2$ resistance ratio.

If you check the spec sheets for the various transistors mentioned here, you'll come up with a wide set of ratings but you'll also find that each of the types has a power dissipation of at least 200 milliwatts, and a collector-to-base rating of at least 25 volts.

What this all means is that you can use silicon transistors in most standard circuits, and in so doing get a moderate amount of power from the output stages.

Although we have been talking about the low-cost jobs, all that has been said applies to the higher priced silicon transistors as well. Naturally, some transistor lead arrangements vary, but their applications remain the same. So if you want to start out experimenting with transistors salvaged from the inexpensive surplus computer boards that many distributors are offering, go right ahead. Later, as you gain experience with silicon types, we think you'll agree that you'd "rather switch than fight."

Reader's Circuit. Who said simple AM broadcast-band receivers have lost their charm? Certainly not reader Cary A. Jane-
ANT. 
L
ner (Rt. 1, Box 208-A, Cameron, Wis. 54822), who submitted the general-purpose receiver circuit shown in Fig. 3. Cary says his little two-transistor "all-wave" radio does a superb job receiving amateur and s.w. bands, in addition to the standard broadcast band. The only requirement is that a new coil be substituted for each band since there are no provisions for switching.

Cary observed that the receiver's upper frequency is determined primarily by the characteristics of Q1 as well as the inductance of the coils used. Tuning will be critical on the high bands unless a smaller tuning capacitor is used for C3, about 140 pf. or less, when working the high bands.

Unfortunately, Cary did not furnish specific coil-winding data, although he did indicate that he used a set of plug-in coils capable of covering from 550 kc. to 15 mc. However, the coils are nothing special; just keep the tap as close as possible to the base-end of the coil.

Let's look at the circuit. Coil L1 and capacitor C3 comprise the r.f. tuning circuit, while C1 and C4 are just couplers. Capacitor C2 is variable from about 60 to 100 pf., and controls the amount of regeneration desired. Transistor Q1 is a 2N706A r.f. amplifier operated as a grounded emitter regenerative detector. It is base-biased by the drop across R1. Interstage transformer T1 is an Argonne AR109, while output transformer T2, an Argonne AR164, was selected to match the impedance of the 8-ohm speaker used.

Transistor Q2 is a 2N109 pnp unit that's being used as an audio driver; it is indirectly biased through R2 and R3. Capacitor C6 is an audio coupler, and C7 is an emitter bypass capacitor which reduces negative feedback; they are both 10-volt electrolytics. Operating power is supplied by a single 9-volt battery, but you could use six penlight or flashlight cells in series instead. The on-off switch can be any s.p.s.t. type.

The receiver can be assembled on a regular metal chassis, on a perforated phenolic board, or even on an etched circuit board. It all depends on your own preferences.

Fig. 3. This two-transistor "all-wave" radio circuit was submitted by reader Cary Javener. Short-wave and standard broadcast-band transmissions can be received merely by changing the plug-in coil (L1) for each desired frequency band.

Fig. 4. Base-modulated oscillator by Philco can be used in a sweep generator, wireless mike, or transmitter circuit. Basically a modified Hartley oscillator, the circuit produces good frequency modulation linearity with modulating voltage applied to the base of transistor Q1.

November, 1965
since neither layout nor lead dress is critical. But regardless of what you do elsewhere, you must follow good wiring practices in the r.f. section; that is, keep leads as short and direct as possible and properly dressed. And watch your polarities.

Cary swears that he was able to pick up amateur stations in Wisconsin, Minnesota, and Michigan using a 75-meter coil wound on a ferrite core, and that almost any standard antenna can be used with his receiver. However, remember that the set’s sensitivity, as well as its selectivity, will be governed largely by the coils used, as well as by the skill of the operator in adjusting both the tuning (C3) and regeneration (C2) controls. In general, C2 should be adjusted to just below the point at which oscillation takes place.

Manufacturer’s Circuit. Developed by Philco and described in Application Report AE755, the base-modulated oscillator shown in Fig. 4 can be used in a sweep generator, wireless microphone, telemetry system, or transmitter circuit.

It is basically a modified Hartley oscillator, with Q1’s base bias supplied by voltage divider R1-R2. Here, the modulating voltage is applied to the transistor base, but equally good frequency modulation linearity would be obtained if the modulating signal were applied to the emitter. However, to get maximum utilization from even weak modulating signals, the base modulation technique is to be preferred. Furthermore, because some amplitude modulation is always present, regardless of what you do, limiters should be used to remove the AM peaks.

In Fig. 4, coil L1 and capacitor C3 form a parallel tuned circuit whose frequency is determined by Q1’s internal collector-to-emitter capacity, the inductance of the coil, and the setting of C3. The interelectrode capacitance, in turn, is a function of the base bias which varies with the applied modulating signal. It can be seen, therefore, that the frequency of the oscillator varies with the amplitude of the modulating signal.

The oscillator is designed to operate at a center frequency of 30 mc., with a maximum deviation of 400 kc., and can be built with readily available components. For instance, transistor Q1 is a Philco 2N502A unit, C1 is a 12-volt electrolytic, C2, C5, and C6 are ceramic or mica capacitors, while C3 and C4 are small trimmers. Coil L1 consists of 20 turns of B&W 3003 1/8”-diameter coil with emitter tap at 3 turns, and the output tap at 91/2 turns. Battery B1 is rated at 12 volts; and all resistors are half-watters.

Transitips. In our October column, you may recall, we discussed some of the effects of harmonic distortion, and pointed out that a nonlinear amplifier can easily become a harmonic generator, producing frequencies that were not part of the applied signal. For example, if you put in a 1-kc. note, you can get out harmonics at 2 kc., 3 kc., 4 kc., etc. We refer to them as second harmonic, third harmonic, and so on.

Now let’s look at another type of distortion which is also due to the nonlinear operation of an amplifier. This is intermodulation distortion, better known as plain I.M. In some respects, I.M. is more annoying than harmonic distortion, and can be a headache even when the harmonic distortion is within a tolerable level.

For example, suppose two signals, each of a different frequency, are applied simultaneously to a distortion-free amplifier. One will merely be superimposed on the other, and the resultant waveform will be as shown in Fig. 5(A). Observe that the amplifier output signal contains only the original signals.

On the other hand, if the same two signals are passed through a nonlinear circuit, one signal will modulate the other, developing an output waveform similar to that in Fig. 5(B). This composite signal contains not only the two original signals, but also frequencies equal to their sum and difference. For instance, if the two original signals were 50 cycles and 1 kc., the output would contain signals at 50 cycles (original), 950 cycles (difference), 1 kc. (original), and 1050 cycles (sum).

The situation becomes even more complex when both harmonic and intermodulation distortion are present. The output waveform would then contain not only the sum and difference frequencies of all signals handled, but harmonics of these, harmonics of the original signals, and the sum and difference frequency signals of the various harmonics.

In terms of practical transistor amplifiers, harmonic distortion generally is caused by incorrect bias, overdrive, a defective transistor, transformer saturation, or a leaky coupling capacitor. Push-pull circuits can be used to minimize the effects of harmonic distortion.

(Continued on page 114)
As the young man sits facing the computer, a punched paper tape is drawn through a photoelectric reader. Now the electric typewriter tied into the computer takes over. The young man shifts slightly forward to read the question that has been typed out. He ponders the question for a moment and then types back his answer. The computer, through the typewriter, responds:

"Your answer is incorrect. At your earliest convenience read pages 74-79 in your textbook. Try again."

The young man described above is using ALPHA-COM, a teaching program which permits a question-and-answer relationship between the student and the computer. The computer’s arithmetic and logic circuits evaluate the answers, deciding whether they are right or wrong. If an answer is right, the computer types the next question. If wrong, it types back an appropriate reply and tells the student to try again. Some typical ALPHA-COM replies are:

"Read the question again, more carefully."
"You are guessing. Try again."
"Ask your instructor for additional reading assignments."

ALPHA-COM is neither expected nor intended to replace human instructors but is a powerful teaching aid that makes the learning process faster and
easier. Developed at Northwestern TV and Electronics Institute of Minneapolis, Minn., it enables the computer to test a student's knowledge, to call attention to his errors, to evaluate his performance by calculating a numerical grade, and to make recommendations for further study. Because Northwestern trains technicians for employment in the electronics industry, the original ALPHA-COM program contains questions relating to electronics theory. It can, however, be easily modified for other subject areas.

A compassionate but demanding teacher, ALPHA-COM (for ALPHAnumeric COndersational Mode programming) will always give the student a chance to "try again" after an incorrect answer, but it insists on a correct answer before going ahead to the next question. Not only can the computer recognize an incorrect answer, it can recognize an illegitimate answer—one that has nothing to do with the question it has asked. It will respond to such an answer by typing out a reprimand to the student, and it will tolerate two such attempts to be "cute." The third time, it will summon the human instructor by repeated ringing of a bell. Only manual intervention by the instructor (he types a special code number) will stop the bell and restore question-and-answer operation.

While the giants of the computer industry direct their major efforts toward business and industrial applications, educators are more concerned with the computer as a teaching machine. It is not difficult to imagine a future installation consisting of dozens of typewriter-equipped stations connected to a central computer which would have sufficient memory capacity and input/output circuitry to handle a whole class of students at once. The computer would communicate with each student individually, allowing each to progress at his own rate, and directing some back to earlier lesson material for review. It would also calculate students' grades and retain these in memory for later reporting to school officials. All this is not mere speculation—it can be done today by any school having computer-oriented personnel and sufficient funds for the necessary hardware.

—Ed Bukstein

GET THAT BEAM ANTENNA SHOT

There are three very good reasons for taking a photo of your brand-new beam antenna. First, you might find a magazine willing to publish the shot (don't laugh—it happens every day); second, you might fit the photo into your next QSL card; but the third reason may be most important. When that antenna went up, so did your insurance liabilities. Not only is a beam a hazard (children always try to climb the tower), but have you considered the cost of replacement? Are the tower and beam insured? If they are, how can you approximate their value—without a photo that an expert could appraise?

Taking antenna photos is not an easy task. Most amateur photographers need reminding that black and white films don't "see" the same things against the bright sky as the human eye. Filtering is called for (see caption), and be sure to shoot when the sun is glancing light off the elements toward the camera.

The photo on the left was taken with 35-mm. Plus-X and a setting of 1/100 sec. at f16—no filtering. On the right is the same scene shot several minutes later with a Kodak Wratten Type A filter at 1/100 and f5.6. Note darkened background and how the elements stand out against the sky.

AmericanRadioHistory.Com
DON'T JUNK YOUR OLD FM TUNER
UPDATE IT FOR LAND MOBILE RADIO SERVICES

By CHARLES E. FRANCIS, K8VRX

HAS YOUR FM tuner been made obsolete by the recent onslaught of vastly improved FM and FM stereo receiving equipment? Then spruce up that old tuner and snoop in on police calls, fire, civil defense, weather reports, and rescue squad operations for sheer pleasure or wild excitement. The simple modifications described here will enable you to change the tuning range of any variable-capacitor-tuned FM tuner or receiver to pick up high-band Land Mobile radio services (see "Hats Off to VHF," August, 1965). It should take less than 30 minutes.

This conversion to receive the 152- to 174-mc. band is designed to maintain the standard 10.7-mc. intermediate frequency. The i.f. section of the tuner need not be realigned. However, to avoid getting lost in tracking and other problems, you should be certain that your tuner or receiver is in good working order before you begin the conversion.

The procedure is basically the same for any variable-capacitor-tuned tuner, regardless of make or model, the only difference being in the number of turns for the r.f. or oscillator coil. While it is easier to pinpoint the effects of your modifications with a grid dip meter or other frequency-measuring device, in most instances you will be able to find your way simply by noticing the effects of each adjustment. The Heathkit Model FM-3 tuner, typical of a great many units now in use, responded very well to this treatment.

Converting the Tuner. The modifications are simple and consist of the following four steps:

1. Remove the tuner case, and all components necessary to gain access to the tuning elements. Do not remove more than you have to. Figure 1 shows the front panel, dial cord, and dial-cord pulley removed to give you a better view of the parts to be modified.

2. You will note that the tuning capacitor (Fig. 2) has two sections, the front being the r.f. section, and the rear the oscillator section. Using a pair of long-nose pliers, carefully remove one rotor end plate from each section. These

Fig. 1. The tuner front panel, dial cord, and dial-cord pulley can be removed to provide adequate working space. In most cases, it will only be necessary to remove the tuner chassis from the cabinet to gain access to tuning capacitor and coils.
plates are press-fitted into place and can be gently worked out of their positions. It should not be necessary to twist, bend or break the plates. **Caution:** Do not bend, loosen, or otherwise damage the other plates. If possible, do not even touch the other plates. After removing one plate from the rotor in each section, there will still be two rotor and two stator plates left in each section. (If your tuner has a different-size variable capacitor with a different number of plates, the procedure is still the same—do not remove more than one plate from the rotor in each section.)

(3) Remove the r.f. coil and replace it with a two-turn coil formed by wrapping a piece of #16 solid copper wire around an ordinary pencil. Stretch the coil turns to a length of \(\frac{3}{4}\) inch, leaving a short pigtail for connection.

(4) Remove the oscillator coil and replace it with one formed by wrapping two turns of #16 wire around a pencil. Stretch the turns to \(1\frac{3}{16}\) inch across. Reconnect the oscillator coil tap at the center of the coil, and reassemble the components and hardware, but do not put the tuner back into the case.

Except for an air check and a few adjustments, your conversion is completed.

**Antenna Considerations.** For optimum performance, a highly directional antenna aimed at the station you are listening to is ideal; but with signals coming at you from different directions, you are better off with a ground plane or other omnidirectional antenna. The vertical antennas usually have a 52-ohm impedance and call for a 52-ohm coaxial transmission line. If you do go for the 52-ohm job, insert a 52-ohm to 300-ohm matching transformer between the line and the set, at the set's antenna terminals.

An ordinary indoor TV 300-ohm antenna can be used quite effectively, if you telescope the elements down to proper size. Simply adjust the length and direction for maximum volume.

**Touch Up and Tune In.** If the tuner works perfectly when you connect the antenna, go no further—you're in! But most likely you'll have to do a little touching up of the coils and/or trimmers. Here's what you do:

1. Tune in a station near 170 mc. and carefully adjust the oscillator trimmer to bring in the station near the high end of the band. If you can't bring in the station where you want it when adjusting the trimmer, try expanding or contracting the length of the oscillator coil to move the station down or up, respectively.

2. Adjust the r.f. trimmer for maximum volume and clarity. If you have the feeling that you could get more out of the r.f. trimmer by tightening it a wee bit but you can't because it is already screwed all the way down, just back off about a turn and a half, compress the r.f. coil a little and try the trimmer again. (Of course, you can expand the coil if the trimmer is wide open and still doesn't seem to be open enough.)

3. Now try tuning in a station at the low end of the band. If the station comes in, that's it. If it doesn't, you may have to shift the tuning range up a bit more. It's easy; the oscillator adjustments shift the band up or down the tuning scale and the r.f. stage peaks the signal.

Should you run into tracking problems, such as good volume and clarity at one end of the band and not at the other, select a station in the middle of the band and, with the variable capacitors set in mid position, adjust the oscillator and r.f. coils and trimmers for maximum volume and clarity. Any tracking errors still present will be reduced by about 50%.
Why depend on batteries when you can get all the energy you need free of charge? How?

**LET THE SUN POWER YOUR PORTABLE**

By HOMER L. DAVIDSON

**YOU CAN USE** the sun to power your small transistor radio—or, if it's raining, you can use a 100-watt light bulb. The only other element you really need is International Rectifier Corporation's "Solar Pac," which can be hooked up to charge the radio's battery, or to operate the radio, or to do both. The "Solar Pac" comes in two models: SP5C26C (4.5 volts at 26 ma.) and SP9C13C (9 volts at 13 ma.), and is available from electronic supply houses for $9.95.

There are many ways you can connect the solar pack to your radio. You may
want to add a switch (see schematic) to provide a choice of either solar or battery power. Or you can simply connect the pack's 6" leads to the battery connections inside the radio. You can even use the solar pack as a plug-in supply by connecting an earphone jack and cord to the pack, removing the existing wires from the radio's earphone plug, and running a pair of wires from the plug to the battery connections.

Mounting the pack is no problem as it is supplied with mounting pads which can be attached easily to any radio case or cover. But for a more permanent installation, place the pack against the plastic back of your radio, outline its shape with a scribe, carefully cut out the required area with a knife-tipped soldering iron or jeweler's saw, fit the pack into place, and seal around the edges with cement.

If you plan to use the solar pack as a universal power supply for more than one radio or transistor project, add alligator clips to the pack's leads for easy handling. Should circumstances require lower voltages than that provided by the solar pack, insert an inexpensive 100-ohm potentiometer in series with the output to reduce the voltage.

Once you know how much resistance you need in a given circuit (by measuring the pot's resistance in the circuit), you can substitute a fixed resistor. Add a resistor only when no battery is in the circuit, and only when the unit is to be used out-of-doors. A resistor is not required indoors as you can move closer to or further away from the light source to obtain a desired voltage.

Hook up a couple of alligator clips to the leads of the solar pack to make easy-to-connect power supply.

By connecting the solar pack in parallel with the battery, you can charge the battery while operating the radio, or run the radio without the battery.

The earphone jack connections of your transistor radio can be modified to accommodate the solar pack.

The solar pack can be cemented to the radio case, and the leads can be slipped under the case flap.
SAFETY RULES FOR SWL'S

EVEN short-wave listening can be a dangerous sport. There are many ways in which an SWL can be accidently injured in the pursuit of his favorite hobby—particularly while making repairs or installing an antenna.

One of the most common types of accidents, fortunately not usually too serious, involves those who insist on probing into their receivers while the power is on. It can be done if you know what you are doing. Unfortunately, it usually takes a few jolts to make some people have more respect for those innocent-looking capacitors.

The safest way to examine a faulty piece of equipment is with the power off. The best thing to do is pull the plug and ground the capacitors before you stick your fingers inside the receiver.

No expert electronics man has gone through life without being walloped by B-plus, or tickled silly by the a.c. power line, or burned by a hot tube. It's smart business to learn from the mistakes of others, because you may not live through one of your own.

The antenna, too, can become an accident machine. We recently received a letter from a mother whose son was electrocuted while erecting an antenna. So slow down and walk away from an installation that can come in contact with a power line. The operator who lost his life may have noticed the nearby power line, and he may have assumed that it couldn't happen to him. What he should have done was to get far enough away from the power line to prevent contact even if the antenna toppled over.

And there's always the risk of falling out of a tree, or off a ladder or roof when you're putting up an antenna. Be sure the ladder is firmly footed and the tree is firmly planted before you climb. It may be embarrassing to find yourself up a tree, or out on a limb, or hanging from your fingernails over the edge of a roof—even if you don't fall. It's a good idea to use the buddy system. Invite a friend over and let him at least hold the ladder for you. Should you become stranded and not be able to get down safely, he will be able to call the fire department to rescue you.

In most cases, just plain common sense goes a long way towards preventing accidents. So take time out to examine a situation before you get involved in one.

(Continued on page 125)
1 Each applicant must be a registered WPE Short-Wave Monitor, and must enter his identification sign on the application form (or facsimile).

2 Each applicant must submit a list of stations (any frequency or service) for which he has received verifications, one for each heard and verified. The list should contain 6, 8, 10, or 12 provinces, depending on which DX award is being applied for. The following information must be furnished in tabular form and in alphabetical order by province for each verification:
   (a) Province heard
   (b) Call-sign of station verified and location
   (c) Frequency
   (d) Date station was heard
   (e) Date of verification (postmark dates acceptable).

All the above information should be copied from the station's verification. Do not list any verification you cannot supply for authentication on demand. The provinces of Canada deemed acceptable are: Alberta, British Columbia, Labrador, Manitoba, New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, Quebec, Saskatchewan, and either Yukon or Northwest Territories.

3 All pertinent verifications, whether QSL cards or letters, should be carefully packaged and stored by the applicant until such time as instructions are received to send in some or all of them for checking purposes. Instructions on how and to whom to send the verifications will be given at that time. Failure to comply with these instructions will disqualify the application.

4 A fee of 50 cents (U.S. coin or stamps) must accompany the list of verifications to cover the costs of printing, handling, and mailing. This fee will be returned in the event an applicant is found to be ineligible for an award. Applicants outside of the United States may send 60 cents (U.S.) in coins of their country if they so desire. Please do not send International Reply Coupons (IRC's).

5 Apply for the highest DX award for which you are eligible. If, at a later date, you become eligible for a higher award, then apply for that award, following these rules and regulations exactly as before.

6 Mail your verification list, fee, and the application form to: Hank Bennett, Short-Wave Editor, POPULAR ELECTRONICS DX AWARDS, P. O. Box 333, Cherry Hill, N.J., 08034. Include in the envelope only those items which are directly related to your entry for the award. Do not include an application for a Short-Wave Monitor Certificate (you are not eligible for any of the awards until you have a Monitor Certificate). If you want to supply news items, reports, etc., please use another envelope.

---

### POPULAR ELECTRONICS' DX AWARD APPLICATION FORM

(please print)

<table>
<thead>
<tr>
<th>WPE Identification</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>City</td>
</tr>
</tbody>
</table>

Please enter my application for the following POPULAR ELECTRONICS’ DX AWARD:

(check one) 6 8 10 12

☐ I have enclosed a list of the required number of provinces, and I hereby certify that I hold a verification from at least one station (any frequency or service) in each of the provinces listed

☐ I have enclosed 50 cents to help cover the costs of processing and mailing my DX Award

Signature ______________________________________ Date ______ 1965

Mail to Hank Bennett, POPULAR ELECTRONICS DX AWARDS, P. O. Box 333, Cherry Hill, N. J.

---

AmericanRadioHistory.Com
ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

Prepared by ROBERT LEGGE

All of the stations below have announced English-language newscast programs at the times and on the frequencies given. Note a number of changes in the setup of the listing from our previous editions: use of EST in the colloquial a.m. and p.m.; use of mc. instead of kc.; and a division of transmissions beamed to the eastern and central parts of the U.S. from those beamed toward the west coast. Some additional broadcasts are beamed to North America, but are not included in this listing since they are not expected to be heard satisfactorily during the winter months.

—THE EDITORS

### TO EASTERN AND CENTRAL NORTH AMERICA

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>CITY</th>
<th>TIME—EST</th>
<th>TIME—GMT</th>
<th>FREQUENCIES (MC.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALBANIA</td>
<td>Tirana</td>
<td>7 p.m.</td>
<td>0000</td>
<td>7.265</td>
</tr>
<tr>
<td>ARGENTINA</td>
<td>Buenos Aires</td>
<td>10 p.m. (Mon.-Fri.)</td>
<td>0300 (Tues.-Sat.)</td>
<td>9.69</td>
</tr>
<tr>
<td>AUSTRALIA</td>
<td>Melbourne</td>
<td>7:45 a.m.</td>
<td>1245</td>
<td>9.58</td>
</tr>
<tr>
<td>BULGARIA</td>
<td>Sofia</td>
<td>7 p.m., 11 p.m.</td>
<td>0000, 0400</td>
<td>6.07</td>
</tr>
<tr>
<td>CANADA</td>
<td>Montreal</td>
<td>7:15 a.m.</td>
<td>1215</td>
<td>5.97, 11.72, 15.32</td>
</tr>
<tr>
<td>CHINA</td>
<td>Peking</td>
<td>8 p.m., 9 p.m.</td>
<td>0100, 0200</td>
<td>7.035, 9.48</td>
</tr>
<tr>
<td>CUBA</td>
<td>Havana</td>
<td>10 p.m.</td>
<td>0300</td>
<td>6.135</td>
</tr>
<tr>
<td>CZECHOSLOVAKIA</td>
<td>Prague</td>
<td>10 a.m. (Sun.)</td>
<td>1500 (Sun.)</td>
<td>15.285, 15.448, 17.825</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 p.m., 10:30 p.m.</td>
<td>0100, 0330</td>
<td>5.93, 7.12, 7.345</td>
</tr>
<tr>
<td>DENMARK</td>
<td>Copenhagen</td>
<td>7:30 a.m.</td>
<td>1230</td>
<td>15.165</td>
</tr>
<tr>
<td>FINLAND</td>
<td>Helsinki</td>
<td>7:15 a.m. (Tues., Sat.)</td>
<td>1215 (Tues. Sat.)</td>
<td>15.185</td>
</tr>
<tr>
<td>GERMANY</td>
<td>Cologne</td>
<td>8:30 p.m.</td>
<td>0130</td>
<td>6.075, 9.64</td>
</tr>
<tr>
<td>HUNGARY</td>
<td>Budapest</td>
<td>7:30 p.m., 8:30 p.m.</td>
<td>0030, 0130</td>
<td>7.305, 9.833</td>
</tr>
<tr>
<td>ITALY</td>
<td>Rome</td>
<td>8 p.m.</td>
<td>0100</td>
<td>5.96, 9.63</td>
</tr>
<tr>
<td>JAPAN</td>
<td>Tokyo</td>
<td>7 p.m.</td>
<td>0000</td>
<td>11.78, 15.135</td>
</tr>
<tr>
<td>NETHERLANDS</td>
<td>Hilversum</td>
<td>4 p.m.</td>
<td>2100</td>
<td>6.085, 9.59</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8:30 p.m.</td>
<td>0130</td>
<td>9.95 (via Bonaire relay)</td>
</tr>
<tr>
<td>NORWAY</td>
<td>Oslo</td>
<td>11 a.m. (Sun.)</td>
<td>1600 (Sun.)</td>
<td>15.175, 17.825</td>
</tr>
<tr>
<td>PORTUGAL</td>
<td>Lisbon</td>
<td>9 p.m., 10:45 p.m.</td>
<td>0200, 0345</td>
<td>6.025, 6.185</td>
</tr>
<tr>
<td>SPAIN</td>
<td>Madrid</td>
<td>8 p.m., 9 p.m.</td>
<td>0100, 0200</td>
<td>6.13, 9.615</td>
</tr>
<tr>
<td>SWEDEN</td>
<td>Stockholm</td>
<td>9 a.m.</td>
<td>1400</td>
<td>15.195</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 p.m.</td>
<td>0100</td>
<td>5.99</td>
</tr>
<tr>
<td>SWITZERLAND</td>
<td>Berne</td>
<td>8:15 p.m.</td>
<td>0115</td>
<td>6.08, 6.12, 9.535</td>
</tr>
<tr>
<td>UNITED KINGDOM</td>
<td>London</td>
<td>11 a.m.</td>
<td>1600</td>
<td>11.84, 15.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 p.m., 6 p.m.</td>
<td>2200, 2300</td>
<td>6.195, 7.13, 9.51, 9.735</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 p.m., 9 p.m.</td>
<td>0000, 0200</td>
<td>6.195, 7.13, 9.51, 9.735</td>
</tr>
<tr>
<td>U.S.S.R.</td>
<td>Kiev</td>
<td>7:30 p.m. (Mon., Thurs.)</td>
<td>0030 (Tues., Fri.)</td>
<td>7.31, 9.665</td>
</tr>
<tr>
<td></td>
<td>Moscow</td>
<td>5 p.m.</td>
<td>2200</td>
<td>7.15, 7.31, 9.665</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 p.m., 7 p.m., 8 p.m.</td>
<td>2300, 0000, 0100</td>
<td>7.15, 7.205, 7.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 p.m., 10 p.m.</td>
<td>0200, 0300</td>
<td>6.07, 7.15, 7.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11 p.m., 12 Mid.</td>
<td>0400, 0500</td>
<td>7.15, 7.31, 9.665</td>
</tr>
<tr>
<td>VATICAN CITY</td>
<td>Vatican</td>
<td>7:50 p.m.</td>
<td>0050</td>
<td>5.985, 7.25, 9.645</td>
</tr>
</tbody>
</table>

### TO WESTERN NORTH AMERICA

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>CITY</th>
<th>TIME—EST</th>
<th>TIME—GMT</th>
<th>FREQUENCIES (MC.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARGENTINA</td>
<td>Buenos Aires</td>
<td>10 p.m. (Mon.-Fri.)</td>
<td>0600 (Tues.-Sat.)</td>
<td>9.69</td>
</tr>
<tr>
<td>AUSTRALIA</td>
<td>Melbourne</td>
<td>6:30 p.m., 7:30 p.m.</td>
<td>0230, 0330</td>
<td>15.22, 17.84</td>
</tr>
<tr>
<td>CHINA</td>
<td>Peking</td>
<td>7 p.m., 8 p.m.</td>
<td>0300, 0400</td>
<td>7.08, 9.457</td>
</tr>
<tr>
<td></td>
<td>Taipei</td>
<td>6:50 p.m.</td>
<td>0250</td>
<td>9.685, 11.825, 15.345</td>
</tr>
<tr>
<td>CUBA</td>
<td>Havana</td>
<td>9 p.m.</td>
<td>0500</td>
<td>6.135</td>
</tr>
<tr>
<td>GERMANY</td>
<td>Cologne</td>
<td>7:10 a.m.</td>
<td>1510</td>
<td>9.735, 11.795</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8:55 p.m.</td>
<td>0455</td>
<td>6.145, 6.16, 9.575</td>
</tr>
<tr>
<td>JAPAN</td>
<td>Tokyo</td>
<td>7:15 p.m.</td>
<td>0315</td>
<td>11.78, 15.135</td>
</tr>
<tr>
<td>KOREA</td>
<td>Seoul</td>
<td>7 p.m.</td>
<td>0300</td>
<td>11.925</td>
</tr>
<tr>
<td>SPAIN</td>
<td>Madrid</td>
<td>7 p.m.</td>
<td>0300</td>
<td>6.13, 9.615</td>
</tr>
<tr>
<td>SWEDEN</td>
<td>Stockholm</td>
<td>6:30 p.m.</td>
<td>0230</td>
<td>5.99</td>
</tr>
<tr>
<td>SWITZERLAND</td>
<td>Berne</td>
<td>7 a.m.</td>
<td>1500</td>
<td>15.305</td>
</tr>
<tr>
<td>THAILAND</td>
<td>Bangkok</td>
<td>8:15 p.m.</td>
<td>0415</td>
<td>11.91</td>
</tr>
<tr>
<td>U.S.S.R.</td>
<td>Moscow (via</td>
<td>7 p.m., 8 p.m.</td>
<td>0300, 0400</td>
<td>9.54, 9.735, 11.85</td>
</tr>
<tr>
<td>Khabarovsk)</td>
<td></td>
<td>9 p.m., 10 p.m.</td>
<td>0500, 0600</td>
<td>9.54, 9.735, 11.85</td>
</tr>
</tbody>
</table>
In the April edition of this column, we began an unofficial campaign to bring the facts about CB radio to the attention of the general public through AM broadcast station interviews. The project was primarily designed to explain the Citizens Radio Service, its purpose, and especially the manner in which it is being used in public service and emergency activities. Following two kick-off interviews in which we were allotted 30 minutes per segment to “spread the word,” we encouraged every CB club in the country to approach their local AM stations with a similar proposal: to be interviewed, discuss and answer questions about CB radio as its users know it.

Just recently Jane Neubauer, the charming hostess of “Tete A Tete,” a daily television information program, heard of our past discussions over AM radio stations WBEL and WOBT, and asked that we join her at WREX-TV in Rockford, Ill., to fill her audience in on “what this CB business is all about!” The pleasure was ours!

Prior to videotaping the show, we felt quite confident that we were in good hands upon learning that the audio and video engineers, Don and Jerry Meinders, and the director of the show, Guy Fiorenza, were all licensed Citizens Band operators. During the near quarter-hour telecast, we were able to cover the advent of CB, its primary purpose and uses, its growth and expanding applications in the realm of emergency assistance.

Jane and her audience were shocked—but interested—to learn that there are 850 REACT emergency teams across the country; 1000 H.E.L.P. volunteer units; 1000 CB clubs actively engaged in public service and emergency assists; and 3 million potential “assistants” ready to volunteer if and when needed. In fact, as a result of the interest stimulated by our first telecast, Jane has invited us back for another session to be devoted strictly to the emergency uses of CB radio.

We suggest that club officers review our April OTCB column; and we urge all clubs, teams, or groups to plot an interesting program for AM radio and/or television. Be sure the plotting is done before approaching the program director. And keep in mind that a good television interview demands good video—your handsome profile with a
The building in the background is the main control center for 13 base stations located throughout the St. Louis (Missouri) Zoo. The sea lion in the foreground appears to be imitating the antenna, a Mosley "Devant-1," perched on the roof of the building.

microphone sticking from your ear is not enough. Take along a set of clear pictures showing your group in action. If possible, bring an older-type handmade CB transceiver to compare with a modern-day piece of gear.

We would appreciate receiving copies of scripts used or a tape dub, if possible. At least, send us the details of your interview along with the results. A good, clear photograph would also be appreciated. Be sure to include names, addresses, and other pertinent information.

Our thanks to Miss Neubauer, WREX-TV, and the TV/CB crew that enabled us to add "video" to "Project Interview." If half of the active Citizens Band clubs across the country were to participate in the project on a local level through area AM/TV facilities, an uninformed public of millions might better understand our communications position before the year is out.

CB Safeguards Animals. We've never been associated with the minority of critics who theorize that "CB has gone to the dogs."

November, 1965

We recently became aware, however, that Citizens Band radio has definitely come to the aid of a large variety of animals paralleling Noah's assortment on the ark. KDTO340 is the call-sign of the St. Louis (Missouri) Zoo. The grounds employ 13 base station transceivers, two mobile truck units, and several walkie-talkies.

The main control station is identifiable to the eye only by the Mosley "Devant-1" base station antenna perched on the roof of one of the refreshment stands on the grounds. The 12 other base stations spread throughout the zoo can be reached by this center or can contact one another through the same control station. In the old days (before CB), a refreshment stand that ran short of supplies was forced to wait for a supply boy who made regular rounds on a motor scooter. A considerable wait often meant loss of profit to the stand plus the loss of friendship on a warm day from the little tyke who wanted that bottle of soda pop "now." Today, a press of the CB mike button, a short transmission, and supplies are on the way in short order.

Workers at each refreshment stand collectively have a wide area view of the entire zoo, enabling them to relay malfunctions of the parking gates or any discrepancies at any of the animal pens within view. Plain-clothes policemen patrolling the grounds can also be contacted through any one of the 13 base stations.

The watchmen who guard the zoo at night contact one another by means of CB walkie-talkies. If one needs help, the other can be on the scene usually in seconds. Also, there are times when temperatures within the zoo need regulating due to the unusual demands of some of the residents. If a furnace needs adjustment, one guard can contact another for assistance, or ask the other to cover his post while he is temporarily occupied.

When animals arrive for the zoo at the St. Louis Lambert Airport, a CB-equipped zoo truck crew meets the airplane, examines the animals, then relays their condition and informs the zoo of any special preparations that must be made for the new residents while they are being transported ten miles to their new home.

The St. Louis Zoo has found Citizens Band radio invaluable for its purposes. The operation of CB behind the scenes helps bring efficiency to the world-famous institution.

Area Call Books. Our old friend, Mel Baer, of K9TVA Enterprises advises us of the availability of cross-referenced Class D CB license directories for several FCC areas.

(Continued on page 119)
A couple of months ago the Editors of POPULAR ELECTRONICS offered to set up a clearinghouse for hams with other hobbies if there was enough interest shown in such a service. Since then the postcards have been coming in, as evidenced by the listings below.

If YOU have a second or third hobby that you would like to talk about on the air, tell us about it, or them. We believe that, through this clearinghouse, other hams who have the same interests will try to contact you. By the same token, the information appearing here should enable you to initiate some calls of your own—to those radio amateurs who have the same hobbies that you do.

To be listed here, just send us a postcard with the following information typed or printed on it: your call letters, other hobbies, the frequencies on which you operate, mode of operation, when you’re on the air, and your name and address. Send the card to: Ham Hobby Clearinghouse, c/o POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016.

WA2FAS—Flying, coin and stamp collecting, and water sports; 80 to 10 meters, 20 and 15 meters SSB; evenings and weekends, Friday evenings preferred. (Gary Goldberg, 221 Clark St., Hillside, N.J., 07205)

WB2KPO—Astronomy, photography, and hi-fi; 75, 40, and 20 meters, SSB; weekends and after school on weekdays. (Howard Lester, 245 Rumsey Rd., Yonkers, N.Y. 10701)

WB2LH—Electronic equipment, especially older models; 14,290-14,320 kc., SSB; 11 a.m. to 2 p.m. Sundays. (R. I. Palluth, 398 Manor Rd., Staten Island, N.Y.)

WB2NIN—Astronomy, photography, and science, and hi-fi; 80 and 40 meters, mostly CW, sometimes AM; 8-10 week nights, 1-5 Saturday afternoons. (Dr. Maurice J. Small, 158 S. Harrison St., East Orange, N.J. 07018)

WB2NRL—Photography and SWL'ing; 40 meters, CW; evenings from 4:30 to 9:30. (Henry F. O'Meara, 21 Glendale Rd., Brockport, N.Y.)

WB2ODI—BCB DX'ing; 75-15 meters, phone and CW. (Chris Schmink, Williamsville, N.Y. 14221)

WB2OVI—Hi-fi/stereo, and project construction; 6 meters, phone, Friday afternoons and Sundays. (Alan R. Sandler, 861 E. 27 St., Brooklyn, N.Y.)

WB2RBA—Model rocketry and photography; 75 meters phone, and 80 meters CW; would like to start a net of teen-agers on 75 meters. (Joe Malloy, 474 Pacific St., Massapequa Park, N.Y. 11762)

WN2TDA—Archery and reading; 40 meters; 5-10 p.m.
during the week and all day weekends. (Bill Dundas, 2 Stiles St., Painted Post, N.Y.)

K3ZLB/5—Radio and ham TV, scuba diving, archery, leathercraft, and hunting; fixed and mobile on any band from 80 to 2 meters, AM, CW, and SSB, and 40 meters TV; weekdays after 2400 GMT, weekends after 2000 GMT. (Joseph M. Sweet, 9312 A. Wolff Ave., Ft. Bliss, Texas)

WA3AL—Aviation and space topics, archery, home construction projects; 40 and 15 meters, CW; nights and weekends. (Michael Griffin, 715 Webb St., Aberdeen, Md.)

WN4YKA—Stamp and coin collecting, chemistry, and camping; 80, 40, and 15 meters; weekdays after 1900 EST, all day weekends and holidays. (Roy L. Moore, 307 Nunn St., Hazard, Ky.)

WB6CMR—Glider flying and sailing; 40, 20, and 15 meters, CW. (Larry Miller, 14918 Kingsley Dr., Gardenia, Calif.)

WB6IAD—Surfing and skateboarding; 40 meters, CW; 1 to 3 a.m. and 12 to 2 p.m. (Charles Smith, 427 Serra Dr., South San Francisco, Calif. 94081)

K7LPO—Science and math; low end of 80-meter band; evenings. (LeRoy Taraba, 155 W. Jackson St., Monmouth, Oreg.)

WA8RER—Astronomy, photography, and amateur rocketry; 6 and 2 meters, AM and CW; any nights from 7 to 10 p.m. (Kenneth J. Burgess, 15577 O'Connor, Allen Park, Mich.)

WN8PWF—Boating and beagles; 7.15 and 7.2 mc.
from 0530 to 0700 GMT; monitors 7.15 mc. (Art Colby, 525 Maple St., Saugatuck, Mich.)

WA9NDU—Stamp collecting and science fiction; 80, 40, and 2 meters. (Bruce Mocking, 5248 Arcadia St., Skokie, Ill. 60077)

WA9NDV—Astronomy, reading, swimming, and skiing; 20 meters, CW and AM, and 15 meters, CW; after 4 p.m. daily. (Joe Larson, 410 Lawrence Ave., Rothschild, Wis.)

W8DDQ—Telephone band communications; would like to start club; phone 515-232-0161; no collect QSO's accepted. (Edward C. Booth, Route 1, Ames, Iowa 50010)

VE2BPJ—Stamp collecting and 8-mm. movies; 20 meters, AM. (Gerard R. Labelle, 1716 Avenue De Grosbois, St. Bruno, Comte Chambly, Canada)

POPULAR ELECTRONICS
USEFUL TIPS ON CONTEST OPERATING

FOR THOSE HAMS who like competition, the most enjoyable part of amateur radio is contest operating. In the next month or so, two of the year's biggest contests are scheduled. They are CQ's "World-Wide DX Contest" (CW and phone), and the ARRL's "Section Sweepstakes Contest" (CW and phone). If you intend to work any of these contests in a big way (the CW and phone contests are separate activities), write to the sponsors for official score sheets and rules, including a stamped, self-addressed, business-size return envelope with your request.

The WWDX phone contest starts at 0000 GMT, October 23, and ends at 2400 GMT, October 24; the CW contest runs from 0000 GMT, November 28, to 2400 GMT, November 29. You obtain the log sheets from and mail your scores to: WWDX, CQ, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050. The SS phone contest starts at 2100 GMT, November 13, and ends at 0300 GMT, November 15; the CW contest runs from 2100 GMT, November 20, to 0300 GMT, November 22. You obtain the log sheets from and mail your scores to: SS, ARRL, 225 Main st., Newington, Conn. 06111. In each contest, you operate for any 24-hour period.

To make a winning score in any of these contests requires both good equipment and good operating, although it is possible to have fun with simple gear. In a DX contest, the competition from high-power stations is almost overwhelming on the 80-, 40-, and 20-meter bands, except in the pre-dawn morning hours. But the competition is less severe on 15 and 10 meters—especially the latter, when it is open. And you will give yourself a better chance if you concentrate on less "exotic" DX like Bermuda, England, and Germany, which the big wheels have already worked, rather than countries like Afghanistan, etc. which everybody needs. In the SS contest, competition for individual stations is less severe than in the DX contest; therefore, transmitter power is not so important, and most experienced SS'ers use less than 150 watts to obtain the lower power multiplier (phone scores are multiplied by 1.5 if transmitter power is less than 150 watts, CW scores by 1.25).

Ordinarily, in a contest, an operator doesn't tarry after a CQ. If he doesn't hear a reply immediately, he CQ's again or moves to another frequency. As a result, if you have to throw several switches to get on and off the air, you will usually be left at the post. For the same reason, long calls are unnecessary. In situations where many operators are calling the same station, too

Garry Shandling, WA7BKG, of Tucson, Arizona, was the winner of the Arizona Section Novice award in last year's "SS" contest. WA7BKG worked 42 states as a Novice; as a General, he has added 9 states and 15 countries to his total. He uses a Hallicrafters HT-44 SSB/CW transmitter and a SX-111 receiver plus a vertical antenna. Garry will receive a one-year subscription for this winning entry in the Amateur Station of the Month contest. If you would like to enter, send us a clear picture of your station—preferably showing you at the controls—and some information about your amateur career and your equipment. Mail your entry to: Amateur Photo Contest, c/o Herb S. Brier, W9EGQ, Amateur Radio Editor, P.O. Box 678, Gary, Ind. 46401.
many of them make excessively long calls in the hope of outlasting the competition. A better method is to make a series of short calls with pauses between them to see what the called station is doing until it answers you or someone else or has apparently left the frequency.

A common mistake is to keep calling the same station time after time. Usually, it is wise to write off a station you can’t raise with a reasonable number of calls, and stalk another station. Chances are the next time you run across the first station, it will be easy to raise.

One of the neatest tricks of contest operating when done properly is “tail-ending.” Just as station A signs off with station B, you give station B a snappy “one-by-one” call on A’s frequency. Station B pauses momentarily to log your call letters before he sends his “final” to station A, after which he works you. Obviously, tail-ending takes real skill; if you call too soon, you will interfere with the contact already in progress, and the called operator will ignore you—if he is a good operator. And if you do it too often, he will place you on his never-work list. Conversely, if you call too late, the station you want will already be transmitting. Further complicating the problem, some operators refuse to answer tail-enders under any circumstances, while other rare stations are virtually impossible to work by any other method.

**Hobby-Type License Denied.** On July 7, 1965, the Federal Communications Commission denied the International Crystal Company’s petition for the issuance of a no-examination, 10-watt “hobby” license for operation in the 29-mc amateur band. The Commission pointed out that issuing an amateur license without requiring the applicant to demonstrate both his ability to send and receive the Morse code and his technical qualifications would contravene article 41 of the International Radio Regulations (Geneva, 1959).

To make its policy unmistakably clear, the Commission further declared: “Even if examinations were not required by international regulations, the Commission would, as a matter of policy, impose such a requirement as being consistent with, and necessary to, the purposes for which the Amateur Radio Service was established.”

Once again, the Commission strongly urges Citizens Radio Service operators who wish to operate radio as an activity in and of itself to obtain a license in the Amateur Radio Service. The agency points out the ease with which a Novice license (which offers its holder the opportunity to obtain the experience necessary for advancement to higher class licenses) can be obtained.

Incidentally, in a hard-to-explain maneuver, the FCC reduced its estimate of the number of valid amateur licenses in existence by 15,000. At the same time, 75,000 were chopped off the CB totals! Possibly someone was counting renewals as new licenses.

**From the Club Bulletins.** In its special YL issue, *SIRAN (South India Radio Amateur Newsletter)* reports that there are four licensed women amateurs among India’s 400 amateurs. It also reports 26 in Australia, and 200 in Germany. And in the USSR, 10% of the amateurs are YL’s.

In the Denver Radio Club’s *Round Table*, Elsie White, wife of KØCNV, takes a dim view of the amateur’s use of the term “XYL” instead of the word “wife.” The practice doesn’t save time. On CW, “wife” contains 10 dots and dashes (only three of them dashes), while “XYL” contains 12

(Continued on page 117)
Tonal Darkroom Timer or Metronome

By FREDERICK W. CHESSON

Adjust tone and timing to your specific needs

Here's a neat little timer that will provide pleasant-sounding musical tones in your darkroom at one-second intervals. Not only will it eliminate the tedium of making prints to a monotonous-sounding, mechanical-clanking type timer, but it will also give you better print control, as its staccato tones are right on the button. Transistor-operated and small enough to fit in any available space, the timer easily converts to a metronome.

How It Works. A unijunction transistor (Q1) in a relaxation oscillator circuit triggers a phase-shift audio oscillator (Q2), turning it on and off. As capacitor C1 is charged through R1 and R2, the emitter voltage of Q1 rises toward the supply voltage. When the emitter vol-
A unijunction transistor (Q1), connected as a relaxation oscillator, triggers phase shift oscillator Q2, which generates the audio tones.

Changing the values of one or more components in the Q1 circuit alters the rate of tone burst, and changing the values of one or more components in the phase shift oscillator alters the tone.

age becomes sufficiently positive, the emitter becomes forward-biased, and discharges C1 through the emitter and B1 junction and R3. The voltage drop across R3 forward-biases Q2 and turns it "on." As C1 becomes discharged, the current through R3 drops, and Q2 shuts "off."

The tone signal is generated by Q2 and the phase shift components (R6, R7, C2, C3, and C4). The signal taken from the collector of Q2 is coupled to a small speaker through T1. The value of 18,000 ohms for resistor R4 represents a compromise between tone duration and intensity; you can substitute resistors with values between 10,000 and 25,000 ohms for different output signals.

Since the unijunction transistor is the oscillator trigger, changing the values of one or more components in the Q1 circuit (R1, R3, R6, R7, and C1) will change the rate of the tone burst. The frequency of the tone can be changed by changing the value of one or more components in the phase shift network.

Construction. A universal meter case makes an ideal container for the timer, as it easily accommodates a small speaker in place of a meter as well as the other circuit components. Potentiometer R1 and switch S1 are mounted in the holes normally used for the meter feed-through terminals. Copper screening is used to cover the speaker.

The small components can be mounted in any convenient manner, such as on a couple of solder-lug terminal strips, with one strip carrying the phase-shift components and the second one the transistors and other components. The miniature output transformer case is soldered to a ground lug on the latter terminal strip, and the battery is fastened to the inside of the case with a U-shaped aluminum strap.

Calibration and Use. The primary winding of T1 can be tuned for a slight increase in output; capacitor values between 0.05 and 0.25 µf. can be tried for C5. Tone pulses should begin about 10 seconds after the unit is turned on. After a minute or so, adjust R1 for one-second beats by comparing the timing of the beats with the sweep second hand on your wristwatch.

**PARTS LIST**

- B1—9-volt battery
- C1—100-µf., 25-volt electrolytic capacitor
- C2, C3, C4—0.05-µf., 100-volt miniature Mylar capacitor
- C5—0.05 to 0.25 µf., 100-volt capacitor—see text
- Q1—2N1671 unijunction transistor
- Q2—2N3391 transistor
- R1—10,000-ohm potentiometer
- R2, R4—18,000-ohm, 1/2-watt resistor
- R3, R6, R7—1000-ohm, 1/2-watt resistor
- R5—12,000-ohm, 1/2-watt resistor
- S1—S.p.s.t. switch
- T1—Miniature output transformer, 300 ohms to 3 or 8 ohms (Lafayette TR116 or equivalent)
- SPKR—Miniature speaker, 3 or 8 ohms
- Misc.—Universal meter case, 7-terminal strips (2), screen mesh, wire, solder, etc.
It's easy to see...
the tremendous plus value in antenna specialists'
new "Colorguard"
Fluorescent International Orange emergency mobile antennas!

Available in many styles, types, frequencies for:
- CITIZENS RADIO SERVICE
- POLICE • REACT TEAMS • FIRE DEPARTMENTS • CIVIL DEFENSE
- MAFINE • H.E.L.P. GROUPS

Mail coupon today for complete information or see your A/S distributor!

<table>
<thead>
<tr>
<th>the antenna specialists co.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A div. of Anzac Industries Inc.</td>
<td></td>
</tr>
<tr>
<td>12435 Euclid Ave., Cleveland, Ohio 44106</td>
<td></td>
</tr>
<tr>
<td>Export Div.: 64-14 Woodside Ave., Woodside 77, N.Y.</td>
<td></td>
</tr>
</tbody>
</table>

The Antenna Specialists Co.
12435 Euclid Avenue, Cleveland, Ohio 44106

Gentlemen:
Please send complete information on your new line of "COLORGLA$D" Emergency Mobile Antennas for professional and citizens radio services.

<table>
<thead>
<tr>
<th>NAME</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ADDRESS</td>
<td></td>
</tr>
<tr>
<td>CITY</td>
<td>S•STATE</td>
</tr>
</tbody>
</table>
New Ideas For Christmas Giving

A Gift Everyone Wants . . . New Heathkit 10-Band Transistor Portable!

Travel The Airwaves Of The World . . . with this new "go anywhere" 10-band portable. 7 bands tune 2-22.5 mc shortwave, marine and amateur stations. Longwave (150-400 kc) receives aircraft and marine broadcasts. 88-108 mc brings you the relaxed listening of FM. And the 550-1600 kc AM band keeps you posted on the latest news, weather and sports.

16 Transistors, 6 diodes, 44 Prebuilt & Aligned RF Circuits . . . your assurance of instant operation, superior performance and easy, 10-hour assembly. Two separate AM & FM tuners are preassembled & aligned, ready to drop into place. FM tuner and IF strip are same components used in deluxe Heathkit FM stereo gear for the finest FM ever heard in a portable!

Two Built-In Antennas . . . a large ferrite rod in the carrying handle for AM and longwave, plus a 5' telescoping whip for FM and longwave.

More Deluxe Operating Features . . . like the battery-saver switch that cuts battery drain up to 35% for indoor listening, or provides full power for strong, outdoor reception; rotating tuning dial; nighttime dial light; 4 simple controls for tuning, volume, tone, AFC and band switching; 4" x 6" PM speaker; earphone & built-in jack; time zone map and "listener's guide." Runs on 6 "D" and 1 "C" flashlight batteries (not included). Also operates on 117 v. AC as it "float" charges batteries with optional converter/charger, GRA-43-1 $6.95, 17 lbs.

New Deluxe Shortwave Radio . . . For The Seasoned SWL!

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 cabinet, and free SWL. antenna. Assemble in 15 hours. 25 lbs.

Explore The Exciting World Of Shortwave With This Low Cost Receiver!

Hear Live Broadcasts From Hundreds Of Foreign Countries . . . pick up the Voice of America, Radio Moscow, government stations . . . tune in hams, ship-to-shore radio, weather and popular AM stations . . . all on this versatile new receiver. Covers 550 kc to 30 mc—includes AM plus 3 shortwave bands. 5" speaker; lighted bandspread tuning dial; relative signal strength indicator; 7" slide-rule dial; BFO; 4-tube circuit plus 2 rectifiers; AM antenna; metal cabinet. 15 lbs.
...... "Do-It-Yourself" Heathgifts!

New All-Transistor, 5-Watt CB Transceiver With 23 Crystal-Controlled Channels For Utmost Reliability . . . At Competitive Prices!

Kit $89.95
Assembled $124.95

Transceiver Kit With 46 Crystals . . . only $169.90

- 23 crystal-controlled transmit & receive channels
- 14 transistor, 6 diode circuit for cool, instant operation and low battery drain—.75 A transmit, .12 A receive
- Full 5 watt performance . . . , minimum of 3 watts RF output plus 3 watts audio modulating power
- Front panel "S" meter indicates signal strength & relative power output . . . aids in alignment
- Adjustable squelch control eliminates speaker hiss during standby
- Automatic noise limiter minimizes noise from ignition systems, electric motors, etc.
- 1/2 uv sensitivity for 10 db signal plus noise to noise ratio
- Built-in PM speaker
- Easy to build circuit board construction
- Attractive TURNER ceramic PTT microphone
- Handsome die-cast, chrome-plated front panel with rust-resistant aluminum charcoal gray cabinet
- Includes power cables & crystals for 1 channel (specify) and gimbal mount for versatile installation
- Shipping weight 9 lbs.
- FCC license required; use must comply with Part 95 FCC Regulations
- Compact "Fit-Anywhere" Size! Only 2 3/4" H x 7" W x 10 1/2" D . . . ideal for car, boat, jeep, tractor, any mobile installation (12 v, neg. gnd. only).
- Operates "Fixed" With Accessory AC Power Supply
- Desk-top base for GW-14 transceiver provides all necessary AC power . . . requires only one plug-in connection.
- Complete 23-Channel CB Crystal Pack . . . $79.95! Regular $135.70 value! 46 transmit & receive crystals for all-channel GW-14 operation. Order #GWA-14-2.

Heath Company, Dept. 10-11
Benton Harbor, Michigan 49023

□ Enclosed is $________ plus shipping. Please send model (s)

□ Please send FREE 1966 Heathkit Catalog.

Name__________________________
Address________________________
City__________________________State__________Zip________

Prices & Specifications subject to change without notice.
LEARN ELECTRONICS
THE NEW PRACTICAL WAY

and build yourself this stereo radio!
All parts and material supplied FREE with lessons. Amazing, easy new method of learning by doing, developed by a great international correspondence school. Start training now for an important new career.

3 Radio Electronics
great
Transistors
courses
Basic Electricity

SEND NOW FOR FREE COLOR BOOKLET

INESCO
INTERCONTINENTAL
ELECTRONICS SCHOOL
U.S.A.: P.O.Box 546, Burlington, Vermont
Canada: 9100 St. Lawrence Blvd., Montreal 11, Que.

NAME
ADDRESS
CITY
PROV.

CIRCLE NO. 54 ON READER SERVICE PAGE

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.

CIRCLE NO. 14 ON READER SERVICE PAGE

OPERATION ASSIST

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

SCHEMATIC DIAGRAMS

GE Model 260 receiver, circa 1940. Tunes BC and 5 s.w. bands. Has 6 tubes. (David Worby, R.R. #2, Box 4, Harltand, Wis.)

Motorola Model WR4 record player, circa 1945. (Charles A. Stuart, 5 Main St., Marstons Mills, Mass. 02648)

E.H. Scott receiver, ser. 2952. Tunes .55 mc.—16.5 mc. on 3 bands. Has 12 tubes. (Marion Faris, Peconic Trrl, Box B3, Riverhead, N.Y. 11901)

Philo Model 46-350 receiver. Tunes BC. Has 6 tubes. (Chuck Schwaer, 1852 W. Lake Ave., Glenview, Ill. 60625)

Triumph Model 830 oscillograph wobulator. Has 7 tubes. (Stanton N. Drummond, 152 N. Crescent Drive, Rome, N. Y. 13440)

E.H. Scott "Phantom" FM receiver, ser. TT398, circa 1946. (A. Viljoen, 22 Strawbighg, S Caroline St., Hillbrow, Johannesburg, S. Africa)

Philo Model 35-4 receiver, code 121, circa 1947. Tunes BC and s.w. on 2 bands. Has 8 tubes. (John Pensock, 2620 Glenview Rd., Wilmette, Ill. 60091)

Boulogne-Billancourt receiver, ser. 587. Tunes 15—20000 meters. (John W. Vogel, P.O. Box 7, Judkins Mathews Co., Va. 22076)

RMA "Phonochord" receiver. Tunes BC and s.w. Has 10 tubes, field coil speaker, and magic eye. (Steve Randolph, Box 390-A, Fairhill Rd., R.D. 4, Sewickley, Pa.)

Springfield walkie-talkie 2-meter radiophone, circa 1957. (John Schroeder, 4272 Atlas Ave., Oakland, Calif. 94619)

Westinghouse Model WR210 receiver, ser. 541970. Coronado receiver, ser. 344068. (David E. Halbaken, P.O. Box 615, Fertile, Minn. 56540)

Superior Model 1230 signal generator, circa 1945. Tunes 7 r.f. bands and 5 a.f. bands. Has 3 tubes. (Paul Rutter, 200 W. South St., Angola, Ind. 46703)

Sansei "Zephyr" hi-fi receiver. Tunes AM and FM. Has 6 tubes and 2 florists. (Emil Albertini, Box 242, McDonald, Pa. 15057)

R-2A/ARR-3 surplus receiver, NXsa-66738, 1149:CF, circa 1940. Has 13 tubes and magic eye. (B. A. Fulton, 754 N. Clementine, Anaheim, Calif. 92805)

Browning Model 35 receiver. Tunes 1.5—22 mc. Has 8 tubes and 6ES5 tuning eye. (Joseph Patrick, Box 104, R.D. #4, Finleyville, Pa.)

(Continued on page 106)
Now, with Hy-Gain's Duo-Beam 10, you can add miles of distance to your Citizens Band range...transmit and receive stronger and clearer signals in the area you've been working. And, because the Duo-Beam 10 is ROTATABLE, you can do it with PINPOINT ACCURACY in any of the 360 degrees surrounding your station! The Duo-Beam 10 is a twin-driven 10 element beam that re-forms the 5 watts output power from your transceiver and funnels it in a "ray-like" path close to the ground to deliver you power equivalent to what you'd get from a CB rig with output power as high as 120 watts. That's "Talk Power." The Duo-Beam 10 is rugged, too...all heavy gauge aluminum construction with iridite treated hardware...designed to survive 80 mph winds. Easy to install on rooftop towers, TV towers, or on a 1½" mast...it's guaranteed to outperform any legal antenna for CB. Model 1110DB $99.95 Net

93 Watts TALK POWER...
DUO-BEAM 6—Another new rotatable Duo-Beam by Hy-Gain...twin-driven 6 element model that delivers 93 watts "Talk Power." Guaranteed to outperform any legal CB antenna other than the Duo-Beam 10. Model 1160B...$69.95 Net

42 Watts TALK POWER...
DUO-BEAM 4—The smallest of Hy-Gain's new rotatable Duo-Beams...a 4 element model that delivers 42 watts "Talk Power." Guaranteed to outperform any legal CB antenna other than the Duo-Beam 6 or 10. Model 1140B...$39.95 Net

Available now from your Hy-Gain Dealer or Distributor
Send for complete descriptive literature—Form No. 13
HY-GAIN ELECTRONICS CORPORATION
8503 N.E. Highway 6—Lincoln, Nebraska 68501
CIRCLE NO. 20 ON READER SERVICE PAGE

November, 1965

AmericanRadioHistory.Com
Why Fred got a better job...

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

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

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

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

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

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

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

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

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

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

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

CIE’s AUTO-PROGRAMMED 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.

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

Full accreditation . . . your assurance of competence and integrity
Cleveland Institute of Electronics is accredited by the Accrediting Commission of the National Home Study Council. You can be assured of competent electronics training by a staff of skilled electronics instructors.


Cleveland Institute of Electronics
1776 East 17th Street, Dept PE-34, Cleveland, Ohio 44114

November, 1965
**ASSIST**

(Continued from page 100)

**DuMont Model 274-A oscillograph, ser. 932. Has 5 tubes and CRT. (Dennis F. Konicky, 200 Vance St., Fort Walton Beach, Fla. 32548).**

**Oxford Model CT400 capacitor analyzer. (B. J. White, 29-S Garden Circle, Waltham, Mass.).**

**E. H. Scott receiver, ser. M-559, Tunes on 4 bands. Has 23 tubes. (Ralph Armstrong, 314 W. Santa Ann St., Ojai, Calif. 93023).**


**Fisher Model T-20, T-30 metal detector. **Detectron** Model 7-T metal detector. **Goldak Model 520-B metal detector. (Roland Earl, 11311 Humnewell, San Fernando, Calif.).**

**Hickok Model 560 mutual conductance tube tester. (Jim Hallock, Jr., Tilden, Ill. 62292).**

**GE (Canada) Model F-82 receiver, ser. 6767, circa 1936. Tunes 530-1720 kc., 2.1-22 mc., on 3 bands. Has 6 tubes. (Lynn Green, Rt. 6, Box 86, Birmingham, Ala. 35217).**

**Superior Model 450-A tube tester. (Charles R. Mueller, Box 8, Keyesport, Ill.).**

**Detrola Model 700 17" TV, circa 1951. Has 18 tubes. (John Baron, 5722 Renville St., Detroit, Mich. 48210).**

**SPECIAL DATA OR PARTS**

**Philco Model 42-350 receiver, code 121, circa 1912; tunes BC and s.w. has 7 tubes. Schematic and parts source needed. (David Jones, 1151 Edison Dr., San Antonio, Tex.).**

**RCA Model 46X13 receiver. Schematic and ballast tube M-46289-9 needed. (R. A. Spinney, 50 Pond St., Billerica, Mass. 01821).**

**Wards "Airline" Model 6D4-1 receiver, ser. 6-D4-904485; tunes BC and s.w. Schematic, dial and pointer needed. (Steve Hallberg, Box 184, Center City, Minn.).**

**Perkin Elmer Model 612-0110 densitometer, ser. 151. Schematic, operating instructions, and input device with connecting cable needed. (Arnold Walter, 155 Bathurst Dr., Toronto, Ont., 14151).**

**Patterson receiver, circa 1938; tunes 550 kc.-18 mc. on 3 bands; has 12 tubes. Schematic and tube layout needed. (Christopher Coles, 1033 Alta Pine Dr., Altadena, Calif. 91001).**

**Heath Model MP-11 marine converter-charger. Kit assembly manual needed. (R. J. Stephenson, P.O. Box 1423, Chattanooga, Tenn.).**

**Sanyo Electric Model 8SP14 receiver; has 3 transistors. Schematic and tuning meter needed. (E. Metz, 4620 N. Kenneth, Chicago, III. 60630).**

**Stromberg Carlson Model RBS receiver, circa 1940; tunes 2-20 mc. Schematic and alignment instructions needed. (Wayne K. Irwin, R.F.D. 21, Mt. Spring Rd., Rockville, Conn. 06066).**

**Philco Model 620 receiver; tunes 530-1700 kc. and 2.3-22 mc.; has 6 tubes. Schematic tuner coils, switch, and other parts needed. (Lance Muller, 8905 Halsted St., San Diego, Calif. 92123).**

**Grunow Model 1067 receiver, chassis #10D; tunes .54 to 15.4 mc on 3 bands; has 10 tubes. Schematic, service data, and source for parts needed. (Richard Neubert, 60 Balch Ave., Manchester, N.H. 03102).**

**Hallicrafters 8-20R receiver, series H-144011; tunes .54-40 mc. Schematic and alignment data needed. (Michael Ramacci, 1 Winfield Pl., Whitesboro, N.Y. 13492).**

**Philo Model 37-570 receiver, circa 1936; tunes BC and s.w.; has 11 tubes. Tuning dial (Philco Part No. 27-5213) needed. (Steve Shapiro, 2512 Princeton Rd., Cleveland, Ohio 44118).**

**RCA Model 513K receiver, circa 1928; tunes BC and s.w.; has 13 tubes. First i.f. transformer needed. (Paul Songer, 2925 NE 45th Ave., Portland, Ore. 97213).**

**Hazeltine "Air Castle" receiver, chassis #821, ser. 313110; tunes AM and s.w. Schematic and power transformer needed. (Bill Crase, Box 639, Mooresville, N.C. 28115).**

**Fada Model C 69 A receiver, ser. 1704; has 5 tubes. Battery voltages needed. (James Pyles, 16 Dobson Rd., East Brunswick, N.J.).**

**Midwest receiver, circa 1933; tunes 155 kc.-32 mc. on 5 bands; has 16 tubes. Schematic and other data needed. (Johnny Simmons, 2953 Crestline, Macon, Ga. 31204).**

**Philmore Model 601-A receiver; tunes BC; has 5 tubes. Schematic and alignment data needed. (E. W. Neubert, 821 W. Santa Ana St., Fort Walton Beach, Fla. 32548).**

**Belmont Radio Model BC-1161-A receiver, circa 1940; tunes 150-210 mc.; has 13 tubes. Schematic, alignment data, and operating manual needed. (J. Laine, 807 E. St., Delaun, Mass. 02026).**

**RCA "Radiola 48" Model AR-596 receiver. Tuner section framework and tuning capacitor needed. (Ray Love, Route 1, Box 44-B, Wilkesboro, N.C.).**

**Presto record head control disc cutter amplifier; has 11 tubes. Schematic and other data needed. (Malcolm Thaden, 6202 Runit St., Berwyn Heights, Md. 20711).**

**GE Model 16C103 TV set, circa 1951. Deflection yoke needed. (Gary J. Schlichter, 54 Barbara Pl., Chestowogu, N.Y. 11225).**

**Admiral Model 4H18 phonograph, TV and AM-FM receiver, Service info. and other available data wanted. (Ray Hans, 22 Sparrow Circle, White Plains, N.Y. 10605).**

**Zenith "Trans-Oceanic" receiver: tunes 550 kc.-18 mc. on 6 bands; has 8 tubes. Schematic, operating instructions, and battery info. needed. (Bunley Jones, Box 488, Hollandale, Miss. 38748).**

**Federal "Orthosonic" receiver, type E, ser. 292705; tunes BC; has 6 01A tubes. Schematic and info. on hooking up batteries needed. (E. E. Lingboom, Elsie, Neb. 69134).**

**Supreme Model 504-A tester. Parts list, schematic, and operating manual needed. (Thomas P. Meehan, 1109 Laurel Ave., E. Palo Alto, Calif.).**
Our original Pacer is a fine CB transceiver.  
But our new Pacer II is even finer!  
Pacer II not only gives you all the features that made our original Pacer such a bargain (23-channel tunable superhet receiver, positive squelch control, quick-change external crystal socket), it now offers new, smaller case, plus a built-in, solid-state, 12-volt power supply, plus 11 (not just eight) crystal-controlled channels, plus an ANL switch and a big, easier-to-read "S" meter.

Best of all, you get all of these goodies at the same old low price.  
You’d think that for $99.95, this is all that you’d get.  
Guess again.  
When you buy Pacer II, you also get a set that has been environmental tested before you buy. And a set that features both American parts and workmanship.  

Better look into a new 1966 model Pacer II today. Complete with channel 11 crystal, PTT mike, mobile mounting bracket, carrying handle, AC and 12V DC power supply cords $99.95

Also New Mustang II

Get on the air for just $79.95 and get these new Mustang II features: eight crystal-controlled (not just six) channels, quick-change external crystal socket, "S" meter, spotting switch, 23-channel tunable receiver, plus PTT mike, positive squelch control.

Complete with channel 11 crystal $79.95

Metrotek Electronics, Inc.  
a subsidiary of Regency Electronics, Inc.  
7900 Pendleton Pike • Dept. P-11 • Indianapolis, Indiana  
CIRCLE NO. 36 ON READER SERVICE PAGE

November, 1965
ASSEMBLE YOUR OWN
ALL-TRANSISTOR
Schober
ELECTRONIC ORGAN

3 NEW MODELS
Recital $1500
Consolette II $850
Spinet $550

This is the new, all-transistor Schober Consolette II... the most luxurious "home-size" organ available today. Full 61-note manuals, 17 pedals, 22 stops and coupler, 3 pitch registers, and authentic theatre voicing leave little to be desired. Comparable to ready-built organs selling from $1800 to $2500.

The pride and satisfaction of building one of these most pipe-like of electronic organs can now be yours... starting for as low as $550. The Schober Spinet, only 38 inches wide, fits into the smallest living room. The all-new, all-transistor Schober Recital Model actually sounds like a fine pipe organ; its 32 voices, 6 couplers, 5 pitch registers delight professional musicians... making learning easy for beginners.

AND YOU SAVE 50% OR MORE BECAUSE YOU'RE BUYING DIRECTLY FROM THE MANUFACTURER AND PAYING ONLY FOR THE PARTS, NOT COSTLY LABOR.

It's easy to assemble a Schober Organ. No special skills or experience needed. No technical or musical knowledge either. Everything you need is furnished, including the know-how. You supply only simple hand tools and the time.

You can buy the organ section by section... so you needn't spend the whole amount at once. You can begin playing in an hour, even if you've never played before—with the ingenious Pointer System, available from Schober.

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

Send for our free 1965 Schober Catalog, describing in detail the exciting Schober Organs and optional accessories; it includes a free 7-inch "sampler" record so you can hear before you buy.

THE Schober Organ CORPORATION
43 West 61st Street, New York, N. Y. 10023
Also available in Canada, Australia, Hong Kong, Mexico, Puerto Rico, and the United Kingdom

THE SCHOBER ORGAN CORP., DEPT. PE-19
43 West 61st Street, New York, N. Y. 10023
☐ Please send me FREE 1965 Schober Catalog and FREE 7-inch "sampler" record.
☐ Enclosed find $2.00 for 10-inch quality LP record of Schober Organ music. ($2.00 refunded with purchase of first kit.)

Name
Address

CIRCLE NO. 38 ON READER SERVICE PAGE

BUILD THESE PROJECTS
IN TIME
FOR CHRISTMAS

HO MODEL TRAIN THROTTLE
This solid-state HO train controller will add that sought-after feature—the "crawl." Ends jerky starts and operates smoothly in either forward or reverse. Build in 6-8 hours.

SLOT RACING ACCELERATOR
A dual control that adds realism to slot racing. Eliminates push-buttons and wire-wound resistors. Works great with Strombecker, American Flyer, Revell, etc. Build in 5-7 hours.

PLUS:
Special features on tape recording with details on new techniques for home recording, how to check recorder performance, how to service your recorder, etc. AND, a separate feature on HOME VIDEO TAPE—WHEN?

LOOK FOR THIS VALUABLE DECEMBER ISSUE
Now with exclusive new **DYNA-BOOST** circuit that intensifies speech signals and extends the range more than ever before!

**Greater Range Power**

**Plus Operating Features and Performance That Make You Proud To Own The Best!**

Cobra

23 CHANNEL FULLY-EQUIPPED AM CB TRANSCEIVER

Here is talk-power you'll be glad to talk about! Full 5 watts input plus built-in speech compression Dyna-Boost circuit that puts the power in the sidebands where it does the most good. Increases modulation level to the very maximum at all times, even for a soft woman's voice. Front panel switch enables you to use Dyna-Boost as you need it. Make the dramatic "talk-test" and prove it for yourself!

Fully equipped with all necessary crystals for immediate operation on all 23 CB channels, at a turn of the switch. COBRA CAM-88, $214.95

**Other Features include:**
- Transistorized 117 VAC/12 VDC Power Supply
- Double Conversion Superhet Receiver
- Delta-Tune Fine Tuning
- Adjustable Squelch Control and Standby Switch
- Illuminated S and RF OUTPUT Meter
- Modulation Indicator
- Plug-in Microphone
- Use as Public Address Amplifier

B&K MANUFACTURING CO.
DIVISION OF DYNASCAN CORPORATION
1801 W. Belle Plaine, Chicago, Ill. 60613

Please send informative COBRA Bulletin 643-P

Name__________________________
Address__________________________
City__________________________State_______Zip No.________

CIRCLE NO. 51 ON READER SERVICE PAGE

November, 1965
(ARM and either N.O. or N.C. contacts) are connected to switch an appropriate solenoid valve in the automatic sprinkler system.

Either the low-resistance connections or high-resistance connections can be used, depending on soil conductivity, electrode (probe) spacing, and desired soil moisture content. In any case, the instrument's Sensitivity control can be finely adjusted to achieve the desired operating characteristics.

**Acoustic Relays.** Add an easily-built, low-cost accessory, and Super-Sens becomes a sound-operated relay. Three types of circuits are shown in Fig. 9.

In Fig. 9 (A), a low-impedance single-button carbon microphone (Shure R10), a 6-volt battery, an 8-ohm to 500-ohm output transformer (Argonne AR-164), a 1N34A general-purpose diode, and a 2-μF, 15-volt electrolytic capacitor apply a positive-going signal to energize the relay.

A single-transistor amplifier, in Fig. 9 (B), enables the use of a high-impedance (Philmore M-55), or a low-impedance carbon microphone. A 1-megohm resistor (R1) is used with high-impedance microphones and a 47,000-ohm resistor for low impedance types. The Sensitivity control is adjusted until the relay closes and is then backed off slightly. Thereafter, a sudden sharp sound will cause the relay to "latch" open.

A crystal microphone cartridge, or a magnetic headphone element can be used as a microphone with the circuit shown in Fig. 9 (C). The diode and transistor are the same as in the previous circuits. The Sensitivity control is set in the same manner as in the circuit in Fig. 9 (B).

The acoustic relay circuits shown here are moderately sensitive, requiring a fairly loud signal for operation. Where extreme sensitivity is needed, Super-Sens can be coupled to a 3- or 4-transistor audio amplifier. The hookup would be the same as in Fig. 9 (A).

**Radio Control.** Super-Sens can be operated by remote radio signals provided that a suitable control circuit is con-

---

Fig. 10. Radio control can be achieved with simple detector. Tune C1, L1 to desired frequency.

Fig. 9. Sound-actuated relays can be made. If microphone is low-impedance type, use circuit (A); high-impedance pickups work well in circuit (C); a low- or high-impedance unit can be used in circuit (B).
nected to its input terminals, as shown in Fig. 10.

The values of tuned circuit L1 and C1 are chosen to resonate at the desired control frequency. A general-purpose diode (1N34A) and an npn transistor (2N169) can be used. Adjust the Sensitivity control until the relay just closes in the absence of the radio signal. An incoming radio signal will open the relay.

Bench tests with the remote control circuit were made using a standard AM broadcast-band ferrite-core antenna coil (Superex “Vari-Loopstick”) for L1 and a 270-pf. ceramic capacitor for C1. With a relatively short antenna, positive relay operation was obtained when a strong local broadcast station was tuned in.

Photocells of all types can be used with Super-Sens to make it respond to variations in illumination and color. Invisible infrared rays can be used as intruder alarms. Smoke detectors and industrial counting devices can also be made. Regardless of the intended application, whether specific or general, the only limit to Super-Sens is your imagination and skill.

**6-WATT AMPLIFIER**

(Continued from page 75)

signal source and amplifier input as shown in Fig. 1. Although a 1-megohm pot is shown, values of 100,000 or 500,000 ohms can be used.

If plans call for the amplifier to be employed with a low-impedance input device, say about 1000 ohms, reduce the value of R4—or even eliminate it. This will give you a substantial increase in gain. There’s no point in reducing the value of R4 for a high-impedance input, as no appreciable gain will be realized. A 150-ohm resistor placed in series with C2 introduces negative feedback, and lowers the output impedance still more, and reduces distortion, but sacrifices gain. The higher the resistance, the greater the feedback and the lower the gain.

The amplifier’s high-frequency response can be substantially improved by substituting 2N2148 transistors for the 2N554’s in the output stage. They cost...
The "Edu-Kit" attracts you with its outstanding practical home radio kits and outstanding quality; and you will learn the theory, construction, and service of radio equipment. It is a natural step toward building radio circuits at home, using regular schematics. How to solder theory, construction, and do the basic education in electronics and radio. Worth many times the small price you pay only $26.95 complete.

**FREE SET OF TOOLS, PLEARS-CUTTERS, TESTER, SOLDERING IRON.**

**FREE EXTRAS**
- Set of Tools
- Radio & Electronics Tester
- Hi-Fi Book
- Quiz Book
- Membership in Radio-TV器材 Circuits
- Certificate of Merit
- UNCONDITIONAL MONEY-BACK GUARANTEE

**THE KIT FOR EVERYONE.**
You do not need the slightest knowledge in radio or science. The "Edu-Kit" is used by men and women of all ages, in the field of electronics training. The "Edu-Kit" using the most progressive method of Learning by Doing. You begin by building a simple but complete circuit, then gradually add complexity to your circuits to build advanced multi-transistor circuits, learn more advanced theory and techniques, and do work as a professional radio technician. These circuits operate on your regular AC or DC house current.

**THE "Edu-Kit" IS COMPLETE.**
You will receive everything absolutely necessary to build 20 different radio and electronic circuits, each guaranteed to operate. Your kits contain capacitors, resistors, diodes, thermionic vacuum tubes, punched metal chassis, printed circuitry, soldering equipment, and instructions. You also get the complete 20 lessons of the Progressive Radio and Electronics Course. You will also receive lessons for servicing with the Progressive Signal Tracer. All everything necessary to build and repair radios. Everything is yours to keep. The complete price of this practical home Radio and Electronics course is only $26.95.

**TROUBLE-SHOOTING LESSONS.**
You will learn in trouble-shoot and service radial circuits. With the unique Signal Injector, and the dynamic Radio and Electronics Tester, our Consultation Service will help you solve any technical problems.

**BIAK NETWORK**
A closer look at the biasing arrangement of the various transistors in the Six-Watt is needed for a better understanding of how the circuit operates and how balanced operation can be achieved even if the d.c. current gain of the transistors differs.

Resistors R1 and R2 maintain the bias voltage at the base of Q1 at approximately one-half the supply voltage. If the voltage at point A in Fig. 1 drops, the potential difference across Q1's base-emitter junction increases and causes Q1 to conduct more heavily. The amplifier changes. How though R3 increases the voltage drop across R3, and increases the forward bias of Q2. This makes Q2 conduct more heavily and increases the forward bias on Q3 at the same time decreasing the forward bias on Q4 and Q6.

Transistors Q5 and Q6 act like a voltage divider across the power supply, and the biasing action just described reduces the dynamic resistance of Q5, and increases the dynamic resistance of Q6. This raises the voltage at point J and tends to restore it to its former value.

If, on the other hand, the voltage at point A rises above normal, the forward bias on Q2 decreases, reducing the bias on Q3 and Q5, increasing the bias on Q4 and Q6, increasing the dynamic resistance of Q3, decreasing the dynamic resistance of Q4, and, finally, decreasing the voltage at point A to its normal value.

Dioide D1 also reflects the bias of Q1 and Q4.

The voltage drop across D1 places a small forward bias on Q3 and Q4, which in turn places a small forward bias on Q5 and Q6. This forward bias reduces any power distortion and serves to thermally stabilize the transistors. The voltage drop across D1 is essentially independent of supply voltage, and therefore is able to maintain the same bias over a relatively wide range of supply voltage.

About $1 more each; the 2N554's were used because of their low cost. Should you decide to substitute "bargain" transistors for Q5 and Q6, you may run into higher than normal leakage currents. To overcome this situation, you can connect a 100-ohm, 1/2-watt resistor between the base and emitter of Q5 on the bottom side of the board.

If you plan to use the Six-Watt as a narrow-band speech amplifier, reduce the value of C2 and place a small capacitor in parallel with R5 to cut the amplifier's response at both the high and low ends.

The amplifier can also be used as a modulator for small transmitters. An ordinary output transformer connected backwards makes a reasonably good match as a modulation transformer. Use an output transformer which can match the impedance of the final stage of your transmitter to the amplifier's nominal 3.2-ohm load.
AM tuner, in addition to the usual FM/FM multiplex. Allied Radio has added the KG-964 to its Knight-Kit line with 34 wpc and with a price tag of $189.95.

In the wholely-wired up line and ready to go are such units as the Harman-Kardon "Stratophonic Series" ranging from 18 to 33 wpc and price tags of $279 to $489. Scott's latest entry in this field is the elegant 388 marketed at just under $500; the 388 appears to be the first receiver using field-effect transistors to virtually eliminate all FM cross-modulation effects. Fisher's latest word is the husky 600T rated at 55 wpc and 1.8 microvolts of FM receiver sensitivity; it's tagged at $459.50. The Bogen line offers the new RT8000 for $319.95 and 35 wpc. For sleekness, try the Electro-Voice 1177 with 25 wpc which sells for only $280.

Other Equipment. Transistors have invaded tape recorders in style, but a report on these units will appear in a separate article scheduled for the December issue of POPULAR ELECTRONICS. You can also find solid-state devices in other odd corners, such as the Shure SA-1 "Solo-Phone"; this small amplifier can be connected to either tape or phono and used to drive two sets of stereo headphones.

Regardless of where you find them—transistors are in hi-fi/stereo to stay. Vale tubes.

Fortunately, this is quite simple. All you have to do is vary the horizontal spacing between the antennas. And you don't need any complicated formulas or measurements, either. The trial and error method works best.

Before you start shifting the antennas, you should construct a symmetrical harness—same type leads, lengths, and matching transformers—between the hybrid splitter and the antennas.

Point both antennas directly at the transmitter. Keeping them parallel, slowly move one antenna closer to, or away from, the other. While you are doing this, you need someone to watch the TV set for a sudden, sharp reduction in the unwanted signal. Secure the antenna in this position. The unwanted signal may still be noticeable in spite of the sharp reduction. But, you're not through yet.

Remember that the unwanted signal must appear as equal and opposite polarity voltages to cancel out. By finding the correct horizontal spacing, you've made sure that the unwanted signal arrives at the two antennas 180° out-of-phase. Now, you must make sure the signals are equal. To do this, simply move one antenna up and down on the mast while someone again watches the screen. Secure the antenna at the point where the unwanted signal is weakest.

Horizontal stacking is used to clean up master TV antenna systems, and it works just as well in home TV installations—especially color installations.
You can earn an A.S.E.E. degree at home. College-level HOME STUDY courses taught so you can understand them. Continue your education, earn more in the highly paid electronics industry. Military veterans, transistors, automation, complete electricity. Over 27,000 graduates now employed. Resident school available at our Chicago campus. Send for FREE BOOK: "Your Opportunities in Electronics." No salesman will call.

COYNE ELECTRONICS INSTITUTE
Educ. Serv. Dept. 85-M
1501 W. Congress Parkway, Chicago, Ill. 60607

EARN Electronics Engineering DEGREE

Solid-state practical radio electronics training at RTS costs you less. Many thousands of American electronics technicians learned through RTS. Earn while you learn. No experience needed. Choose courses between high paying job or your own business. Send for big, specially designed electronics kit included. Keep present job. Professionals approved. Send for this FREE CATALOG, SAMPLE LESSON AND BUSINESS OFFER.

TRAINING CENTER, Dept. 60002
265 East Figueroa Ave.
Los Angeles, Calif. 90036

FOREIGN CURRENCY RATES

Australian pounds: 2/5
Austrian schillings: 130
Belgian francs: 248
Colombian pesos: 65
Danish kroner: 35
Dutch guilders: 18
English pounds: 1/16
Finnish new markka: 16
French francs: 25
Greek drachmas: 150
Hong Kong dollars: 28
Indian rupees: 24
Irish pounds: 1/16
Israeli pounds: 14

Italian lire: 3,120
Japanese yen: 1,800
Lebanese pounds: 15
Mexican pesos: 62
New Zealand pounds: 1/16
Norwegian kroner: 36
Pakistan rupees: 24
Philippine pesos: 20
Portuguese escudos: 144
South African rand: 3.50
Spanish pesetas: 312
Swedish kronor: 25
Swiss francs: 22
Venezuelan bolivares: 22

West German marks: 20

Mail order with remittance to:
Pclopular ELECTRONICS
Portland Place / Boulder, Colo., U.S.A. / 80311

SOLID STATE
(Continued from page 80)
distortion for, as we discussed last month, even-order harmonics are cancelled out in a push-pull stage.

Unfortunately, the push-pull circuit can also introduce an undesirable amount of intermodulation distortion due to the non-linearity of the composite transistor characteristics. The remedy, here, is to use matched transistor pairs in the push-pull stage, and then operate the stage Class A or Class AB to insure a smooth crossover point.

In summary, to minimize all types of distortion in your transistor audio amplifier:

(1) Adjust individual stage bias values for operation within the transistor's linear region, biasing single-ended stages Class A, and push-pull stages Class A or AB. Avoid the use of Class B stages.

(2) Make sure that no stage is overdriven.

(3) In push-pull circuits, use only transistors with matched gain and leakage characteristics.

(4) Make sure that iron-core transformers are operated within their d.c. ratings to avoid saturation.

(5) Use good-quality coupling capacitors to avoid interstage leakage.

(6) Use inverse feedback where appropriate.

Product News. The Clarostat Manufacturing Company (Dover, N.H.) has just announced a new low-cost trimmer potentiometer. Ideal for miniature transistor circuits, the unit is only 1/2" in diameter by 1/8" deep. It is designed for screwdriver adjustment, is available in standard resistance values from 100 ohms to 1 megohm, and has a power rating of 1/4 watt.

A new line of extremely high gain Darlington pair transistors, packaged in single cases, has been introduced by the Solid State Electronics Corp. (15321 Rayen St., Sepulveda, Calif.). The first device in the line, the SST610, offers a current gain of 10,000 with an output current of 120 ma. Future units will have a gain of up to 100,000 or more, according to the manufacturer.

The development by General Electric's Semiconductor Products Department of a
new continuous-strip manufacturing process should result in more low-cost SCR's for consumer products. The first units produced with the new process are 150-watt, 117-volt types; later units will have ratings of up to 2 kw. or more. Initially the new SCR's will be used in motor control circuits of such appliances as food mixers and sewing machines.

Well, the Holiday Season is approaching; now is a good time to start assembling transistorized gifts for your friends. Until next month . . .

-Lou

MATH QUIZ ANSWERS
(Quiz appears on page 67)

1 - H  Amplifiers which have their load resistors in series produce an output signal proportional to the sum of the in-phase input signals.

2 - F  A step counter produces an escalated output which varies exponentially with the number of pulses it receives. It can be used to count the number of pulses it receives, and as a frequency divider by allowing it to trigger another circuit, say at every 2nd, 3rd . . . 7th step, as desired.

3 - I  A differentiator circuit produces an output whose instantaneous values are proportional to the rate of change of the input voltage waveform.

4 - G  A voltage doubler produces a d.c. output which is approximately equal to twice the r.m.s. value of the a.c. input voltage.

5 - D  A voltage divider provides an output which is in the same proportion to the applied voltage as the divider resistance is to the total resistance.

6 - A  An integrating circuit provides an output voltage which is approximately proportional to the time integral and potential of the input voltage.

7 - J  In a ratio detector circuit, the variations of audio frequency output signals have the same ratio as the variations of the applied FM frequency signals.

8 - C  A triode square law detector produces an output signal which is proportional to the square of the input signal.

9 - E  A differential amplifier produces an output signal whose amplitude is proportional to the difference between two in-phase input signals.

10 - B  A voltage tripler circuit produces a d.c. output which is approximately equal to three times the r.m.s. value of the a.c. input voltage.
The frequency response, which can be quite good, is determined by the quality of the output transformer you use. The amplifier will put out 600 milliwatts with an input of around 1/2 volt into 50,000 ohms. This is usually adequate for most inputs except magnetic pickups and other extremely low-level sources.
Fig. 5. Basic line-operated solid-state amplifier delivering up to one watt of audio power at 10% distortion; at one-half watt distortion is only 2%. Frequency response is a function of the quality of the output transformer used, but is usually good.

A data sheet, No. ICE-313, on RCA solid-state devices 40261 through 40265, is available on request from: Radio Corporation of America, Electronic Components and Devices, Harrison, N. J. The RCA 40264 power transistor and 40265 rectifier are priced, respectively, at $1.20 and 35 cents, and are available from RCA semiconductor distributors.

AMATEUR RADIO
(Continued from page 94)

dots and dashes (half of them dashes). When spoken, “XYL” contains three syllables; “wife” contains one. Furthermore, Elsie complains, being called an “ex” young lady casts aspersions on her state of preservation, and is an insult to her intelligence and to the skill of her beauty operator. Elsie realizes, by the way, that she is fighting a lost cause.

As reported in the June 15 issue of the DX-pedition of the Month Bulletin, John H. Gayer, HB9AEQ, honorary president of the International Amateur Radio Club, Geneva, Switzerland, speaking at the Second SSB Banquet in London, England, related that one of the problems plaguing amateur radio was unauthorized commercial intruders moving into the ham bands at hours November, 1965 117

AmericanRadioHistory.Com
when amateur activity is low. From personal observation, several South or Central American commercial CW stations move into the 20-meter amateur band almost every afternoon. But if a couple of powerful amateur stations happen to open up on the frequency usurped by the intruders, the latter soon move back where they belong—or on someone else's frequency.

News and Views

Allan J. Sorkin, WN6PT, 9115 S. Strub Ave., Whittier, Calif., operates on 80 meters using a converted ARC-5 war-surplus transmitter feeding an ended dipole antenna. He receives on a Knight-Kit R-55 or on a BC-454; both are helped along by a preamp and a surplus automobile filter. Allan likes to rag-chew to give himself plenty of code practice, so he can get his General license as soon as possible, which he plans as the next step in his campaign to earn an Extra Class license. . . . Arne Henden, WNSHRM, 1565 S. Esperanza, Las Cruces, N. M., reports that three out of four of the stations he works say he is their first New Mexico contact. Arne stays on 40 or 15 meters and has 40 states worked, including three contacts with Hawaii. He likes Guatemala, Canada, and the Bahamas. An Elmac A-54 transmitter pushing 40 watts into a 40-meter dipole antenna, and a Hammarlund HQ-110 receiver handle the electronic work. Arne's neighbors are in for a "thill" soon—he is building a 40-10 meter quad antenna and a 15-meter beam, both to go on a 40' pole. . . . Don L. Marshall, WNSGEO, 1728 Sheffield Drive, Akron, Ohio, is a resourceful ham. When his Novice license arrived, he already had a Hallicrafters SX-140 receiver; but the HT-40 transmitter, which was on order, hadn't arrived. So Dan built himself a 25-watt transmitter and knocked off five states in his first week on the air. Now, with the HT-40, he has 23 states worked. His operating is on 80 meters, with an 80-meter inverted-V antenna.

All Florida High School Amateur Radio Clubs, take note. Plans are under way to organize a Florida H.S. Net. Write to C. Lynn "Tank" Miller, W4AUBQ, president, Hillborough H.S., Altoona (W4AIVQ), 309 West Lambright, Tampa, Fla., 33604, for information. . . . Agustín O. Monasterio, XETOOL, P.O. Box 41-634, Mexico 10, D.F., Mexico, is one of the youngest of the 8000 Mexican amateurs (he is 16). In three months, running 50 watts on 20 meters, AM phone, he has worked 19 countries—all in the Americas. His transmitter is a Heathkit DX-60 feeding a 40-, 20-, 15-meter inverted-V antenna, and he receives on a National NC-140. Unfortunately, Augustin has not yet been able to get the antenna to "load" on 40 or 15 meters, but being limited to one band hasn't seemed to slow him down much. . . . Pete Doyle, WN2OUO, 18 Woodcliff Lake Rd., Paddle River, N. Y., tells us how he made out his Novice career by working Italy the day before his license expired. Being away at school most of the time cut down Pete's on-the-air time, but he did work 13 states and a few other DX stations besides Italy with his Heathkit DX-60 transmitter and a Lafayette HE-10 receiver. Of course, Pete is now Gung Ho after his General ticket. . . . Mike DiCorpo, WN1CRS, 35 Sunny Brook Bend, Waterbury, Conn., also found that school cuts down on a fellow's QSO total. Still, he made 100 contacts in 10 states and Canada with his Heathkit DX-60 transmitter in spite of a poor receiver—he now has a much better Lafayette KT-32 receiver. And with his adequate dipole antennas already up for 80, 40, 20, 15, and 10 meters, Mike is ready for the arrival of his General ticket, too.

Everitt C. Bollin, W3JDOV, 2909 E. Laneval St., Baltimore, Md., is a radioman in the Navy stationed in Washington, D.C., following a tour of duty on Midway Island, where he operated as KM6CJ. In two months on the air from Baltimore, Ev's Knight-Kit T-150 transmitter, Gotham V-80 vertical antenna, 20-meter dipole, and Hallicrafter SX-140 receiver have made him the holder of two of a WAS (Worked All States) certificate. . . . John Wieder, WAOJYJ, RFD 1, Northboro, Iowa, likes to rag-chew on 75-meter phone and to chase DX on 20-meter CW. He has one transmitter—a Heathkit DX-100; two antennas—an 80-meter dipole and an 80-meter inverted-V antenna; and three receivers—a Hammarlund HQ-150, Heathkit GR-91, and Hallicrafters S-85. John's brag list contains QSL cards from 13 of the 44 states worked, and all Canadian call areas, plus Puerto Rico. . . . Richard T. Schweitzer, Jr., WB2PCF, 240-27-145 Ave., Rosedale, L.I., N.Y., is a three-antenna man. They are: a Hy-Gain 14-AWS vertical; an 80-meter inverted V; and a Hy-Gain TH-2 2-element beam. Like WAOJYJ above, he has 44 states worked and 43 QSL's; in addition, he has all Canadian provinces and 16 countries worked. Johnson a "Ranger" transmitter and a Drake 2-B receiver serve as the go-betweens between Dick and his antennas. . . . Brian Kirchoff, WN6WWD, 206 Alpine St., San Rafael, Calif., had no trouble deciding which was his most thrilling contact—American Samoa! In addition, he has 9 states worked. Brian's Heathkit DX-20 runs 50 watts to feed a 40-meter dipole antenna 30' high, and he receives on a Lafayette HE-40.

Good luck in the WWDX and SS contests. Until next month, keep your "New Ham Views" and pictures coming; and remember, we appreciate receiving copies of your club paper. The address to use is: Herbert S. Bier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Ind., 46401.

73, Herb, W9EGQ

Household current from car, boat, plane 12 VDC

Powers 117 VAC TV, phonos, ham rigs, tools, lights, shavers, etc.

FULL 125 WATTS—TOP EFFICIENCY

Electro gives most for the money:

• Advanced solid state design—short-circuit proof.
• Stable frequency for phonos, recorders.
• Battery charge indicator light.
• Simple to use—plug in and turn on!

First line, Delco 2N441 transistors insure dependable, long life.
Cords total 12 feet for extra reach.
Fused for battery and inverter protection.
Backed by Certified Performance Ratings.

Plugs into 12 volt cigarette lighter socket.

Model T-100 $39.95 list, complete

$39.95 list, complete

NEW ELECTRO TRANSISTORIZED INVERTER

See your electronic, appliance, auto, marine supplier. If he's out of stock—send us his name.
Appropriately dubbed "Call Letter Directory," the volumes list CB'ers in both alphabetical and numerical order by state, town, and licensee in each town. In addition, the directory contains Part 95 rules and amendments, the phonetic alphabet, the 10-Code and an alphabetical listing of call-letter prefixes for all areas, and a 1960-65 U.S. area map.

The books are put together well, are highly legible, and are a real help when you know the other party's call-sign but not his name, or vice versa. Directories are currently available for areas 6, 8, 9, 11, 12, 18W and 18E. The listings are up to date and total 13,000 to 40,000 per directory, depending upon the size of the area. Prices range from $3.50 to $5.95. The directories will be republished annually, and other area listings will be available soon.

For all the details, drop a line to K9TVA, Dept. SS, 6429 N. Glenwood Ave., Chicago, Ill. 60626. And while you're at it, ask Mel for a copy of his illustrated brochure which lists a bundle of useful CB identification badges, decals, pins and accessories.

Club News. The Metropolitan Denver Citizens Radio Club of Denver, Colorado, has reported on their participation with authorities when a 12-foot wall of water.

---

Get Your First Class Commercial
F.C.C. LICENSE
and earn your
A.S.E.E. DEGREE

Grantham School of Electronics can prepare you quickly for a career in electronics. In 4 months you can prepare for employment as a communications technician, or in 8 months as a television technician, or in 18 months as a highly-trained electronics technician holding an Associate in Science in Electronics Engineering degree.

The Grantham degree curriculum is laid out in such a manner that the first semester (first 4 months) prepares you for a first class FCC license and for technical employment in communications, and that the first two semesters prepare you for employment as a television technician in a TV-service shop or in a TV-broadcast station. Therefore, you may choose to discontinue Grantham training at the end of either the first or second semester and still enjoy a productive career in electronics. Also, if you wish to continue and earn the degree, your ability to work in electronics after the first semester may enable you to "pay your way" through the rest of the course.

Those who continue for the degree must take the final two semesters at the Hollywood Division of the School. These final semesters include a lot of applied math, as well as some physics, technical drawing, English, etc.

Daytime or evening class schedules are available. Also, FCC license preparation is available by correspondence. Get complete details by telephoning or writing any one of the Divisions of the School listed below. Ask for Catalog 53-S.

**Grantham School of Electronics**

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

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

3123 Gillham Road, Kansas City, Mo. 64109
(Phone: JE 1-6380)

818-18th St., NW, Washington, D.C. 20006
(Phone: 298-7460)
**First Time Ever Published**

**The 1966 SKIING International Yearbook**

...a luxuriously illustrated compendium of 1965's important events...a timely forecast of the excitement-packed 1966 season—by the editors of SKIING MAGAZINE. only $1.25

The 166-page Charter Edition of the SKIING International Yearbook is a collector's item that will be relished by every serious skier.

Far more than just a major artistic endeavor (although there are numerous original drawings, dramatic photographs, striking full-color pages and specially designed type, which make for extremely pleasing composition)—the 1966 SKIING International Yearbook enables you to relive the best moments of the past season and to glimpse into the dynamic year of skiing just ahead. For example—

- complete reviews of the major European and American Alpine events—pro racing—Nordic events—season's records, U.S. and abroad—plus—

**EQUIPMENT:** A complete guide, including prices and brands!

**TECHNIQUE:** comparison of the major skiing systems.

**TRAVEL:** complete Guide To Skiing in North America...what the new European season holds in store!

**PLUS:** "Equipment and The History of Skiing"—illustrated with original art and way-back-when photos.

DeLuxe, Gold-Embossed Leatherflex-bound Charter Edition...just $3 postpaid!

A handsome, permanent edition of this brand new yearbook, mailed postpaid! To order the regular or DeLuxe edition, complete this coupon and mail it today!

**SEND**

350 DAVIS SERVICE DIVISION • Dept. SIY
589 Broadway • New York, N.Y. 10012

Send me a copy of the 1966 SKIING International Yearbook, as checked below:

☐ $1.25 enclosed, plus 15c 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.

--- PAYMENT MUST BE ENCLOSED WITH ORDER. ---

1965 OTCB Club Roster. The following are clubs reporting to *On the Citizens Band* for the first time. New clubs or those which have not been listed in this column in the last year should forward all details to keep our "active" CB club list current. Be sure to include number of members, when organized, primary activities, emergency assistance, and special teams or groups. A picture of your group could end up on these pages—if you include it.

**Anchorage, Alaska:** Southcentral Alaska Chapter of MCEU, Inc. This club was organized in December, 1964. The officers are: Tom Moore, KKN0808, president; Jerry Miller, KLN9149, vice president; Tony Armstrong, KKB3724, secretary; and Rick Croan, KLU0173, treasurer. The group was heading down the South Platte River threatened Denver and the metropolitan area. Approximately 200 CB'ers responded immediately to a call for assistance in evacuating persons living along the river. Before the threat was over, more than 500 CB'ers were on hand to help where needed. Several mobile units were placed at roadblocks while others were used for transportation. Most of the CB'ers involved averaged three to four hours sleep in 24 hours; some went without sleep for two days.

The Five Watt Wonders CB Radio Club of Greater New Orleans, La., made an all-out drive to up membership, set up a permanent 24-hour monitoring station, and ready their group for upcoming Mardi Gras festivities. The club's monitoring channel hit the air for the first time this year on Mardi Gras Day. The station handled emergency traffic for 12 hours through contact with CB mobiles stationed at six different Red Cross stations spread along the Mardi Gras parade route. New Orleans Red Cross and police officials were amazed at the swiftness with which the CB'ers handled 113 emergency requests for supplies and ambulance service during the activities.

In Fort Lauderdale, Fla., a Mr. Richard Gaddy was so appreciative of the "fast service" he received from CB'ers in the Eleven Meters Citizens Radio Club, he decided to join them. His car was stolen early one a.m., and his main concern was that the vehicle contained a number of valuable books and papers belonging to the insurance firm that employed him. Club members spread the word throughout Broward, Dade and Palm Beach counties. Two days later CB'er Jake Moore, KKP5456, spotted the car and relayed the information to Bill Walker, KKP4058. All stood by until sheriff department deputies took over, and Mr. Gaddy's car and its contents were returned intact.

---
president
Hudson, appliances
Communications
earthquake. director, for
lauded
Illinois Squad
Chicago,rado, surer.

president; Bob nelson
authority
Club of DX during the nighttime hours.

the kc.
of the North
transmitters
11,955 kc., as well as
the BBC relay
the Philippines
be
Taipei, occasionally Colombo, Ceylon, on
from the Pacific, audible, tral
during the
frequency
States.

and
the
is
and
South
daylight hours and
audible,
found
being sent
out to
in
the
west
Over
the
air
All the model numbers,
information...every vital statistic
on
130 pages, more than
20 complete features, covering every aspect of tape recording.
You get expert tips by the dozens, on equipment—making
better tapes—editing—copying—sound—on everything
you want and need to know about tape recording.

Plus a complete directory of the latest monaural and stereo
recorders—the only complete buyer's guide available in the
tape recorder field!

Over 100 photos—full data on 220 models from 30 different
manufacturers! All the model numbers, specifications,
dimensions and prices...every vital statistic you
need to compare the newest recorders and select the
finest one in your price range.

The 1966 TAPE RECORDER ANNUAL is an indispensable guide
for everyone who wants better performance, greater versatility
and a lot more fun from his tape recorder...month
after month...tape after tape!

GET THE DELUXE
GOLD-EMBOSSED LEATHERFLEX EDITION
... for just $3.00 POSTPAID!

Ziff-Davis Service Division • Dept. TR
589 Broadway • New York, N.Y. 10012
Send me a copy of the 1966 TAPE RECORDER ANNUAL, 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 please print PE-11
address

city state zip code

--- PAYMENT MUST BE ENCLOSED WITH ORDER. ---

November, 1965
19 Meters. Almost unlimited DX possibilities exist in this band from before sunrise until after sunset local time. Overall, the 15-mc. band will be the best DX band at this time of year with every major foreign broadcaster, and many smaller ones, using these frequencies in daylight hours.

Of special interest will be the new British relay station on 15,310 kc. This transmitter has a power of 250,000 watts and will carry programs for West African consumption. The announced schedule says that the transmitter will be on the air at sunrise, and at 0900 is scheduled to move to 15,435 kc. and remain there until sign-off at 1730 EST.

Turkey will be a good catch from 1100 to 1600 EST on 15,195 kc. Listen also for Nigeria on 15,255 kc. with transmissions from mid-morning to mid-afternoon EST.

16 Meters. On good days in this band very strong signals should be received—even exceeding the strength of those in the 19-meter band. DX will peak in the morning and should taper off in the early afternoon. On the West Coast, DX will decrease sharply after 1000 PST.

Announced schedules show Egypt on 17,785 kc. and Switzerland on 17,795 kc. South Africa, on 17,805 kc. will be on the air during the morning hours, local time.

13 Meters. Increased sunspot numbers will result in more extensive use of this band by foreign broadcasters. Although it will be used primarily by the BBC and the VOA, the Congo has announced transmissions on 21,500 kc. and Ghana will be on 21,545 kc. from 0900 to 1030 EST. Switzerland has plans to beam transmissions to Southeast Asia from 0330 to 0530 EST.

Broadcast and Long-Wave Bands. Station directories indicate that there are more than 10,000 broadcasting stations operating in the band between 500 and 1600 kc. Of these, approximately 4000 are licensed in the United States. During the daylight hours, reception in this band will not be a problem, since medium-wave transmissions do not propagate to any appreciable distance. At night, however, it will be a serious problem, particularly in suburban areas with congestion and interference from DX stations 500 to 1500 miles distant.

DX'ers should look between the broadcasting channel allocations in North America for Europeans, especially Madrid on 584 kc., Lisbon on 755 kc., Rome on 845 kc., Paris on 863 kc., London on 1214 kc., Lille on 1376 kc., Monte Carlo on 1466 kc., and Vienna on 1475 kc. And the VOA maintains a station in Munich on 1196 kc. that can occasionally be heard on the eastern coast of North America.
SHORT-WAVE LISTENING
(Continued from page 87)

Utility DX’ers Take Note. Jan Tuner, Editor of the Radio Communications DX Club in Sweden, tells us that a new point-to-point guide—a booklet containing 25 pages of addresses, report forms in four languages, frequency lists, advice on reporting, and a list of military stations—is now available. The listed price is $1.20 via surface mail, $1.40 via airmail. For further information, write directly to RCDXC, Kyrkvagen 6A, Kopp- parberg, Sweden.

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.

Afghanistan—R. Kabul, 15,225 kc., was noted at 1900-1330 in German with music. This station requires very sharp tuning. Do not confuse it with a nearby propaganda station, or with R. Nederland which is on 15,220 kc. at a comparable time.

Albania—R. Tirana can be heard cloning in Spanish at 1115, 7117 kc. but badly squeezed by Moscow and Athens. Major portion of the program is news. This station is also heard in French at 0000 on 9990 kc. and in Eng. to N.A. on 7225 kc. at 1900-1930.

 Algeria—Algiers, 6049 kc., has an ID in French at 1604 after a dramatic offering. The station was also noted signing off in Spanish at 1730.

Angola—Local area monitoring of all stations in Angola has resulted in the following complete and up-to-date list (frequencies in parenthesis are officially listed but not currently in use): Emiteiro Oficial de Angola—3975, 4820, 6025, 7225, 9555, 9700, 9760, 17,705 kc.) R. Clube de Angola—4870, 7140, 9630 kc.; R. Ecclesiæ—4985 kc. (11,755 kc.); R. Clube de Quenza Sul—4840, 7285 kc. (6000, 11,970 kc.); R. Clube do Congo Portugues—6135 kc. (4980 kc.); R. Clube de Malanje—4935, 7115 kc.; R. Clube do Moçico—5137 kc.; R. Clube de Cabinda—5035 kc. (7280 kc.); R. Clube do Lobito—4910, 7175 kc.; R. Dinamia—4770, 9615, 11,685 kc. (11,700 kc.); R. Clube de Huambo—3704, 5065, 7125 kc. (5680, 7140, 9665, 11,925 kc.); R. Clube de Mocamedes—(3740, 5065, 5015, 7240, 9515 kc.); R. Clube da Huila—3870, 5025, 9675 kc. (11,940 kc.); R. Clube do Bié—4885, 7380 kc. (7225, 7215 kc.); R. Comercial de Angola—3990, 4775, 7155 kc. (3990, 3995, 4775, 4860, 7150 kc.); R. Clube de Benguela—5040, 6150 kc. (3985, 3975, 7160, 9505 kc.);

Belgium—Brussels is noted on a new frequency, 9615 kc., at 1730-1800 in French and Flemish with pop music.

Brazil—Stations observed recently in the 19-meter band are as follows: R. Jornal do Commercio, Recife, 15,145 kc.; a weak station in Fortaleza—probably R. Clube do Ceara, 15,165 kc.; R. Marajoara, Belem, 15,215 kc.; R. Tupi, Rio de Janeiro, 15,370 kc.; R. Clube Ribeirão Preto (identifying as

November, 1965 125

Now—tune Short wave as easily as AM!

Hallicrafters’ new S-200 "Legionnaire"

foreign broadcast (plus U.S.) receiver

Only $59.95

Hallicrafters exclusive "S-P-R-E-A-D" TUNING
• Four super-spread foreign broadcast bands plus AM • Logging scale • Headphone jack

write for specifications

Export: Int'l Div. 519 W. Keystone Ave., Chicago, Ill 60624

"Quality through Craftsmanship"

CIRCLE NO. 18 ON READER SERVICE PAGE

You’ve got to SEE it to BELIEVE it!

instant lettering

dry transfer MARKING KITS for ELECTRONIC EQUIPMENT...

...the fast easy way to completely mark electronic equipment, drawings, schematics, prototypes, etc.

Words, letters, numerals, switch patterns, arcs, etc., are printed on a special transparent carrier film. Rubbing over one of these elements with a ball point pen releases it from the carrier film and adheres it to your working surface. It’s that simple to get professional looking results.

We want you to try this amazing product. Ask your favorite dealer for a free sample or write direct.

THE D.A.T.A.K CORPORATION
63 71st Street Dept. 615 Guttenberg, N.J.
CIRCLE NO. 12 ON READER SERVICE PAGE
Variable equalizer necessary for professional quality recording or playback. Ideal for use between mixer and tape recorder or tape to tape, etc. Write for details or send $2.00 for LP demonstration record. Copycat equalizer and tape recording techniques. Refunded with purchase.

Order direct or write for information

PRAT), 15,415 kc.; and R. Nacional, Brasilia, 15,445 kc. In addition, a weak, unidentified station believed to be a Brazilian is on 15,225 kc.

On about 3310 kc., a station announcing as R. Gazeta has been logged from 1911 to 1940 with Brazilian vocal and instrumental music and some announcements and ads in Portuguese.

Congo (West)—Radiodiffusion Television Congolaise was heard on 9718 kc, with African music at 1430-1530. This Brazzaville outlet is not dual to 9729 kc.

Cyprus—A new frequency for the BBC East Mediterranean Relay, Limassol, is 9580 kc. It was noted with BBC news at 1300 and 1400 and local programming in between. S/off appears to be 1615. Heavy QRM from Venice prevents solid copy.

Ecuador—Station HCBJ, Quito, uses 15,120 kc. at 1430 in Eng., dual to 17,850 kc., and 15,105 kc. at 1605 in German.

Station HCAJ3, R. Trebol (which does not announce as El Trebol), 4915 kc., is noted at 2310-2345 with typically bouncy Ecuadorian music. An ID is given every 10 to 15 minutes. The location reportedly is Zaruma but the announcer seems to say “desde Caliban” (?) and mentions Loja often.

Ethiopia—Radio Voice of the Gospel, Addis Ababa, has the following current Eng. schedule. Transmitter 1: 0635-0630 to Ceylon on 15,410 kc.; 1045-1100 to Ethiopia on 6901 kc.; 1400-1445 to West Africa on 11,785 kc. Transmitter 2: 0830-0900 to India on 9730 kc.; 1130-1145 to Malawi on 9765 kc.; 1300-1315 to E. Africa on 9655 kc.; and 1415-1530 to S. Africa on 9705 kc. There is an Eng. and Zulu xmas at 1315-1415 to S. Africa on 9705 kc. on Tuesdays, Thursdays, and Saturdays only. Reports also indicate a good signal along the East Coast at 1300-1300 on 11,845 kc.; this transmission is in Arabic. A late item lists 7268 kc. as now being used at 2245-2330 daily (except Saturdays) in Somali, and from 2330 in Amharic.

Gabon—Radiodiffusion Television Gabonaise, Libreville, is heard on 4777 kc. with interrupted music from 1740 to 1755/15 with announcements in French. Normal closing time is 1800 Sundays, 1610 weekdays.

Germany (East)—R. Berlin International is scheduled to the N.A. East Coast at 2000 and 2130 on 9560 and 11,880 kc., and to the West Coast at 2245 and 2340 on 9770 and 11,920 kc. The 2310 xman on 11,880 kc. appears to be the best received.

Ghana—Accra has been testing to N.A. in Eng. at 1500-1600 on 9760 kc. (and on 11,800 kc. in

The listening post of Mike Larcombe, Folcroft, Pa., contains both a Hallicrafters S-120 receiver and a Heathkit AR-3, Mike, otherwise known as WPE3EAL, has 69 QSL cards; 60 countries logged, 33 verified.

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

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

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 Nuvisors, Novars, Compactrons, 10-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. Also tests all popular picture tubes.

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

Mercury Electronics Corp. • 315 Reslyn Road • Mineola, N.Y. 11501

November, 1965

CIRCLE NO. 26 ON READER SERVICE PAGE
Arabic), at 2230-2330 on 6110 kc., at 0100 (possibly from 0030) on 3366, 4825 and 4915 kc., and from 1730 on 4835, 4915, and 4980 kc.

**Grease—** Forces E/C Station, Athens, was logged on 6045 kc. after V/G CGBR at 2245 with soft music, annts in Greek and wake-up exercises to 0000. It was also noted at 1600-1800 with a wide variety of music. This station has been very rarely logged since it was on 7430 kc. about ten years ago.

**Italy—** Rome broadcasts in Eng. as follows: to N.A. at 2000-2030 on 11,905 and 9630 kc.; to Egypt at 0735-0755 and to Malta during the same time period on 11,905, 9630, and 6010 kc.; to the United Kingdom at 1615-1635 on 11,905 and 9750 kc.; to the Near East at 0700-0730 on 8950 and 9710 kc.; and to Japan at 1705-1725 on 9110 and 9710 kc.

**Ivory Coast—** The new International Service from Abidjan on 6015 kc. is heard nicely with arias from Gluck's "Iphigenie en Aulide" at 1650-1750. The ID is "Radio diffusion Television Ivoirienne."

---

### 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

- Paul O'Connor (WPE6EUK), Canton, Ohio
- Clifford Cardwell (WPE5LU), Fort Worth, Texas
- Marvin E. Robbins (WPEB0MW), Broomfield, Colo.
- Dan Tognetti (WPE6DHH), San Rafael, Calif.
- Chuck Edwards (WPE4BNK), Fort Lauderdale, Fla.
- John R. Low (WPE3EWW), Wilmington, Del.
- Lanny Aldrich (WPE1EL), Burlington, Vt.
- Edward P. Hensel (WPE3KG), Laurel, Md.
- Mike Tilbrook (WPE3FTZ), Pittsburgh, Pa.

#### Forty States Verified

- Steven M. Stern (WPE2KR), Highland Park, N. J.
- Tim Kerfoot (VE3PE1TH), Toronto, Ont., Canada
- Gregg A. Calkin (VE1PE3L), Saint John, N.B., Canada
- Dick Schier (WPE4HIO), Chattanooga, Tenn.
- David Smith (WPE1GBC), Everett, Mass.
- Robert Lauzon (WPE2WWS), Pittsford, N. Y.
- Dean Christopherson (WPE3GBB), Denton, Md.
- Michael Moffat (WPE6FAU), Long Beach, Calif.
- Craig Anderton (WPE2JHM), Ridgewood, N. J.
- Danny Brodt (WPE3CWJ), Gaithersburg, Md.

#### Thirty States Verified

- Robby Dungan (WPE6FEP), Norwalk, Calif.
- Joseph E. Marks (WPE9CSA), Chicago, Ill.
- George E. Mlnnar, Jr. (WPE2MBW), Buffalo, N. Y.
- John Vickers (WPE41KG), Wrightsville, Ga.
- Bob DuBrissol (WPE1GGL), Long Meadow, Mass.
- John H. Long (WPE3DYU), Lebanon, Pa.
- James A. Sloman (WPE3BZC), Levittown, Pa.
- J. Paul Ochenkowski (WPE1FFY), Hammond, Conn.
- Alan Raylesberg (WPE2MKW), Bayside, N. Y.
- Larry Zigrang (WPE9HLM), South Bend, Ind.
- Dick Carpenter (WPE2LPX), Newfield, N. Y.
- Dick Holic (WPE2MGR), Endwell, N. Y.
- Richard Fcho (WPE8IGR), Cleveland, Ohio
- Bobby Joe Scott (WPE4HMX), Kingsport, Tenn.
- Robert J. Wagner (WPE3GIO), Philadelphia, N. Y.
- Stephen Schmidt (WPE2IKG), Webster, N. Y.

#### Twenty States Verified

- Bobby Conder (WPE4HQT), Winston-Salem, N. C.
- Kenneth A. Fraga (WPE2NPH), New York, N. Y.
- Douglas McKirahan (WPE5HSZ), Oak Park, Ill.
- Gary R. Cumiskey (WPE9HMT), Elkhart, Ind.
- Jim Archibald (WPE9HNR), Belleville, Ill.
- Ronald Kumor (WPE8HHN), Detroit, Mich.
- Donald Hughes (WPE6GBB), Big Bend, Calif.
- Jim Keller (WPE0EID), Grandview, Mo.
- Noel Vander (WPE1GHU), Bedford, Mass.
- Thomas Berlinger (WPE2NIR), Bronx, N. Y.
- Lawrence J. Pearce, Sr. (WPE6GAW), Barstow, Calif.
- John Januszewski (WPE2JG), Sayreville, N. J.
- Gregory K. Gebala (WPE2NAX), Lakewood, N. J.
- Chester W. Wood, Jr. (WPEDELH), St. Paul, Minn.
- Ross Lambert (WPE2MFS), Riverdale, N. Y.
- John and Richard Hanelko (WPE3GKC), Pittsburgh, Pa.
- Les Scofield (WPE8IU), Kalamazoo, Mich.
- Bruce Collier (WPE0ELA), Council Bluffs, Iowa.
- Wayne L. Elsmore (WPE7CCK), Klamath Falls, Oreg.
- John A. Brebner (VE3PE2EL), Kingston, Ont., Canada
SHORT-WAVE ABBREVIATIONS

amnt—Announcement
BHC—British Broadcasting
Corporation
H/C—Broadcasting
Eng.—English
ID—Identification
kc.—Kilocycles
N.A.—North America
OKM—Station interference
R.—Radio
s/off—Sign-off
V.O.—Voice of America
xmsn—Transmission
xmt—Transmitter

Maldive Islands—After long test xmsns, Multi Sinico Radio is now conducting regular broadcasts at 0200 on 9650 kc. in Hindi, Singlualue, Tamul, and Japanese. Has anyone logged this station as yet? We’d appreciate receiving the complete schedule as well as the address and technical information.

Mexico—Station XEMP, Mexico City, 11,740 kc., is now using the ID La Charruta del Cuadrante. It is being heard from 1815 to 1915 in Spanish.

New Guinea—R. Wewak, VLOCD. Papua, has been noted weekly on 3335 kc. with a world news bulletin in Eng. at 0300 followed by a varied music program.

Pakistan—Karachi uses 9614 kc. in parallel with 11,672 kc. for the Turkish xmsn at 1345-1430. The 9740-kc. frequency listed by some sources is not being used.

Peru—The mysterious R. Union, 6115 kc., is heard at 0100-0200 with dance music; the only ID’s noted to date consist of con una programa especial de bailarines—a call-sign is never given, nor a location. Some sources list R. Luz, Lima, as being on 6115 kc.; however, it is actually on 3355 kc. and only from 2200 to 2330 s/off with classical music, annuots, and commercials in Spanish.

Poland—Warsaw’s latest schedule reads: to South America in Polish at 1800-1830, 1830-1900, 1930-2000, and 2000-2030 and in Spanish at 1900-1930 and 2030-2055 on 9675, 11,840, and 15,120 kc.; to Australia and New Zealand in Eng. at 0230-0300 and 0330-0400 and in Polish at 0230-0250 and 0300-0330 on 9675, 11,840, and 15,120 kc.; to Africa in Eng. at 0700-0730 and 0800-0830 and in French at 0730-0800 and 0830-0900 on 7125, 11,840, and 15,120 kc., in Eng. at 1400-1430 and in French at 1330-1400 on 7285 and 9675 kc., in Eng. at 1700-1730 and in French at 1730-1800 on 7125, 7145, 7285, 9675, and 11,840 kc.

Portugal—Lisbon is operating at times on 7225 kc. at 1730-1830 with pop music and Portuguese language in a beam to Sao Tome, Angola, and Mozambique; from 1830 to Brazil. The La Voz del Occidente service was heard at 2120-2145 but not dual to 6025 or 6185 kc.

Somalia (Western)—A short-wave xmt is reported to be in operation at Apia on 6040 or 6140 kc. Schedule and the correct frequency are requested.

Somali Republic—R. Mogadiscio, 4668 kc., has been noted operating in Arabic at 2200 with world news; an ID at 2212, then Eng. news; from 2220 with native-language news, probably Somali. This is in dual to 7160 kc.

South Africa—The South African B/C Corp. will spend $6.6 million to build the most powerful radio xmt in Africa, according to one news source. It will be used to send a true image of the republic and its people to the outside world, the article said. Broadcasts will be made in nine languages. However, there was no mention of frequencies to be used nor a target date for the opening of the station.

Spanish Guinea—Emisor de Radiodifusion Santa Isabel, Fernando Po, 6250 kc., is excellent at times with uninterrupted Chopin etudes from 1658 to 1735; then light pop music to 1752/closed. S/off annuots were in Spanish and a brief march preceded the actual close.

Tahiti—Both outlets of R. Tahiti are giving excellent results on the West Coast, but the 6140-kc. outlet is now better than the 11,825-kc. outlet. The former is best around 0000-0100 in French, the

November, 1965

129
## POPULAR ELECTRONICS

### November 1965

#### ADVERTISERS INDEX

**READER SERVICE NO.** | **ADVERTISER** | **PAGE NO.**
--- | --- | ---
1 | Allied Radio | 138, 139, 140, THIRD COVER | 130
2 | American Basic Science Club, Inc. | 114 | 130
3 | American Institute of Engineering & Technology | 130 | 130
4 | Amphonic-Distributor Division | 12 | 130
5 | Amphenol-Borg Electronics | 12 | 130
6 | Antenna Specialists Co., The | 97 | 130
7 | Bank of America | 109 | 130
8 | Blonder Tongue | 3 | 130
9 | British Industries-Garrard | 6 | 130
10 | Broadcasting Laboratories, Inc. | 11 | 130
11 | Bushnell-Applebee Co. | 111 | 130
12 | Capital Radio Engineering Institute, The | 16, 17, 18, 19 | 130
13 | Cleveland Institute of Electronics 102, 103, 104, 105 | 130
14 | Conn | 129 | 130
15 | Consolidated Auto Wholesalers | 133 | 130
16 | Coyne Electronics Institute | 114 | 130
17 | Dalak Corporation | 28 | 130
18 | DeVry Technical Institute | 29 | 130
19 | Edmund Scientific Co. | 126 | 130
20 | Electro Products Laboratories, Inc. | 118 | 130
21 | Empire Technical Institute | 101 | 130
22 | Fairchild Electronics | 5 | 130
23 | Finney Company | 31 | 130
24 | Fisher Radio | 23 | 130
25 | Grantham School of Electronics | 135 | 130
26 | Hallicrafters | 125 | 130
27 | Heath Company | 98, 99 | 130
28 | Hitachi | 126 | 130
29 | Hy - Gain Electronics Corp. | 40 | 130
30 | Intercontinental Electronics School | 100 | 130
31 | International Crystal Mfg. Co., Inc. | 39 | 130
32 | International Rectifier Corp. | 103 | 130
33 | JFD Electronics Corporation | 13 | 130
34 | Johnson Company, E.F. | 33 | 130
35 | Kuhn Electronics Inc. | 126 | 130
36 | Lafayette Radio Electronics | 121, 122 | 131
37 | Mackenzie | 124 | 131
38 | Mark Products | 4 | 131
39 | Mercury Electronics Corp. | 127 | 131
40 | Metra Electronics | 107 | 131
41 | Micro Electron Tube Co. | 53 | 131
42 | Miller Company, J.W. | 106 | 131
43 | Milwaukee School of Engineering | 8 | 131
44 | Multigraphics Company | 135 | 131
45 | Multicore | 124 | 131
46 | National-Wide Tube Co. | 38 | 131
47 | National Radio Institute SECOND COVER, 1, 38 | 131
48 | National Technical Schools | 98, 99, 70, 71 | 131
49 | Olson Electronics Corporation | 129 | 131
50 | Progressive "Edu-Kits" Inc. | 112 | 131
51 | RCA Electronic Components and Devices | 11 | 131
52 | RCA Institutes, Inc. | 34, 35, 36, 37 | 131
53 | RTS Training Center | 114 | 131
54 | Ray-Tel | 30 | 131
55 | Sanders Co., Inc. Howard W. | 135 | 131
56 | Schober Organ Corporation, The | 106 | 131
57 | Scott, Inc., H.H. | 29 | 131
58 | Semtronics Corp. | 32 | 131
59 | Share Brothers, Inc. | 41 | 131
60 | Sonar Radio Corp. | 113 | 131
61 | Topuz Incorporated | 116 | 131
62 | Turner Microphone Company, The | 25 | 132
63 | U. S. Army | 27 | 132
64 | University Sound | 117 | 132
65 | University Sound | 117 | 132
66 | Valparaiso Technical Institute | 124 | 132
67 | Verco Electronics, Inc. | 116 | 132
68 | Weller Electric Corp. | 28 | 132

### SHORT-WAVE CONTRIBUTORS

- Roger Cainrie (WPFE1GK), Manchester, N. H.
- ferry Brainin (WPFE1FA), N. Y.
- Alan Raylesberg (WPFE1JW), Bayside, N. Y.
- Doug Lamerson (WPFE1MW), Richmond Hill, N. Y.
- Al Nauerb (WPFE1NW), Washington, N. J.
- Ira Schulte (WPFE1XZG), White Plains, N. Y.
- Jay Hans (WPFE2NGL), White Plains, N. Y.
- Paul Mayo (WPFE2NG), Brooklyn, N. Y.
- Connie Tamagna (WPFE2TPK), New York, N. Y.
-草地 Grady (WPFE2VJC), Charlotte, N. C.
- Jack Kerri (WPFE2SMP), Houston, Texas
- James Helmkie (WPFE2SLC), Schenectady, Texas
- Gary Kiefel (WPFE3DZD), Tecumseh, Ohio.
- Jack Stephenson (WPFE3S), Okoloia City, Okloa.
- Shaler Hanische (WPFE3SJO), Pasadena, Calif.
- Trev Clegg (WPFE6AF), Fresno, Calif.
- Stan Smolosky (WPFE7CE), Globe, Ariz.
- Melvin Hickman (WPFE8TW), Walla Walla, Wash.
- Dan Schonberg (WPFEWJH), Shaker Heights, Ohio.
- William Carlisle (WPFEWH0), Columbus, Ohio.
- K. D. Palmer (WPFEWJNT), Decatur, Ill.
- Gerry Dexter (WPFEWDB), West Bend, Wis.
- A. K. Niblack (WPFEWHK), Vincennes, Ind.
- John Weaver, Sr. (WPFEWLA), Pueblo, Colo.
- Jack Perloko (WPFEWEC), Sao Paulo, Brazil.
- Bert Pester (WPFEWEO), Sudbury, Ont., Canada
- Charles Bailey, Athens, Ga.
- Jerry Buzan, Greenville, S.C.
- George Bennett, Anderson, Ind.
- Robert Harris, Siouxet, N. Y.
- Bob Hill, Boston, Mass.
- Jim Hindenlang, East Moriches, N. Y.
- Paul Judkins, Herndon, Va.
- Joe Piechuta, Plantsville, Conn.
- Bert Pryor, Athens, Ga.
- Christopher Schwind, Williamsville, N. Y.

#### Radio Voice of the Cabinet Affairs, Addis Ababa, Ethiopia

**Sweden Calling DX'rs Bulletin, Stockholm, Sweden**

Latter around 2200 with Tahitian-language programming.

**Thailand**—B. Thailand, HSKJ, Bangkok, operates to K.A. at 2315-0015 with news in Eng. at 0905, and in their General Overseas Service at 0525-0557 with news in Eng. at 0930, on 11,910, 7165, and 6180 kc., for the Thai Forces in Korea, Republic of Vietnam and Cambodia at 0430-0520 and in a Home Service relay at 0900-0950, on 11,910 kc. There is no Eng. listed for the two latter xmas. Reception reports are requested and will be verified by card and acknowledged by letter. Return postage is not received.

**Tunisia**—Tunis J, 6195 kc., in the Arabic Network, overrids the BBC with chanting at 2345, an anmt in Arabic at 2348, then wake-up exercises. It is QRM'ed after 0000 by the BBC and another signal, probably that of R. Tunis.

**Windward Islands**—St. Georges has moved up from 5010 kc. to 5020 kc. where it is heard at 1730-2115. The 19-meter outlet has also moved, this time up to 1530 kc.; try for it around 1530. East Coast listeners and those in the southern states might also try for one of the medium-wave network stations: Castries on 1585 kc. (down from 1580 kc.); St. Georges on 540 kc.; Roseau on 895 kc.; and Kingston on 705 kc. All of the latter stations broadcast with 500 watts except the 250-watt Castries outlet.

**Medium Waves**

Your Short-Wave Editor frequently monitors 800 kc. evenings to check on the signal of PJB. Trans World Radio, Bonaire, generally runs fair to good despite the presence of two Canadian stations, CKLW in Windsor, and CJAD in Montreal, as well as the 150,000-watt voice from XELO in Ciudad Juarez, Mexico. But we were surprised recently to receive the following report from a listener just thirty miles from CKLW: "PJB comes in here fair to good at 2100 with religious talks. This is the first time anyone living within 200-300 miles of either CKLW or CJAD has reported the 800-ko. outlet."

---

*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 order. Copy may be returned only when accompanied by publisher's approval. Closing Date: 1st of the 2nd preceding month (for example, March issue closes January 1st). Send order and remittance to: Hal Cymes, POPULAR ELECTRONICS, One Park Avenue, New York, New York 10016.

FOR SALE

FREE! Giant bargain catalog on transistors, diodes, rectifiers, SCR's, zeners, parts. Poly Paks, P.O. Box 942, Lynnfield, Mass.

MESHNA’S TRANSISTORIZED CONVERTER KIT $4.50. Two models converts car radio to receive 30-50 mc or 100-200 mc (one mc tuning). Meshna, Lynn, Mass. 01901.


GOVERNMENT Surplus Receivers, Transmitters, Spyscopes, Radios, Parts, Picture Catalog 20¢. MESHNA, Nahant, Mass.


CB WPE QSL Cards. Samples Free, Radio Press, Box 24, Pittstown, New Jersey.


"SPECIAL WPE-SWLB-2CB-QSL cards, 3 colors, $2.50 per 100—Free Samples. Garth, Jutland, New Jersey."

CANADIANS—GIANT Surplus Bargain Packed Catalogs. Electronics, Hi-Fi, Shortwave, Amateur, Citizens Radio. Rush $1.00 (Refunded). ETCO, Dept Z, Box 741, Montreal, CANADA.


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.

JAPAN & Hong Kong Electronics Directory, Products, components, supplies, 50 firms—just $1.00. Ippano Kaisha Ltd., Box 6266, Spokane, Washington 99207.

CANADIANS, TRANSISTORS AND PARTS. Free catalogue contains data on 300 transistors. J. & J. Electronics, Dept PE, Box 1437, Winnipeg, Manitoba.

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.


QSL's BROWNIE W3CJ 3111A Lehigh, Allentown, Pa. 18103. Send $0.10¢ with catalogue 25¢.

TRANSISTORS—Miniature Electronic Parts. Send for free Catalog. Electronic Control Design Company, P. O. Box 1432K, Plainfield, N.J.

CITIZEN BANDERS! Get base station Performance with your mobile units. No modifications or soldering necessary. Proven performance. Send for free details or send ($15.00) to: T. Francis, 15 Park Row, N.Y. 38, N.Y.

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¢ per word. Maximum subject to publisher's approval. Comparisons must be factual. No emotional language. 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.

DETECTIVES! Free brochures! Electronic intelligence devices for your needs and budget. SILMAR ELECTRONICS, 3476 N.W. 7th Street, Miami, Fl., 33125.

INVESTIGATORS, FREE BROCHURE, LATEST SUBMINIATURE ELECTRONIC SURVEILLANCE EQUIPMENT, ACE ELECTRONICS, 11500-L NW 7TH AVE., MIAMI 50, FLA.

CONVERT any television to sensitive, big-screen oscilloscope. Only minor changes required. No electronic experience necessary. Illustrated plans, $2.00. Relco Industries, Box 10563, Houston 18, Texas.

BUY Appliances, Cameras, Watches, etc. at factory prices plus 10%! Free Details! Cam Company, 436-11 Bloomfield Ave., Verona, N.J. 07044.

NEW Supersensitive transistor locators detect buried gold, silver, coins. Kits, assembled models. $19.95 up. Free catalog. Relco-A33, Box 10563, Houston 18, Texas.


110VAC 60cy from car generator. Powers lights, refrigerator, transmitter, receiver, etc. Simple, easy to convert. Plans $2.00. Tendo, P.O. Box 12098, Houston, Texas 77017.

ACHTUNG! Das machine is nicht fur Gerfingeroken und mittengarten. Is easy schnappern der Springenwerk, blowanfusen und poppcorken mit spitzensparken. Ist nicht fur gerwerken by das Dummekopfen. Das rubbernecken sightseren keepen hands in das pockets. Relaxen und watch das Blinkenlights. This attractive, brass metal plaque only $2.00 each, pdd. 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, Greenacres, Ind.

TELEPHONE VOICE SWITCH: (LS-500). ACTUATES AUTOMATICALLY AND UNATTENDED ANY TAPE OR WIRE RECORDER. PICTORIAL INSTALLATION INSTRUCTIONS INCLUDED. $23.75. POST PAID USA, WJS ELECTRONICS, 737 NORTH SEAWARD, 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 SURREPTITIOUS TRANSMITTING DEVICES IN CONFERENCE ROOMS, HOME AND OFFICES, ETC. WRITE FOR DETAILS. WJS ELECTRONICS, 737 NORTH SEWARD, HOLLYWOOD, CALIF. 90038.

DIAGRAMS—SENT AIRMAIL—TELEVISION $3.00, RADIO 1919-1965 $2.00. GIVE MODEL. DIAGRAMS, BOX 55, WILLIAMSPORT, PA. 17704.

SAFEGUARD PRIVACY! New instrument detects electronic 'bugs,' wire-tapping and snooping devices. Free information. Dee Equipment, Box 7263-E7, Houston 8, Texas.


LASER: Hobbyists, experimenters, amateur scientists. Build your own coherent-light optical laser. Complete instructions, drawings, schematic diagrams and parts list. $6.00. Same as above, diode laser, $3.00. Technical Writers Group, Box 5501, State College Station, Raleigh, N.C. 27607. 

REVERBERATOR (ECHEL) 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. 


STROBOSCOPE: Build your own. Observe wheels, fan blades, gears, etc. while rotating. Uses 2 tubes and neon bulb. Complete plans, drawings, schematic and parts list. $3.00. Technical Writers Group, Box 5501, State College Station, Raleigh, N.C. 27607. 


TRANSISTOR ignition systems. Famous "Operation Pick-up" kit finest components only $13.95 Postpaid. Also other systems and components available. Free catalogue. ELECTROMART, Box 2680, Milwaukee, Wisconsin 53214. 


INVESTIGATORS—DETECTIVES—INDUSTRIAL SECURITY OFFICERS: New 1966 line of Electronic Surveillance Devices. Incorporating most advanced subminature design. Greater range; lower battery drain; unique sophisticated circuitry; extremely durable. HIGH QUALITY PROFESSIONAL EQUIPMENT AT ROCK BOTTOM PRICES. Fool-proof wireless units are extremely SIMPLE TO USE! You DO NOT have to be an engineer to get PROFESSIONAL results with THIS equipment. TROL 1966 models ready NOW! Take advantage of Special Introductory Offer. Don't delay! For FREE details write TROL ELECTRONICS-PE, 342 Madison Avenue, New York, N.Y. 10017. 


LOWEST Prices Electronic Parts. Confidential Catalog Free. KNAPP, 3174 8th Ave. S.W., Largo, Fla. 


DETECTIVES: ELECTRONIC SURVEILLANCE DEVICES. LOW COST. SIMPLE OPERATION. FREE BROCHURE. DETECTION SYSTEMS—PE, BOX 455 GRAND CENTRAL, NEW YORK CITY 10017. 

ELECTRONIC "Crackajacks," transistors—photocells—relays. Guaranteed prize box $1.00 plus 15¢ pp. DART ELECTRONICS, Box 214, Jericho, N.Y. 

PLANS ONE TUBE DX Shortwave kit (12,000 record) 24 pages—50¢. Experimenters catalog 250 exclusive items—25¢, refundable. Laboratories, 993-L, Redwood City, Calif. 

QLS CARDS—Best quality, price. Write Jac-Mar, Box 522, Dos Palos, Calif. for price list. 

LOOKING FOR TREASURE? Complete Detailed Circuit Information to Build Low-Cost Transistor Metal Locator and Small Detector Two Circuits $2.00. Treasure Hunter, Box 1796, Costa Mesa, Calif. 

FREE ELECTRONICS (new and surplus) parts catalog. Bigelow Electronics, Bluffton, Ohio 45817. 

--- 

CLASSIFIED ADVERTISING ORDER FORM 

Please refer to heading on first page of this section for complete data concerning terms, frequency discounts, closing dates, etc. 

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>27</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>32</td>
<td>33</td>
<td>34</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

Words \[ @ 55¢ (Reader Rate) \] \[ @ 90¢ (Commercial Rate) \] = $ Total Enclosed $ 

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 35mm, COD, PO, AC, etc., count as one word. Hyphenated words count as two words. PE-1165
BUILD A "LIVE" TV CAMERA CHEAPER THAN EVER! Simplest 5 tube circuit to date. EXCELLENT PERFORMANCE acclaimed 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 $3.00 refundable with order of any kit. PERFECT FOR HAMS, EXPERIMENTERS, SCIENCE FAIR STUDENTS. Check our unbelievable prices. RUSH 10¢ for INFORMATION PACKED CATALOG. Box 396P, ATV RESEARCH, South Sioux City, Nebr. 68776.

ANEMOMETER (electric wind speed indicating system) complete with meter, cable, transmitter and wind socket, plus FREE wind gauge—$19.95—Send money order and save shipping charges. Pioneer Sales Co., Box 7151, Dallas, Texas.

FREE ELECTRONICS (new and surplus) parts catalog. Bigelow Electronics, Bluffton, Ohio 45817.

TV CAMERAS. Model 400 complete with good vidicon and lens. Used as demonstrators. Only $200 F.O.B. Vanguard, 190-48 99th Ave., Hollis, N.Y. 11423.

FM STEREO Tuner, alignment generator. Kit $79.50, Wired $99.50. AmerLabs, 471 Clifton Avenue, Newark 4, N.J.


CB CRYSTALS—SUBMINIATURE Types Only $1.50 each. Postpaid. List of Channels Available. Quaker Electronics, Hunlock Creek, Pa.

1965 SEDANS...only $995

FULLY GUARANTEED!

GET A 1965 Ford or Dodge for only $995. Our amazing wholesale fleet operation saves you $1,000 (1964 cars only $595). For personal use or profit. Supply limited. Write for free illustrated catalog and details.

ALL THESE FEATURES:

- 4-Door
- 6 Cylinders
- Automatic Transmission
- Heater * Jack * Spare
- Refinished Choice of Color
- Nationwide Delivery or You Pick Up

GUARANTEE in writing on Motor, Transmission, Rear End. Write to:

CONSOLIDATED AUTO WHOLESALERS, Dept. PE-11
120 E. 56 St., New York, N.Y. 10022 PHONE: (212) 421-2223


QSL-CB-SWL (letters) Cards. Samples 10¢. MARTIN, 828F SCHUYLKILL AVENUE, READING, PENNA.

REVERBERATOR: Build your own echo box for car radio, stereo, guitar. Complete instructions, Schematics and parts list $3.00. Technical Publications, University Station, Box 14084, Gainesville, Fla.


ROBOTS—Build your own. List of Unique Schematics—25¢. P.O. Box 12303, Fort Worth, Texas.

ELECTRONIC LIGHTER. No Flint, Wick, Battery or Moving Parts. Wagner, 6200-A Whitewood, Library, Pa. 15129.

VIDEO TAPE RECORDER: VKR-500 factory wired $295.00. Box 27881, Los Angeles, Calif. 90027.


COLOR-BAR Generator, Sencore CG-126, Unused, Only $102; Jeff Fiala, 2523 S. Homan, Chicago 60623.


HAM EQUIPMENT


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:

name
address
city state
zip-code

Notify us of your address change as far in advance as possible—it takes about 2 months for a change to become effective. (Eg. A notice received in May becomes effective with the July issue.)

Mail to: POPULAR ELECTRONICS
1255 Portland Place, Boulder, Colorado 80311

November, 1965
WANTED


SHORTWAVE LISTENING

SWL GUIDE, English programs listed by the hour. DOUBLE LISTENING PLEASURE. $2.00. SWL Guide, 218 Gifford, Syracuse 2, N.Y.

LP RECORD—Shortwave station announcements, interval signals, anthems, Pakistan, Jerusalem, Sudan, many more. Broadcast quality. $3.95 postpaid. SWL RECORDS, P. O. Box 150, Culver, Calif. 90231.

HIGH FIDELITY

"LOW, Low quotes: all components and recorders. HiFi, Roslyn 9, Penna."

Hi-Fi Components, Tape Recorders, at guaranteed "We Will Not Be Underpaid" prices. 15-day money-back guarantee. Two-year warranty. No Catalog. Quotations Free. Hi-Fidelity Center, 1797 (P) 1st Avenue, New York, N. Y. 10028.

FREE! Send for money saving stereo catalog #P11E and lowest quotations on your individual component, tape recorder, or system requirements. Electronic Values, Inc., 200 W. 20th St., New York, N. Y. 10011.

TUBES


RADIO & T.V. Tubes—336 each. Send for free list. Cornell, 4213 University, San Diego, California 92105.


TAPE AND RECORDERS

TAPE Recorders, Hi-Fi, components, Sleep Learning Equipment, tapes. Unusual Values Free Catalog. Dresser, 1523PE, Jericho Turnpike, New Hyde Park 11, N. Y.

BEFORE Renting Stereo Tapes try us. Postpaid both ways—no deposit—immediate delivery. Quality—Dependability—Service—Satisfaction—prevail here. If you've been dissatisfied in the past, your initial order will prove this is no idle boast. Free Catalog, Gold Coast Tape Library, Box 2262, Palm Village Station, Hialeah, Fla. 33012.

RENT Stereo Tapes—over 2,500 different—all major labels—free brochure. Stereo-Parti, 1616-PE Terrace Way, Santa Rosa, California.

STEREO TAPES. Save up to 60% (no membership fees, postage anywhere U.S.A.). Free 60 page catalog. We discount batteries, recorders, tapes, accessories. Be assured of slogans "not understood," as the discount information you supply our competitor is usually reported to the factory. SAXITONE, 1776 Columbus Road, Washington, D.C.

RENT 4-TRACK STEREO TAPES—Narrow it down, it has to be TRIMOR—Goodbye to partial satisfaction! Service and Dependability our keynote—ALL LABELS and TITLES BROCHURE and TAPE CATALOG. TRIMOR Company P. O. Box 748, Flushing, N. Y. 11352.

TAPE-MATES makes available to you—ALL 4 track stereo tapes—ALL labels—REMOUS SAVINGS—POSTAGE FREE to your door—for FREE BROCHURE write TAPE-MATES, 5280-P E. Pico Blvd., Los Angeles, Calif. 90019.

TAPE RECORDER SALE. Brand new, latest models, $10.00 above cost. Arkay Sales, 1028-C Commonwealth Ave., Boston, Mass. 02215.


TAPE-MATES offers the world's first 3 HOUR—Long play stereo library—CLASSICAL—POP—JAZZ—DANCE and VARIETY—top recording artists—ONLY $9.95—FREE TAPE-MATES membership with initial order—for FREE BROCHURE write TAPE-MATES, 5280-P E. Pico Blvd., Los Angeles, Calif. 90019.


CONCORD Model 330 automatic telephone connection Surveillance Accessories, Free Details, Electronics, Box 301, N. Y. 10028.

TAPE-MATES now offers the first completely PORTABLE CAR-STEREO PLAYER—nothing to install—can be used in CAR—HOME—OFFICE—BOAT, etc. Also complete CAR-STereo Music Library available—for FREE BROCHURE write TAPE-MATES, 5280-P E. Pico Blvd., Los Angeles, Calif. 90019.

PLANS AND KITS


TRANSISTORIZED FM TRANSMITTER kit $7.50 (less mike). FM radio kit $8.50, Plans $1.50 each. Radcon, 1736 Minnesota, Fairfield, Calif. 94533.


TACHOMETER! Fully Transistorized for All make cars. 0-10,000 RPM. Build for under $7.00. Send $2.00 for details. Group Laboratory, Box 87, Prospect Hts., Ill. 60070.

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.

CLEAN Equipment Works Better, Sells for More. Vacuum Cleaner Nozzle, Stem 8"x3" $1.50, Spitz, Box 405S, Arlington, Virginia 22204.

EQUIPMENT


POPULAR ELECTRONICS
MAGNETS

ALNICO-CERAMIC—FLEXIBLE—ASSEMBLIES. What you need, we have. Maryland Magnet, 5412H Gist, Baltimore, Md. 21215.

BOOKS


PATENTS


INSTRUCTION

LEARN While Asleep, hypnotize with your recorder, photograph. Astonishing details, sensational catalog free! Sleep-Learning Association, Box 24-ZD, Olympia, Wash.

FCC License in 6 weeks. First Class Radio telephone. Results Guaranteed. Elkins Radio School, 2603B Inwood, Dallas, Texas.

HIGHLY—effective home study review for FCC commercial phone exams. Free literature! Cook’s School of Electronics, Craigmont, Idaho 83523.

REI First Class Radio Telephone License in (5) weeks Guaranteed. Tuition $295.00. Job placement free. Radio Engineering Institute, 1336 Main Street, Sarasota, Fla.


PICTORIAL Study in Amateur Radio. Free Details, Dwight Cross, 1212 Lynch, St. Louis, Mo. 63118.

FCC LICENSE TRAINING THROUGH TAPE RECORDED INSTRUCTION. Bob Johnson Audio-Visual License Training, 221 S. Sepulveda, Manhattan Beach, Calif.

MOVIE FILMS

THIS Christmas. Give or Get INDIY “500” 8mm Color Movie Library by “pro” cameramen. Three most thrilling Indianapolis “500” Races—1963 is $10.95 p.d.—1964 is $11.95 p.d.—1965 is $12.95 p.d. Outstanding $35.85 Value! Buy All 3 Together ONLY $31.95 p.d., SAVE $3.90. Send Check or money order to: SPORTLITE “500” FILMS, Dept. CPE, 20 N. Wacker Drive, Chicago, Ill. 60606.

MAGAZINES


HELP WANTED


November, 1965

37c
eac.
MAGAZINES

THIS ISSUE

DESKBOARD

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, Gilbar 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 3, N.Y.

35c EA.
LARGE, SELECT STOCK . . . DEPENDABLE, FAST SERVICE. SEND FOR COMPLETE TUBE LIST


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, Gilbar 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 3, 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.

RECORDS

DISCOUNT Records, All Labels—Free List. Write Cliff House, Box 42-P, Utica, N.Y.

PROTECT YOUR RECORDS! Two Cleaning Cloths $1.00. Towers, Lafayette Hill, Pa. 19444.

GOVERNMENT SURPLUS

“GOVERNMENT SELLS”—Surplus Electronics: Oscilloscopes; Transceivers; Test Equipment; Radar; Walkie-Talkies; Boats; Jeeps; Aircraft; Misc.—Send For—“U.S. Dept. Directory—Procedure”—$1.00—Service, Box 425 (ZE), Nanuet, N.Y.

GOVERNMENT Surplus. Complete Sales Directory $1.00. Surplus Publications, Box 45781E, Los Angeles 45, Calif.

JEOPS from $53.90. Trucks from $78.40—Boats, Typewriters, Airplanes, Electronic Equipment, 100,000 Bargains “as is” Direct From Government In Your Area. Complete Sales Directory and Surplus Catalog $1.00. Deductible First $10.00 Order. Surplus Service, Box 820-J, Holland, Michigan.


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.

MUSIC

SUB carrier detector adds programs of continuous, commercial-free music thru any FM tuner when plugged into multiplex output of tuner. Hear the hidden background music programs now on FM, Kit, no alignment necessary, $49.50. Wired unit $75.00. Music Associated, 65 Glenwood Road, Upper Montclair, New Jersey, Tel. 201-744-3387.


MUSICAL INSTRUMENTS


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! 152-page FALL-WINTER catalog! Over 1700 PIc-TURES! 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.

HYPNOTIZ E 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.

PHOTOGRAPHY—FILM, EQUIPMENT, SERVICES

MEDICAL Film—Adults Only—“Childbirth”—1 reel 8mm $7.50–16mm $14.95. International-E, Greenville, L.I., New York.


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 692, 263 Adelaide St. W., Toronto, Canada.

DO-IT-YOURSELF

TRANSISTORIZED Two Band Kit, Tunes Aircraft, Foreign, Police and Broadcast. $5. Headset $2. Ekeradio, Box 131, Temple City, Calif.

PERSONALS

INVESTIGATORS, FREE BROCHURE, LATEST SUBMINIA-TURE ELECTRONIC SURVEILLANCE EQUIPMENT. ACE ELECTRONICS, 11500-K NW 7TH AVE., MIAMI 50, FLA.

“HYPNOTIZE . . . One word . . . One fingersnap.” on stage. Satisfaction—or refund. $2.00. Hypnomaster, Box 9399-E8, Chicago 90.

PHOTOGRAPHS

PHOTOGRAPHS and transparencies wanted, to $500.00 each. Valuable information free—Write Inraphoto-PE, Box 74067, Hollywood 90004.

DETECTIVES

DETECTIVE Opportunities. Experience unnecessary. Write, Wazgner, 125 West 86th, New York 10024.

STAMPS

TURKEY 50 different $c approvals. Hijop, Box 505, Norristown, Pa. 19404.

SPECIAL TRIPLE OFFER—111 All Different Stamps—25 All Different Topicals—Full Year’s Membership in Las Vegas Stamp Society—All for $1.00. Our system puts your duplicate stamps to work for you, and gives you full catalog value for same. KINNEAR, 558Q Oakley Blvd., Las Vegas, Nevada 89105.

500 FINE MIXED U.S. 15c, Wright, Box 753-X, Hagerstown, Md. 21740.

EMPLOYMENT INFORMATION

COINS

FIFTY Indian Pennies $14.00. BROOKLINE COIN, Box G, Auburn, Mass.

NOW! Get 3 Real Old Lincoln Cents! Send 10¢ and receive 1919, 1920 and 1925. (Only one set to a customer.) Other offers on approval. Littleton Coin Co., Littleton T12, N.H.

BUSINESS OPPORTUNITIES


VENDING Machines—No Selling. Operate a route of coin machines and earn amazing profits. 32-page catalog free. Parkway Machine Corporation, 715PE Ensor Street, Baltimore 2, Md.

ELECTROPLATING Equipment and supplies. All types for home workshops and industrial. Send $1.00 (refundable) for equipment guide formulas, operating data, catalog. HBS Equipment Division 90, 3543 East 16th, Los Angeles, Calif. 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, Shannon 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.

GET INTO CUSTOM UPHOLSTERY. Turn Old Furniture into big $$$ spare time. Repuholster chairs, divans like new. Make custom slip covers, drapes. No experience required. We supply everything. Write for Big FREE illustrated Book on Easy Home Instruction and how we start you in big $$$ home business. Modern Upholstery Institute. Box 899-OJ, Orange, Calif.


NEW PUBLICATION. "Green Dollar Gold Mines." Professional business secrets for success and profits in radio and TV repairing. $5.95. United Products Co., 922 W. Grove St., Bloomington, Ill. 61701.

OBTAIN abundant capital for your business. Details free. McReynolds, 406 West D St. Elizabethton, Tenn. 37643.

WHY RENT?—$3,800.00 Builds $8,000.00 Home. Instructions—$1.98. Homecraftsman, 552 Front, Scranton, Pa. 18505.

EARN MORE MONEY as a Microwave Systems Engineer. Illustrated handbook gives complete fundamentals of microwave propagation, limitations. Valuable aid to planning, evaluating microwave systems. Send $1.00 to Box 1882, Indianapolis, Ind. 46206.

MISCELLANEOUS

HYPNOTIZE secretly, cleverly, one glance . . . or money back. $2. Elton's, Box 18223-PE27, Indianapolis, Indiana, 46218.

BEERS, PEACH BRANDY, WINES—Strongest Formulas, $2.00. (Complete brew supplies—hydrometers catalog 10g)—Research Enterprises, 29-D Samoset Rd., Woburn, Mass.


November, 1965
FREE

send today for your

ALLIED

1966 CATALOG

world’s largest selection

SAVE MOST ON:

Stereo Hi-Fi
Tape Recording
CB 2-Way Radio
FM-AM & AM Radios
Short Wave Radios
Portable TV • Phonographs
Amateur Gear
Intercoms & P.A.
Automotive Electronics
Test Instruments
TV Tubes & Antennas
Power Tools, Hardware
Parts, Tubes, Transistors

MORE OF THE BEST IN ELECTRONICS FOR EVERYONE

508 VALUE-PACKED PAGES
including exclusive products and
special values available only
from ALLIED

508 VALUE-PACKED PAGES
including exclusive products and
special values available only
from ALLIED

MORE OF THE BEST IN ELECTRONICS FOR EVERYONE

EASY TERMS
Use the convenient
Allied Credit Fund Plan
—over 24 months to pay

ALLIED RADIO
The World’s Largest Electronic Supply House
Printed in U.S.A.

satisfaction guaranteed or
your money back

POPULAR ELECTRONICS
Special in your FREE 1966 Allied Catalog

see what's new in the wonderful world of knight-kits

Knight-Kit GUARANTEE: Buy any Knight-Kit. Build it. Operate it. You must be satisfied or we refund your money.

THERE IS A knight-kit FOR EVERY NEED!

easiest to build—enjoy big savings

- Stereo Hi-Fi
- Hobby Kits
- Intercom
- CB 2-Way Radio
- Test Equipment
- Amateur Gear
- Short-Wave
- Automotive

send for your 508-page 1966 Allied Catalog

ALLIED RADIO, Dept. 3-L
100 N. Western Ave., Chicago, Ill. 60680

FREE

Send today for your 508-page Allied 1966 value-packed catalog

ALLIED RADIO

CIRCLE NO. 1 ON READER SERVICE PAGE
PICK ANY NUMBER FROM 1G3GT TO 19AU4 AND YOU'RE A WINNER!

CIRCLE NO. 2 ON READER SERVICE PAGE

...AND ON AND ON. FOR THE COMPLETE LIST, WRITE:
AMPEREX ELECTRONIC CORPORATION, HICKSVILLE, L.I., NEW YORK 11802.