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This we did. Our friend spent a moment in quiet thought, then retorted, "The number you crossed out was . . ."

To which we commented "How in h . . . did you know?" He told us eventually, but it cost us two six-packs. The price to you dear readers, is a bit cheaper. Just pass your newsstand two
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LAFAYETTE RADIO ELECTRONICS CORPORATION • 111 JERICHO TURNPIKE, SYOSSET, L.I., N.Y. 11791

AUGUST-SEPTEMBER, 1967
months from now and sneak a peek at this column before the vendor has a chance to shoo you away. And if he gets tough, tell 'im I'm a big city Editor said it was okay.

White Paper on a White Lie! You read it in this column and elsewhere—the FCC's emphatic denials that there is no truth whatever to reports that it planned to switch 27-MHz walkie-talkies to a new band located on 49 MHz. They said that there was "no such proposal," that the first publication to run the story was misrepresenting the facts, that someone had apparently seen a rough and early stage in-house FCC worksheet which was meaningless and had drawn many wrong conclusions, etc., etc.

Since the story had created such a furor in CB manufacturing circles and had upset users so much, just about every major publication had been only too happy to relay the FCC's message to the public—the message which squashed the entire story as a cheap hoax.

Funny thing about the story, though. Would you believe that only a month or so after the FCC's denials it quietly released its plan to move walkie-talkies from 27 MHz to 49 MHz? The proposal was almost word-for-word the same as the one that had been reported earlier and then denied so loudly. In short, the FCC had succeeded in hoodwinking the CBers of the nation, lying to the public, and then embarking on its irrational plan despite a barrage of complaints.

CBers, of course, are stuck with the FCC. And they are used to the shabby treatment doled out on the shores of the Potomac. Editors, however, are something else again. We don't particularly like to be told a pack of barefaced lies—especially by a tax-supported, governmental agency. The FCC forced many publications to go out on a limb with their readers. And we, for one, have a feeling that when the FCC makes its humble appearance at the editorial offices for story coverage on one of their self-aggrandising projects, it may not get the hearty welcome to which it has become accustomed.

Reason has it that there are plenty of walkie-talkie people—not to mention Hams and CBers—who are nauseous and noxious over the shoddy treatment that Big Brother Frank-Charlie-Charlie has ungraciously bestowed on them in the past and will likely continue to confer in the future. To put an end to this philistine farce let's send the FCC a protest—a short message that'll wake them up to our little folk in the outside world. We propose that you join with us in sending an empty beer can to the FCC.

It's easy to do. Just address a letter to the Federal Communications Commission, Washington, D. C. 20554 and paste it on a beer can. Slap a 10¢ stamp on the can and drop it into the nearest mailbox on September 1, 1967. That's right, on the first of September. When our friends at the FCC return from their Labor Day fun and frolic they can play a game worthy of their talents—Stack the Cans. Thus occupied, maybe they'll leave the Rules unchanged for an hour or two.

A word of caution—we have no gripe with the Post Office, so clean out those cans (don't go out of your way to attract flies). Also, tape the edges at the open ends—Mr. Postman doesn't want any cut fingers.

Now, get on the pipe and tell all your friends. If we make the FCC look like a scrap dump, maybe they'll realize that us little folk is what America is made of.

Complaint Department. It isn't very often we get complaints from our readers, but when we do each complaint is considered in light of other complaints as well as compliments received. Also, we don't make it a practice to publish reader letters as a rule, but rules are made to be broken. Here is one exception that we would like you to read and then weigh our comments to the writer.

Dear Editor:

I have just purchased my last copy of your magazine. This drastic step was the result of your publishing an article in your February-March 1967 issue entitled "It's War" by Alex Karlin. The single statement that incensed me to write this letter was Mr. Karlin's perverted idea that CW on the ham bands is "obsolete." Obviously, Mr. Karlin has no knowledge of amateur radio at all. Most hams use CW a majority of the time and are realizing the benefits of more QSOs and more DX. Although single sideband is almost as good as CW, there are times when SSB has no value at all and only CW can break through. I know many people, myself included, who use CW exclusively and who enjoy showing off their proficiency in code ability. Either Mr. Karlin has no ham license at all (in which case he should not be writing this article), or he is one of those kids who have been on phone so many years that he doesn't even remember the code.

As for this man's one-sided view of incentive licensing and the ARRL, may I say he is all wet. I, for one, am a member of the League who is in favor of incentive licensing. I feel that any ham who is worthy of the full privileges should prove that he is better than the average by passing a more
rigorous exam. There are many hams who agree with me in my support of the League and its policies. Mr. Karlin is speaking for a loudmouth minority in this article and I feel you should give equal space to print a retraction that shows some of the numerous things the League has done for the good of ham radio, including the incentive licensing proposal. I leave it up to some decent CB operator to refute his statements degrading CB radio to nothing more than some toys for kids to play with. I truly hope this letter has shed some light of truth on an article filled with lies.

Mitchell Tuckman, WB2VYJ

Well, Mitchell, you wrote a mouthful. However, we take exception to one point in your letter. That is your having purchased your last issue of Radio-TV Experimenter. Apparently, our magazine was of some value to you because you plunked down 75¢ to get your copy. And, though you did not say so, I assume you were a steady reader of our publication. Therefore, if one article drives you to break association with a magazine, you, Mitchell, are not our kind of reader!

Let's consider the case of two readers who disagreed with Editor-In-Chief Sienkiewicz in the past. One is Tom Knettel, K2AES & KBG-4303, currently the editor of S9 magazine. Many moons back when the skin on the teepee was still a young buck, Tom phoned to tell Editor Sienkiewicz that his SWL coverage in another magazine was "disgusting" and he should do something about it. Tom had one or two articles under his belt, so our Editor told (Continued on page 112)

... No. 19—at 185 pounds; five feet, ten inches; Dr. Bill Wilson, Anesthesi...
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Bug or Debug—That Is the Problem. Whether you are worried about someone “bugging” your privacy or you just want to play some “party” tricks on a group of friends, you’ll find The Electronic Invasion a good, interesting book to read. Author Robert M. Brown reveals that complex electronic devices are no longer limited to the cloak-and-dagger set. Technological advances, largely “fallout” from the aerospace and military electronics miniaturization developments, of eavesdropping equipment (and their manufacturers) are available to all. Do-it-at-home, check your employees or spy on your competitors—equipment is priced for every pocketbook.

Case histories are cited, telling the pitfalls that finally tripped the operators and put them under the thumb of the law. Even double-spys are entering this lucrative field—supplying customer and competitor by bugging their installed anti-bugging devices to furnish salable information.

Manufacturer listings help the do-it-yourselfer locate items that sell for as little as $3.50 that may be adapted to eavesdropping purposes.

Additional chapters cover telephone bugging, miniature microphones and amplifiers, wireless microphones, voice scramblers, bug detection and much more for the worried individual who wants to protect himself and his privacy. Want a copy? Then write to John F. Rider, Publisher, Inc., Dept. IL, 116 W. 14th St., New York, N. Y. 10011 if your bookstore is fresh out of copies.

Kids Have the Most Fun? Why is it folks think that electronics is a difficult subject to understand? Not only that, but they claim no one can have fun in electronics! Now ain’t that a kick in the head? Well, Leo G. Sands has authored a new title, Having Fun in Electronics, that dispels these false claims. Beginning with simple theory, Leo takes the beginner through the how’s of electronics. Using the breadboard technique of building circuits, the text provides the neophyte with a sound beginning for developing his own designs once he has mastered set but not a tape recorder. Well, here’s a book that should dispel that notion by pointing out how to approach circuit troubleshooting in a new way. Ten-Minute Test Techniques for Electronics Servicing compares almost every circuit you may encounter from an amplifier to a rectifier. It then describes how all can be easily tested using simple servicing procedures and basic test instruments. To explain these techniques learned the hard way during 25-years’ experience, author Elmer Carlson has outlined step-by-step techniques for localizing trouble in an improperly operating stage. The defective component is then pinpointed using a minimum amount of test instruments.

Sorry, you won’t find this troubleshooting handbook on your electronics dealer’s book rack. To get your copy write to the publisher, TAB Books, Drawer D, Thurmont, Maryland 21788.

Time and Temper Savers. Many experimenters and technicians have difficulty making the transition from vacuum tubes to transistors, or claim that they can troubleshoot a television
the fundamentals. Several basic circuits, including audio amplifiers and power supplies, are provided to help him reach a level of design ability. The emphasis is based on "breadboarding" of various electronic circuits so that the ability of the experimenter can be developed by a practical do-it-yourself approach. Several interesting bench-type projects are presented to put fun into learning about the basic principles. The book is intended for the electronics hobbyist or student. Pick up a copy today and have a ball. Having Fun in Electronics is available at book stores and electronics parts suppliers.

Can't get a copy? Write to Howard W. Sams & Co., Inc., 4300 West 62nd Street, Indianapolis, Indiana 46206.

Power Packing Manual. The RCA Silicon Power Circuits Manual is the newest member of the growing family of RCA technical manuals. Although this new manual is intended primarily for circuit and system designers working with solid-state power devices, portions of it will also be found useful by students, radio amateurs, and build-it-at-home hobbyists.

The SP-50 has been prepared to provide design information for a broad range of power circuits using RCA silicon transistors, rectifiers, thyristors, SCRs and triacs. It includes an introduction to semiconductor physics, as well as descriptions of construction, theory of operation, and important ratings and parameters for each type of device. Some of the manual's sections are: Semiconductor Materials, Junctions and Devices, Silicon Rectifiers, Thyristors, Silicon Power Transistors, Rectification, Power Regulation, AC Line-Voltage Controls and much more.

Your copy of RCA Silicon Power Circuits Manual, SP-50 may be obtained from RCA distributors, or by writing to Commercial Engineering, RCA Electronic Components and Devices, Harrison, N. J. 07029.

Over one billion dollars are spent in the U.S. on educational books every year. The knowledge gained from these books can never be measured. Are you getting your fair share?
Budget Discotheque
A 4-speed transistor portable phonograph, Model GD-16, that can be assembled in 1 to 2 hours has been brought out by Heath. There’s just one small circuit board to wire, a 4- by 6-in. speaker to mount, and two connectors to plug into the preassembled changer. Really compact, 14 x 7¾ x 20½ in., the GD-16 carries like a small suitcase. The changer folds into the case when carrying and flips down for easy play of

Pro Scope In A Kit
The Knight-kit KG-2100 oscilloscope has a DC to 5 MHz vertical amplifier response which permits the display of pulses of fast rise time. Among the special features of this Knight-kit oscilloscope are: lock-in characteristics for viewing stable waveform presentations even at upper frequency limits; built-in Rotron fan; high vertical sensitivity (5mv/cm) for servicing transistorized equipment; 85 Nanoseconds rise time; horizontal response from DC to 800 kHz; triggered sweep (200 Nsec/cm down to 1 Sec); regulated high and low-voltage power supplies. Power consumption is 200 watts; size is 14¼ x 10¼ x 18½ in., weighs 40 lbs. In kit form the KG-2100 oscilloscope is $249.95; $349.95, factory assembled. Full details from Allied Radio Corp., Dept. 20, 100 N. Western Ave., Chicago, Ill. 60680.

Tuning In All Cars...
Under their Realistic label, Radio Shack’s “Patrolman,” which was originally restricted to high band VHF broadcasts (147-175 MHz), is now available in low band VHF (30-50 MHz). Both models are only $24.95, feature the regular AM 535-1605 kHz broadcast band, continuous no-drift tuning, batteries, and AC adapter jack. A plus for Patrolman owners is the new VHF daily weather broadcasts at 162.55 MHz, in addition to police, fire, mobile phone, coast guard, industrial, civil defense and general emergency broadcasts. At Radio Shack stores, or write to Radio Shack, Dept. Cl, 730 Commonwealth Ave., Boston, Mass. 02215.
Guitar Speakers

From Altec Lansing come two musical instrument speakers, the 12-inch 417A (up to 75 watts music power) and the fifteen-inch 418A (up to 100 watts) which will easily handle the tremendous audio peaks peculiar to electronically amplified musical systems without destroy-

Altec Lansing 417A & 418A Musical Instrument Speakers

ing the speakers. Both speakers were field tested by professional and amateur guitarists during the developmental stages and approved by them before production. The 417A and 418A have 3-in. voice coils of edgewound aluminum ribbon and a rugged diaphragm with a lightweight aluminum dome. Heavy-cast aluminum frames are used and the massive magnet structure houses an Alnico V magnet. Prices: $68.00 for the 12-in. 417A; $80.00 for the 15-in. 418A. Want to know more? Write to Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif. 92803.

VOX Mike

Lafayette's Stock No. 99-4604 voice-actuated microphone is designed for use with a battery-operated transistorized tape recorder equipped with a jack for remote microphone control. Electronically-controlled relay in mike automatically starts the recorder when sound is picked up; automatically stops the recorder when sound stops. The Voice-Control / Off / Remote switch goes like this: in Voice-Control position 6-transistor circuitry operates amplifier and electronic relay in mike; in Remote position microphone oper-

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NAME
STREET
CITY STATE
ates as a dynamic mike with remote on-off switching. There is an additional control for adjusting sensitivity of microphone above ambient noise levels. Recommended for use with Lafayette RK-30, RK-55 and RK-60 tape recorders. Requires 9 volt battery. At electronic parts stores or write to Lafayette Radio Electronics Corp., 111 Jericho Turnpike, Syosset, N. Y. 11791.

Two-Way Police Radio Kit

E. F. Johnson has come up with two portable, two-way radio kits matched to the new FCC police regulation permitting low-power surveillance radio communication without prior approval. Only power output is limited under the new regulation and must not exceed two watts.

Offering 50 Police Radio frequencies between 40 and 50 megacycles, the Johnson 1½-watt Messenger 106 hand-held transceiver features rechargeable batteries with built-in chargers, leather hand-strap cases and telescoping antennas. They come packed as two-unit ($376.55) or three-unit ($604.25) kits in a portable carrying case. The 3-unit kit contains two 22-in. clamp-on auxiliary antennas for use on police cars. Details can be had from the manufacturer: E. F. Johnson Co., Waseca, Minn. 56093.

Control That Impedance!

The S-11 Controlled Impedance speaker system is specifically designed for use with solid-state components, which perform best over a narrow range of load impedance. The S-11 system has an impedance range carefully limited by integrated engineering development of both speakers and crossover. Scott's new system measures 24 x 14 x 11¾ in., has a walnut-finish air-suspension enclosure, and will retail at $149.95. For specifications write to H. H. Scott, Inc., 111 Powder Mill Rd., Maynard, Mass. 01754.

Hol For The Open Road With Bright TV!

Especially designed for trailers, cottages and mobile homes, the new JFD Explorer Log Periodic TV Antenna Kit pulls in clean color TV on all VHF and UHF channels; also FM. Can be assembled in a matter of minutes and stored most anywhere. The Explorer is made of 100% reinforced aluminum with a gold anodized finish. Kit includes antenna, mast, mount, twin-lead, standoff and hardware, and a VHF/VHF/FM signal splitter. The Explorer (Model LPV-TL5) is listed at $30.75 and you can write to JFD Electronics Co., 15th Ave. at 62nd St., Brooklyn, N. Y. 11219 for details.

Receiver-Turntable

For those who already own a pair of speakers, Harman-Kardon offers Model S-C6, an AM/FM/FM Stereo receiver-turntable; it's similar to their SC-440 compact but is sold without speakers. The record changer is the new BSR equipped with an Empire 808 magnetic pickup. There is a special circuit that switches the receiver to stereo and back to regular FM automatically. Other features include a stereo headphone receptacle on the front panel, tuning meter for best AM and FM reception, and the facility to handle a tape recorder. A Lucite dust cover is optional. The S-C6 lists at $329.50; further info from Harman-Kardon, Inc., 401 Walnut St., Philadelphia, Pa. 19105.
Monogram Your Equipment with Electricity
A new hand-held electric engraver has been introduced by the Dremel Mfg. Co., Racine, Wis. The tool uses a carbide or optional diamond engraving point and etches almost any material from soft plastic to glass, ceramics and high alloy steel. It's powered by a Dremel recipro-
crating motor that delivers 7,200 strokes per minute. By adjusting the dial, the operator regulates depth of stroke from delicate lines to deep marks. With nylon housing, hook for hanging, and complete instructions, the "electric pencil" is available at hardware suppliers for $14.95.

Gee, Dad, It's a Thomas "Paramount"!
This beautiful kit version of the Thomas horseshoes console "Paramount" solid-state theatre organ represents a saving of about $500 over the factory-assembled model. Heath calls it the TO-67. It has 15 manual voices and 4 pedal voices selected by flipping multi-colored switches.

Dremel Electric Engraver

Heathkit "Paramount" Organ

World Famed BREVETTATA
TEAR GAS PISTOL

Appearance of this fine tear gas weapon is similar to real gun. It is ideal for people who work in lonely, dark locations and require protection. Men give this gun to wives and daughters for night security. Many industrial applications.

In operation, gun steps aggressor without permanently injur-
ing him. Neither permit nor license is needed, but it is not sold to minors. It fires six car-
tridges without reloading. Each gun comes with six tear gas shells and six blanks for practice and is shipped prepaid. Gun unit prices include, 62 shells and all shipping costs.

1 Gun-unit at

2 Gun-units at

3 Gun-units at

4 Gun-units at

Extra boxes of ten tear gas shells at $1.50 per box (prepaid with gun orders). Extra boxes of blanks at $1.25 per box.

UNITED SAFETY SUPPLY CO.
310 West 9th Street
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Navy MARINE BAND WALKIE-TALKIE

TRANSMITTER & RECEIVER-This equipment is crystal controlled and can be operated on any one channel within frequency range 2.8 to 45 MC. Voice (A3) communication can only be heard if output of Trans. is 0.2 watts. Satisfactory communication between units over average distance should be maintained equal to one (1) mile. With Tube: 1/1555, 1/1554, 2/1744, 3/5844. Voltsac required 67.5 VDC 8 MA; 135 VDC 4 MA. Receiver: 67.5 VDC 1.3 MA; 125 VDC 10 MA; 1.5 VDC 225 MA & 6 VDC 50 MA. 7270. 1500 cps. Unit comes in a waterproof plastic case w/strap for belt or power supply. Telescoping antenna 8 ft. Complete w/straps, antennae, 2 crystals FT-243 and one choice of Freq. Newborns. Complete w/strap, microphone, WLI: 6 ins. $9.95.

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Everybody's communications system—that's CB. And whether you're an old salt or a rank beginner the 1967 CB BUYERS' GUIDE is chock full of nifty needed know-how, know-why, and know-when on the biggest radio service in the world. Everything, absolutely everything, on CB from base station to boat station is included. You'll find complete, easy-to-understand lab checks on 75 CB rigs: the lowdown on what CB can do for you; the full scoop on CB organizations. Get with it—zero in on where the action is—with the 1967 Edition of CB BUYERS' GUIDE—at your local newsstand now!
SPECTACULAR CLOSE-OUT SALE!
66⅔% OFF ORIGINAL LIST!
THOUSANDS SOLD AT $149.95
NOW SAVE $100. ON WORLD'S FINEST MINIATURE TAPE RECORDER

NOW ONLY $49.95
(Plus $2.50 shipping and handling)

Complete with remote control dynamic microphone/speaker and private earphone plus FREE reel of long-playing tape!

RECORDS MEETINGS... STUDIES...
TELEPHONE CONVERSATIONS...
DICTATION... INTERVIEWS...
LETTERS... PARTIES...
EVEN SECRETLY!

COMPACT — YET POWERFUL ENOUGH FOR UNDERCOVER WORK!

This is the world-famous pocket recorder advertised across the country for $149.95 — now at “give away” savings! Imagine, only 4-ounce light, Phono-Trix slips easily into pocket or purse, goes with you anywhere for on-the-spot recording of music, speech, parties — will even pick up a whisper across the room! — all with amazing fidelity!

RECORDS UP TO AN HOUR AND 10 MINUTES PER REEL!

Located as the world’s finest miniature tape recorder, Phono-Trix is precision-made by W German craftsmen. Automatic push-button operation makes it easy to use with standard ½-inch tape. You can get anywhere, will record up to an hour and 10 minutes on a single reel! Now in service throughout the world by detectives, police departments, private investigators, news reporters, writers, and thousands of people for everyday remembrances, business needs, and as a remarkably efficient and no training!

RECORDS... PLAYS BACK... ERASES... AMPLIFIES!

Much more than just an ordinary tape recorder, Phono-Trix with accessory desk-top amplifier/speaker becomes a portable, Public Address System, with enough volume to fill a large hall. Or use it to amplify telephone conversations while you record at the same time with both hands free! Runs for 24 hours on ordinary penlite and "D" batteries (3 each) or with AC adapter can be plugged into regular household current for incredible economy!

ONLY A LIMITED QUANTITY AT THIS CLOSE-OUT PRICE — SO ORDER YOURS TODAY!

Well-known Department, Electronic, and Camera stores have already sold over 30,000 Phono-Trix recorders through ads in the New York Times, Wall Street Journal, Playboy, Esquire, and other leading publications. But now, due to manufacturer's intensification, the limited supply still available must be closed out! And at savings below original wholesale! Once this limited supply is gone, this offer can never be repeated again. So fill in and mail the order form with your check or money order now!

ACTION ELECTRONICS, INC., Dept. RTV-667
4 East 46th St., New York, N. Y.

NO OTHER POCKET RECORDER OFFERS ALL THESE TOP QUALITY FEATURES:

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GET THESE ACCESSORIES AT BARGAIN PRICES, TOO!

#1 High-powered desk-top amplifier/speaker
was $20 — NOW ONLY $14.95

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was $9 — NOW ONLY $6.95

#4 AC house current adapter
was $20 — NOW ONLY $14.95

#5 Extra tapes with reel
were $2.50 each —
NOW ONLY $1.95 FOR 3

ACTION ELECTRONICS, INC., Dept. RTV-667
4 East 46th Street, New York, N. Y.

RUSH ME — Phono-Trix Recorders at only $49.95 (plus $2 postage-and-handling — $51.50 total) complete with remote control microphone/speaker, "private listening" earphone and FREE reel of tape. Also send me the following accessories (please order by number):

- #1 #2 #3 #4 #5

I have enclosed check/money order for $ total.
Charge to my Diner's Club account.

NAME 
COMPANY (if any) 
STREET 
CITY 
STATE 
ZIP CODE 

Add 5% sales tax for N.Y.C. residents, other taxes where applicable.
stop tablets. The TO-67 has Thomas Color-Glo key lights so you can play complete songs with melody, harmony and bass even if you’ve never played an organ before. There are two separate speaker systems; a built-in 2-speed rotating Leslie and a main speaker system with two 12-in. speakers, creating a stereo effect. Other features: two 44-note keyboards; 28 notes of electronic chimes; selective repeat percussion to produce xylophone, mandolin, marimba sounds; 13-note bass pedals; selective attack percussion; reverb; stereo headset outlet; walnut-finished hardwood cabinet and bench. Heath says it can be assembled in 80 to 100 hours; and for $5 providethis $331/2 record, TOA-67-3, which demonstrates the full professional capabilities of the TO-67. Price is $995.00, write for details to Heath Co., Benton Harbor, Mich. 49023.

Definitely Not a Black Box

For young members of the Affluent Society who are suspicious of the “black box” retailing of a popularly advertised receiver or amplifier with speaker systems of unidentified brand or performance, Electro-Voice has come up with what they call a starter set, including the E-V 1177A (FM) or E-V 1178 (AM/FM) receiver and a pair of E-V Eleven speaker systems. The walnut-veneered, vinyl-coated speaker enclosures measure 8 1/4 x 15 1/4 x 6 1/2 in., and have a high-compliance, dual-cone 8-in. driver retailing at $33 each. The solid-state receiver features 65 watts IHF power into 4 ohms; platinum and brushed chrome front panel; colored input indicator lights; wide range, low distortion sound output. The FM model is advertised as $280.00, with AM $35.00 additional. At high-fidelity dealers, or contact Electro-Voice, Inc., Buchanan, Mich. 49107.

Electronics Goes to Bed. Now, without intricate weaving, a blanket is being marketed that has its nylon fibers bonded electrostatically. Want more facts? Write to West Point Pepperell, 111 W. 40th St., New York, N.Y. 10036.

How to Write a Classified Ad That Pulls

Deluxe 48 page booklet—only $1 per copy. And, with the booklet, you get a $2 credit towards your payment of your classified ad in SCIENCE & MECHANICS. Send $1 now to SCIENCE & MECHANICS, 505 Park Avenue, New York, New York 10022.
Tube Bad. Yes, manufacturers of tube type CB sets may be saying "too bad" when they get a glint of the new Courier 23-Plus from e.c.i. (Electronics Communications Inc.), 56 Hamilton Ave., White Plains, N. Y. Why "too bad?" Well, the gang up at e.c.i. claims that the 23-Plus is designed to pull in all channels louder and clearer than any other tube rig in its price class ($189).

Truly dedicated to the ultimate in reception, the rig has a new cascode front end and a Nuvisor mixer. In addition, it's got dual conversion circuitry and every known feature to squash, smash, and smother static and other teeth gnashing noises.

Other goodies in this set include a transistorized power supply, illuminated S-meter (which doubles as an RF output meter), an illuminated channel selector, a built-in public address system, a jack for an extra speaker (stereo CB, anyone?), single knob tuning, a modulation indicator. It comes stuffed to the gills with crystals for operation on all 23 channels, mounting brackets, power cords, microphone, and that well known Courier reputation for big sound on the band.

Ship Shape. So many folks have been putting CB rigs on their boats that Regency Electronics whomped up a marine type CB rig to meet the needs of this rapidly growing specialty market.

The new Regency Ranger rig is an 11-channel, all-transistor job which comes out in full sail with a heavy welded steel chassis which is spray coated for protection from moisture and salt. The speaker is splash proof, and the PC board is epoxy glass.

From an operational standpoint, the Ranger runs a Collins mechanical filter for jazzy selectivity. The power supply is all set for the 12 volts which most boats offer. You can also operate from 117 volts AC with an optional power supply. The set doubles as a marine hailer by means of an external speaker.

Sail into the sunset with the Ranger aboard for $175. See your nearest chandler or write to Regency Electronics, 7900 Pendleton Pike, Indianapolis, Ind. 46226.

Speak Softly and Carry a +2. The Turner +2 isn't a sports car, it's a new CB microphone with a built-in speech amplifier. Specifically designed for two-way radio work, the +2 uses a 2 stage amplifier to boost your voice. You can vary the amount of amplification or even kill it altogether if it isn't needed for a local contact. When you've got one of those long-hand contacts, just crank up the gain and take control of the channel with something that will sound like the voice of doom when you hit the modulation. The +2 connects to your rig's mike socket and will work with any equipment.
Turner Plus 2 Mike

See it at your local CB emporium or find out about it from The Turner Co., 909 17th St., Cedar Rapids, Iowa 52402.

Pushbutton Baby. If you've a mind to go portable-a-la-pushbutton you may want to look into the new Claricon 2 watt transceiver. The unit weighs in at a scant 2 lbs. and can be installed in your car or boat, or even carried slung over your shoulder from a strap. It features 2 channel operation, and all the set's functions are accomplished by means of pushbuttons. Operating from 8 "AA" penlite batteries, you can check the condition of the batteries by looking at the little meter on the front panel. The mike doubles as the loudspeaker to save space. For further information on this set, contact Claricon.

Don't Distress, Compress. For those of you who want a little extra soup in your set's modulation output, may we suggest the Vibratrol Transistorized Compressor Amplifier. With a fancy monicker like that, the thing would have to be good—and it is! Vibratrol, 7845 Merrimac Ave., Morton Grove, Ill. 60053, did it with their little soldering guns! The unit features a unique compression circuit that boosts low levels

Claricon 2-Watt CB Rig

August-September, 1967
of modulation while maintaining high input levels at a constant output.

The unit connects in minutes to any transmitter and can be used with any crystal, ceramic, or dynamic microphone. The controls are On/Off, compression and level. The unit operates from a self contained battery so the only connections are plugging your mike into the socket on the compressor, and then plugging the compressor into the socket on the CB rig. By the way, this gadget works wonders for audio amplifiers, PA systems, and tape recorders. Price is $23.95.

Big Brown Bargain. The Multi-Elmac Co., Oak Park, Mich. 48237, whipped up a solid state CB unit which is the answer to the prayers of many folks who don't want to (or aren't able to) invest a large chunk of cash into CB gear. Their little Citi-Fone II rig sells in the $50 price range. The reason they are able to market a good unit at such a low price is that they have eliminated much of the frills and window dressing found in the glamour sets. The rig contains a plain and simple 5 watt transmitter offering 2 channels. It is coupled with a receive converter which feeds the CB signal into your car's regular AM broadcast radio. It's a snap to connect and doesn't require any cutting or soldering; you don't even have to remove the AM radio from the car. If you get a CB/AM coupler you can even use the car's antenna for CBing.

Bigmouth. For those of you who are always being told that they can hear your carrier but your modulation seems a bit low, here's the answer in spades. More than a simple mike booster, this is a highly sophisticated, distortion-free speech processor which will give your rig more than 10 db of greater "talk power" (and that's a-plenty).

In simple terms, it's a solid-state speech clipper which has been specially designed to eliminate a very undesirable by-product of many conventional clippers; that of making a very loud but highly distorted growl out of your charming voice.

The unit, known as the CSP-11, installs quickly and without grief right in the microphone lead (sure you can do it with your 10 thumbs and 20 year old soldering iron) and draws its power from its own self-contained batteries. Price is $110.

For more details and some high falootin' graphs on just what this thing can do for you, write to Comdel Inc., 218 Bay Road, Hamilton, Mass. 01982.

Rectify That Puny Signal. If you've gotten that queasy feeling that maybe 'ol Nell, your trusty CB rig, may be past its glory (or on the way to glory), here's a possible solution.

First, don't sell old Nell if you feel that her signal is somewhat less than what might be desired. Bring her back to life with one of the rectifier tube replacements being offered by Specialty Engineering and Sales Company, 600 San Mateo Blvd. S.E., Albuquerque, N. M. 87108.

The rectifier tube replacement is actually better than the original tube in your CB rig! Plugged it into the socket of the original tube (no circuit changes are required), it doesn't generate power-losing heat like tubes, avoids the current drain of tube filaments, and it has a higher voltage output than the tube it replaces.

If your set has a 6X4 or 12X4 rectifier you will be able to use the model X4. For sets having 6BW4 or 12BW4 you can have a go at the model BW4. The little devils sell for $6.95.
USSR SWBC

When did the Communist shortwave station R. Vilnus in the U.S.S.R. start broadcasting their nonsense to the free world?

—E. S., Winnipeg, Man.

Don't know! The Soviet Embassy in Ottawa or Washington, D. C. should be able to give you that information. But remember, write in a nice tone—those folks still believe in Lenin, you know.

Respect for the Aged

I have recently acquired an old Howard radio made in Chicago. For tubes it has three type 26 and a T227 plus rectifier. The last patent is April 1, 1924. The serial number must be 10271-No. 7 and it's called a Neutrodyne. It also has a battery eliminator. I wonder if you could tell me its age and approximate value. It works and is in excellent condition.

—F. J., Sterling, Ill.

Vintage 1928. Value—whatever the junk man will pay for iron and copper. Possibly some radio-TV store would like it for a publicity gag. Don't dump it tomorrow though—we'll probably have someone write in because they

— then get your electronics cool with this introductory offer to the 2 leading electronics magazines!

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ASK ME ANOTHER

always wanted one exactly like their Aunt Tillie's.

Good Guy
Recently in your column, G. J. of Charlotte, North Carolina, asked for information about an old Gulbransen radio. I have considerable information on various models. If G. J. will contact me, I shall be pleased to help him. I have nothing to sell.

—H. A. C., Samoset, Fla.

G. J., if you see this, write to H. A. C. at P.O. Box 7321 in Samoset. We don't know what H. A. C.'s game is, but we're sure part of it is being a nice fellow! Our thanks!

Dick Tracy Detector
Where can I get a converter for listening to 450-MHz band police and other land-mobile stations?

—M. K., Bronx, New York

Ameco has just introduced its Model CUT converter for the 450-MHz band which can be used with an AM BCB receiver. Your local Ham or electronics parts store should have it in stock.

What's the Delay
Where can I get Amperite relays and what do they cost?

—L. L. M., Chicago, Ill.

Allied Radio in Chicago lists them in their 1967 catalog on page 299. Eyeball it and your problems are licked. In fact, everybody, look up Amperite relays and see what they have to offer. Their delay relays are handy gadgets for many a project.

Let Your Fingers Do the Walking
Where can I get or buy a band switch bracket with coil assembly and volume control with on/off switch for a Zenith Super Deluxe Trans-Oceanic portable radio model B600?

—O. V., Chicago, Ill.

Look in the telephone directory yellow pages section under "Radios, Wholesale" and you'll find the name of the Zenith distributor whose parts department should have the parts available. The same technique works for RCA, Motorola, Admiral, Philco, Westinghouse, etc. Gee whiz, O. V., where are you when the telephone company commercials interrupt your favorite after-midnight TV movie?

K & E, Where Are You?
My husband is a radio engineer and is having trouble finding audio-frequency graph paper. None of the business and office supply stores have it. The radio supply companies here do not seem to know where to get it. Possibly you can give us the name and address of some companies that make radio paper supplies. The name on the sheet he has is: K & E Audio Frequency—359-46G Keuffel and Esser Co. Made in U.S.A. Do you by any chance know the address?


The address of one of K & E's retail stores is 60 East 42nd Street, New York, N. Y. 10017. Have you tried art supply and drafting material stores?

11-Meter Dilemma
I possess a Hammarlund HQ-170 and would like to receive the 11-meter band. I would have no doubt have to sacrifice the 28-30 MHz band. How should I modify the receiver?

N. W. F., Fort Smith, Ark.

For specific information, write to Irving Strauber, Hammarlund Mfg. Co., Mars Hill, N. C. 28754.

20/20—What a Deal!
Would you please tell me which is the best correspondence course you know of. I'm a school dropout of the 10th grade. I work on a tow boat and have six months out of the year free, or I should say 20 days on and 20 off. I work in a TV shop while home and know very little about electronics. I have a chance to make something of myself in the shop. I would like your help.

—J. T., Calhoun, Ky.

There are several excellent courses. Schools seeing this will probably send you information (inquirer's address is Box 84, Calhoun, Kentucky 42327). Check through the pages of this magazine (and others catering to the electronics industry) for long-standing advertisers.

P.S. Twenty days on and twenty off sounds like a good deal. The Editor had a job like that only he had 20 days on and one day off. This came to an end when he received his Army discharge.

"... and here's a nice feature!"
• a tonic for tired SWLs
• a hotline to NASA and the mysteries of the space age
• your passport to the unbelievable chaos of the crowded skyways
... that's our

**STRATOSPHERIC SUPER SLEUTH**

a self-powered VHF eavesdropper tuning a world you've never heard!

By Charles Green, W6FFQ

If SWLing doesn't pack the thrills per Hertz (cycle?) it once did, chances are you're due for a change of scene. Sure, you'll miss Radio Moscow... and that OA2 on 20 meters... and WWV... and the local CB folderol—or will you? Let's face it—wouldn't you rather give a listen to jet pilots and control towers, NASA satellites and other space gear, aircraft and Civil Air Patrol and maybe even 2-meter hams? All you have to do is step up to where the action is—in the VHF world above 100 MHz. *(Continued overleaf)*
Drawings show method of mounting tuning capacitor (at left) as well as size and placement of all chassis holes.

**SUPER SLEUTH PARTS LIST**

- **B1**—4 1 1/2-volt "D" cells
- **C1**—.01 mf, 25 V ceramic disc capacitor
- **C2**—5 mmf, 25 V ceramic disc capacitor
- **C3**—.001 mf, 25 V ceramic disc capacitor
- **C4**—6.5 to 13 mmf tuning capacitor (Lafayette 32CO917)
- **C5**—470 mmf, 25 V ceramic disc capacitor
- **C6**, **C8**—.05 mf, 100 V plastic film capacitor
- **C7**—100 mf, 15 WVDC electrolytic capacitor
- **C9**—5 mf, 15 WVDC electrolytic capacitor
- **J1**—Phono jack with RF insulation (Switchcraft 2505F or equiv.)
- **L1**—1.72 uh RF choke (J.W. Miller RFC-144; Lafayette 34C8973)
- **L2**—LO band coil (106-128 MHz, 2 turns No. 20 wire, 1/8-in. diam. x 1/4-in. long, with 1/2-in. leads—see text)
- **L3**—HI band coil (126-150 MHz, 1 turn No. 20 wire, 1/8-in. diam., with 1/2-in. leads—see text)
- **Q1**—2N1788 transistor (Sprague)
- **R1**, **R2**, **R7**, **R9**—1000-ohm, 1/2-watt resistor
- **R3**—2700-ohm, 1/2-watt resistor
- **R4**—25,000 ohm, linear-taper potentiometer
- **R5**—4700 ohm, 1/2-watt resistor
- **R6**—2200 ohm, 1/2-watt resistor
- **R8**—25,000 ohm, audio-taper potentiometer
- **S1**—SPDT slide switch
- **S2**—SPST switch (on R8)
- **SPKR**—2 1/2-in., 8-ohm speaker
- **Misc**.—4-transistor audio amplifier (Radio Shack 277-1240), two dual D-size battery holders, perf board and push-in terminals, cowling-type minibox (8UD SC-2132 or equiv.), 52-in. telescoping whip antenna (Radio Shack 21-1156 or equiv.), sheet aluminum for antenna bracket, spacers, etc.

Estimated cost: $25.00
Construction time: 5 hours
The thing that makes that big step possible is our Stratospheric Super Sleuth, one of the neatest little VHF receivers ever devised. And don't shy away because you think its construction will be a grind, because it isn't. A single perf-board mounted right on the tuning capacitor holds the handful of components that make VHF reception possible; the balance of the rig consists of a ready-made audio amplifier (transistorized, of course), plus a speaker and four flashlight batteries. The unit even carries its own telescoping whip antenna.

The Circuit. A glance at the schematic reveals that the receiver actually tunes two bands—106 to 128 MHz and 126 to 150 MHz—depending on the setting of band-switch S1. A high-frequency transistor (Q1) is used in a superregen detector circuit, and the transistorized audio amplifier drives a 2 1/2-in. speaker. A built-in battery makes this compact unit perfect for portable operation.

Tracing the circuit, signals received at J1 are coupled through the gimmick capacitor to the emitter of Q1; capacitor C2 provides RF feedback for the superregenerative detector circuit, which is tuned by C4 and L2 or L3 (switched by S1). The superregenerative operation is controlled by R4 and the detected signals fed through C9-R7 to R8. This potentiometer, in turn, controls the audio input to the amplifier unit and the 2 1/2-in. speaker. Four D-cells are connected in series to supply 6 volts to the receiver and amplifier circuits.

Construction. Our model was built in a cowl-type, 3- x 8- x 5-in. aluminum mini-box. The major assemblies are mounted on the front and rear panels, with the amplifier on the box bottom. Since C4's shafts are concentric for vernier action, they cannot be cut. Therefore, we used 1/2-in. spacers to mount C4 behind the front panel and keep the tuning knob a convenient distance from the panel surface. Countersink the front-panel mounting screw holes for C4, and use flat head screws to provide a flat surface for the dial.

After you cut the speaker hole, install a section of perforated aluminum to protect the speaker cone. Use serrated washers between controls R4 and R8 and the inside of the front panel to prevent movement. We used rubber faucet washers as spacers to mount the amplifier. These washers will conform to the module's irregular surface and won't short the conductors as metal spacers might.

The detector circuit is built on a 1 1/4- x 2 1/2-in. section of perf board, which is then mounted on the bottom of C4 with spacing...
washers. As with all high-frequency circuits, the wiring here should be short and direct as possible. Dimensions for coils L2 and L3 are only approximate, since their frequency coverage will depend on the exact wiring layout of your receiver. To make the coils, wind the specified number of turns of No. 20 bus wire around a ¼-in. drill for L2 and a ⅞-in. drill for L3. The gimmick capacitor is made of 4 turns of No. 22 hook-up wire, with the ends separated to prevent shorting.

Bend a suitable piece of scrap aluminum into a U bracket to support the whip antenna. We mounted the antenna in rubber grommets fitted into holes cut in the bracket ends. Jack J1 should be a phono jack with good quality plastic insulation to minimize RF losses.

To add bypass capacitor C8, find the junction of the 100k and 10k resistors (at the collector of the first transistor stage) in the amplifier (check the circuit diagram supplied with the amplifier). The addition of C8 is necessary to prevent the detector quench frequency from overloading the amplifier.

The dial on our model is a 1⅛- x 2 ⅛-in. section of white cardboard, with an inked ⅛-in. border. We made the pointer with a length of bus wire inserted in a fiber washer reamed to fit snugly over the outside concentric shaft of C4.

**Calibration and Operation.** Install the batteries in the receiver and set S1 to the LO band position, pull the whip antenna out to full length, and turn the volume control (R8) full clockwise. Adjust the tuning control to full capacity position (full CCW) and rotate the regen control (R4) until you hear the characteristic superregen hiss in the speaker.

Set a signal generator to 106 MHz (modulated output) and loosely couple it to the receiver antenna by connecting the generator output to an 18-in. lead placed along the rear of the receiver. Squeeze or lengthen L2 until you hear the generator signal in the speaker. Adjust the volume control for a comfortable listening level and calibrate the LO band dial to 128 MHz with the generator. You may have to readjust the regen control as the tuning control is advanced up the dial.

After the LO band is calibrated, set the signal generator frequency to 126 MHz and squeeze or lengthen L3 until you hear the generator signal in the speaker. The regen control may have to be readjusted for best reception. Calibrate the HI band dial to 150 MHz with the generator.

Next, disconnect the generator and tune the receiver for signals. For strong stations, the whip antenna will be OK, but for weak-signal reception an external ground-plane antenna may be required. A TV antenna will also suffice for horizontally polarized signals. Shortening the whip antenna to about 18-in. will usually improve reception at the higher frequencies. Practice in adjusting the regen control as you tune the receiver will make reception of weaker signals easier.
Dry Run On The SST

Super solutions to super problems of the supersonic jet

Sooner than you imagine, super jets flying at super speeds will be winging world travelers through space to all parts of the globe. Still on the drawing boards, the Supersonic Transport (SST) poses many a problem, primarily because man and his physiology never will quite escape the horse-

Though pilot has both feet firmly on the ground, tests he undergoes simulate mile-high conditions. Mask (top) checks metabolism; centrifugal device (right) approximates gravitational pull at high altitudes. Above, physician talks to pilot in chamber as he "flies" from 8200 to 82,000-ft. levels.
Dry Run on the SST

In fact, projecting and solving those flight problems that concern human physiology have required a virtual dry run on the SST.

Much of this research is being carried on in France, which, with Britain, is developing the sleek Concorde in an effort to beat both the U.S. and in the U.S.S.R. in this particular space race. The catch is that the SST is like no other craft ever devised and designers have precious little to lean on.

Fifteen miles above the earth, for example, the brightness of the sky is about 1/5 that on the ground at high noon. The blue dwindles in color, replaced with a glare that

Inside chamber (above), pilot plugs leads into special suit, linking devices that monitor body functions with indicators on external panel. Pilot will be subjected to mock SST “trip,” and while enroute will describe sensations to attending physicians.

At right, subject adjusts breathing apparatus prior to undergoing tests in special pressure chamber.
isn't light-providing but that could hurt the eyes even to the point of permanent damage. Research concluded that pilots would have to wear special glasses at all times, but designers succeeded in going one better than physicians in the course of solving this one.

Because the crew will have little need to look out cockpit windows during a flight, the Concorde will be equipped with a nose that rises, locking tight up into the craft during flight. But below an approximate 3-mi level, the cockpit will nose down sufficiently to let windows in the top and sides slide into place and provide a view of the surroundings. —Ron Mitchell

At left, subject prepares to test suit designed to maintain internal pressure equivalent to that at roughly 8200 ft even at altitudes ten times higher.

Below, electroencephalographic device charts subject's reactions to a variety of visual phenomena.

Above, researchers utilize special enclosure to gauge effects of differing types of air on tomorrow's SST passengers. With outside air at roughly —140 F, designers hope to capitalize on jet engines' 1200-F heat to bring cabin to required 68 F.

At left, contents of subject's lungs are analyzed to determine consequences of atmospheric changes.
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August-September, 1967
Trained mechanic lets electronic devices do all the dirty work.

Car drives onto inspection rack in electronic diagnostic center.

(said the computer)

"sense shimmy -service same"
Measuring radiator cap pressure. Wrong reading could mean engine overheating.

Big board loaded with dials reads out car's health, not to mention how far vehicle will travel after the brakes have been applied.

Front wheel spins on roller device during tests which measure braking power and degree of tire scruff. No guesswork here.

Is your flivver falling apart? Or is your Mustang just whinnying like an old nag? Whatever the case, don't take it to a moonlighting grease-monkey working in his backyard after 5 p.m. Take advantage of the latest in automotive repair—the electronic diagnostic center (one wag calls it "MediCar")!

You won't see an oily rag in sight. Clean as a clinic, the center looks more like the data-processing room at Strategic Air Command. Presiding over the computer-like works is the mechanic, only now he's traded wrench and pliers for test cables and meters. He'll truss your buggy to a maze of instruments and study the read-out on dozens of electronic measuring devices.

The chart showing test results resembles the one used for an Army induction physical. But heart, lungs, and circulation are of course replaced by horsepower, ignition, and cooling system. Some 75 different diagnostic tests are administered to the vehicle, all in the course of about 25 minutes and with nary a lost moment for head-scratching or kicking the tires.

The center shown in our photos was opened recently by Socony Mobil Company just outside New York City. If the idea catches on, more such units are in the offing. A homey touch: you can watch the car as it travels the gauntlet and listen to a running commentary of the procedure.

At the end you'll get a complete analysis of the car's ailments. It could be something costly like petered-out pistons. Or the electronic doctor could prescribe: "Just a dose of Dry-Gas and you'll be A-OK in a week."
RAZ-MA-TAZ RELAY

□ So you’re fiddling around in the shop one day and you need a relay—just a simple, regular old relay. You know—clunk, on—clunk, off. Well, if you’ve got an old code key sitting around not earning its keep, you’ve got the answer just a’lookin’ for a problem.

Practically any lever-type transmitting key can be put to good use as a handy-dandy experimenters’ relay. You simply mount an iron core electromagnet under the key lever as shown in the photo. Here’s how.

First, make the wood block to the size shown. Cut the part that holds the coil and clips down to about 1 in. thick.

To speedily construct the magnet, slip two 3/4 in. diameter fiber washers on to a 1/4 in. x 1 1/2 in. long iron machine bolt. Drill a 3/16 in. hole in the wood block directly under the head of the key and twist the bolt into the hole. Screw it down until you’ve got about 1/4 in. between the head of the bolt and the head of the key. Now wrap the space between the fiber washers with #24 cotton-covered enameled magnet wire. The two ends go to the Fahnestock clips as shown.

Fasten the key in the right position on the block. Then adjust the key screw adjustments for about 1/8 in. key travel, making sure that the keying contacts ‘make’ when the key is pulled in by the magnet. Adjust the key-tension spring for just enough zing to return the key.

This coil should be good for about six volts—but for other voltages you’ll have to add or subtract coil wire to suit.

If the key lever happens to be made of brass, just screw an iron bolt into the threaded head of the key for the magnet to grab hold of.

Since most keys have both a ‘make’ and ‘break’ contact, what you end up with is a fully adjustable, single-pole double-throw raz-ma-taz relay.

TAMPER-PROOFER

□ Stop telling mother-in-law, the kids, nosy friends, hostile neighbors, etc., to leave the gear in your workshop alone, to not send distress signals on your California Kilowatt ham gear, or that they may hurt themselves on that 100 watt laser you’ve got set up to make holograms. All you’ve got to do is Tamper-Proofer the ON/OFF switch, and that’s simple. Take a gander at the photo and you’ve got the essentials.

Then, take and bend a 5/8 in. x 1/2 in. angle from a heavy piece of strap iron 1/2 in. wide. Drill yourself a hole in the 1/2 in. side just big enough to pass the staple of your padlock. Now drill two small holes in the other side of the angle and through the switch plate. Attach the angle to the plate with a couple of nuts and bolts, and then mangle the protruding threads so they can’t unscrew the nuts when you’re not looking.

38 Radio-TV Experimenter
So unlimber the rig already and...

DX the cream of the 49ers

By C.M. Stanbury II

The 49-meter band is used for regional coverage throughout the world, except in the U.S. Hence, there's always something on this band for the SWL to get his teeth into. No matter where the sunspot count stands, international SWBC stations such as R. Sweden, V. Germany, V. America, and the BBC (the latter pair with a worldwide network of relay stations) will almost always use frequencies between 5950 and 6200 kHz. And since the 1930s, when shortwave became a full-fledged communications media, stations around the world have used 49 meters for regional coverage. Thus, except for the midday period, something is always happening here, making the band a first-class hunting ground for experienced and novice DXers alike.

In the 30s, a number of privately owned American SWBC stations operated on 49M. The transmitters were officially licensed as experimental, but they actually served the same purpose as do today's 50-kw BCB outlets. For example, W8XK relayed KDKA (Pittsburgh), W9XAA carried programs of WCFL (Chicago), and so on. Unfortunately, regional shortwave broadcasting never caught on commercially in the U.S. And by the time World War II came along, the 49-meter transmitters not already out of business were taken over by the Voice of America and put to international use.

Everywhere else in the world, 49-meter outlets now serve to supplement coverage of BCB affiliates. Just across the border, in Canada, we have such stations as CFRX, 6070 kHz (Toronto), relaying programs of 50-kw BCBer CFRB to northern Canada 24 hours a day. Like most Canadian stations, CFRX is an excellent verifier. Another Canadian is CFVP (formerly VE9CA), which has been on 6030 kHz some 30 years relaying programs of CFCN (Calgary, Alta).

On The Continent. Over in Europe, regional broadcasting is always tinged with international aspects because of the close proximity of the many different countries and languages. And since 1945, this has been further complicated by the cold war. Under these circumstances, 49-meter outlets have a definite advantage over BCB counterparts due to the fact that nearby jammers on 6 MHz tend to skip at night (i.e., within a 200 mile radius, jamming signals pass right through the ionosphere without being reflected back to earth). And with reduced ground-wave coverage, jamming 49 meters effectively during the hours of
DXing the 49ers

darkness becomes particularly difficult. Because of this, Berlin's RIAS (Radio In the American Sector) uses 6005 kHz 24 hours a day for anti-Communist transmissions to East Germany. Like V. America, RIAS is an arm of the U.S. Information Agency. At 1045 to 1800 EST, a 20-kw transmitter in West Berlin (which counts as a separate DX country) is on the frequency. For the rest of the day and night, a 100-kw outlet in Munich is used. The 6005 kHz frequency is RIAS' only shortwave outlet.

Many domestic German stations also have 49-meter relays. The list includes Bayerischer Rundfunk, 6085 kHz (Munich); R. Bremen, 6190; and Suddeutscher Rund-

funk, 6030 (Muhlacker). All are fine catches when heard in North America, as are three other European regions—R. Luxembourg, 6090 kHz; R. Monte Carlo, 6035; and R. Andorra, 5995. Watch for these stations around midnight.

Come this winter, most international broadcasters returning to 49 meters for transmissions to North America will be European—especially stations on the west coast of the Continent, like R. Portugal on 6025 and/or 6185; the BBC on 6110; and V. Germany on 6075, 6100, and 6145. Just how well these stations (or other European regions) are heard will vary considerably from night to night. On good nights, novice SWLs will get some much-needed practice in locating and logging 49-meter signals. On poor nights, DXers might as well forget Europe and look for regional stations in the tropics.

South Of The Border. In the tropics, BCB frequencies are afflicted by very high noise levels year 'round. Clear-channel BCB coverage, as we know it in the temperate zone, is very difficult. In fact, static is such a problem that special SW bands—60, 90, and 120 meters—have been allocated for local broadcasting. Despite these special bands, many broadcasters, especially in Latin America, prefer 49 meters. Many of these stations are so strong that they are a cinch to pick up. And they become even easier picking when QRM from European stations isn't around due to poor bounce conditions from that-a-way.

Come fall, you can count on at least one international Latin American SWBC station on 49 meters. That is the notorious R. Havana (Cuba), with English broadcasts every evening at 2000 EST on 6135 kHz. From Cuba, you can get to hear Helena Guzman, and friends, with such items as a course on guerrilla warfare by Ernesto Guevara, the Cuban high-up who's been hiding out the past couple of years.

Most other Latin American stations on 49 meters broadcast exclusively in Spanish, except Brazil, where the language is Portuguese (which sounds more guttural than Spanish), and Haiti, where French and Creole (a French dialect) are spoken. None of these should give the novice too much trouble, since it's comparatively easy to pick out these stations' ID announcements, given a little practice. Possibly the easiest Brazilian station to catch is R. Inconfidencia on 6000 kHz (Belo Horizonte). You'll find it peaking around sunset. At times you may get some QRM from La Voix de la Revolution Duvalieriste in Port au Prince (Haiti), since it's only about 50 miles distant.

For additional info on who's where on 49, check White's Radio Log. Good listening!
So you've heard about that DXer who thinks maybe Radio Americas doesn't make its home on Swan? Now hear about one who says it does—and proves it!

Radio Americas is on Swan Island or in an area within three miles of Swan and at firm anchorage. This is the only conclusion I can make after a year of exhaustive research into the whereabouts of this "semi-clandestine" station.

First, let me tell you a little about R. Americas. It is considered the direct descendant of R. Swan and as such might still be considered a front for CIA operations. The Miami representative of Radio Americas, Inc., a chap named Roosevelt Houser, said in a phone conversation with me, "We have no connection with the U.S. government. I have heard, though, that our predecessor, Vanguard Services, Inc., was mixed up with the CIA."

The station manager echoed Houser's words.

NC From CIA. While in Washington, D.C., I tried to get in touch with the CIA (yes, Virginia, there is a CIA!), but unfortunately they were not available...
for comment. Now (if we are to believe some rumor mills) I'm probably being shadowed and my mail watched.

And besides all that the Americas people have a commercial rate card! They accept advertising at the rate of $24 per 60-second spot, single insertion. The hourly rate is $175, single insertion. Their studios are located in Miami, or, more properly, in Coral Gables, Fla., at 101 Madeira Ave.—Zip Code 33134. I know this to be a fact because I was there.

According to the station manager, all programs are done in Miami, except the news, which, using the various shortwave frequencies of the UPI's Latin American wire, is produced on Swan itself. I'll have to take his word for this since he didn't offer me a trip to Swan (though I tried).

Their mailing address is Apartado (Box) Postal 352, Miami, Fla. They announce this on their one frequency which I measure at about 1157 kc (oops! kHz). They actually vary between 1155 and 1165 kHz. They formerly used 6 MHz in the 49-meter international shortwave band, but this was discontinued in late September of 1966.

This fact was "proof" that the station was located in Yucatan to one well-known SWL, since a hurricane devastated Yucatan during that period, not Swan. But the station manager had a slightly better answer. He told me the transmitter, an RCA job putting out 7.5 kw, had simply hit the point of no return. It was just costing too much to keep repairing a rig that wasn't paying off. If you figure listeners' mail as a response, then this 6-MHz operation just wasn't pulling its own share. Let's face it, SWLs were not Radio Americas' prime, or even secondary, target, so farewell 6 MHz!

Castro? Carramba! R. Americas (and I think this is no secret) aims for the anti-Castro Spanish-speaking crowd. They even go so far as to announce "La Voz de la Verdad para Todo el Continent." If your high-school Spanish is a little rusty that means, "The Voice of Truth for All the Continent."

By the way, if you haven't heard this station and would like to get a QSL from them, send a report of what went on during their 1157-kHz transmission for any ten-minute period to the address above. This broadcast can be heard almost anywhere on the East coast of the U.S. and should be audible except near Chicago, where WJJD spews forth 50 kw on 1160 kHz, and around Salt Lake City, where KSL booms 50 kw on 1160. In Florida, both are audible, along with Swan and a multitude of jammers.

The jammers tend to make R. Americas unique as it is the only station that the Bearded One has felt need to award more than one jammer. On an average day Ronald Schatz, a DXer from Miami (now in the U.S. Navy), has spotted up to 10 jammers putting forth noise from 1155 to 1165 kHz. This raucous racket has been described by one broadcast engineer as "FM noise," though another observer says it's more like "YEECH!"

Besides jamming Americas, Fidel's jammers (no, you can't get a QSL from a jammer!) add background fun and noise to:

<table>
<thead>
<tr>
<th>Station</th>
<th>Frequency</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>WGBS</td>
<td>710</td>
<td>Miami, Fla.</td>
</tr>
<tr>
<td>WWL</td>
<td>870</td>
<td>New Orleans, La.</td>
</tr>
<tr>
<td>WMIE</td>
<td>1140</td>
<td>Miami, Fla.</td>
</tr>
<tr>
<td>....</td>
<td>1180</td>
<td>VOA in the Keys</td>
</tr>
<tr>
<td>WKWF</td>
<td>1600</td>
<td>Key West, Fla.</td>
</tr>
</tbody>
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All in all, 1100-1200 is bad for any kind of DXing, and this is to say nothing of what it does to your ears.

The great anti-Castro clandestine station, "Radio Libertad, La Voz Anti-Comunista," heard on 1404 kHz in Puerto Rico, is not jammed. This struck me as strange (actually, I was going to say a bit more about Radio Libertad . . . their postal address is blocks from my house in Miami Beach, Fla. . . . but it seems it's against postal regulations to reveal a box holder's name).

Aero and Ham. As another way of logging Swan Island that nobody will dispute, try the FAA stations. The Miami FAA supplied the following information:

<table>
<thead>
<tr>
<th>Station</th>
<th>Frequency</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>WSG</td>
<td>3329</td>
<td>5945</td>
</tr>
<tr>
<td>WSG</td>
<td>2738</td>
<td>AM phone ship-to-shore emergency channel, also daily weather forecast at 1700 GMT</td>
</tr>
<tr>
<td>SWA</td>
<td>407</td>
<td>Aero beacon</td>
</tr>
</tbody>
</table>

All these are low-powered, but I am sure they will fill in a prepared QSL sent to En-
gineering Department, FAA-Miami, Miami International Airport, Wilcox Field, Miami, Fla.

Also, Hams abound on Swan or KS4 land. KS4CB, KS4CC, and KS4CD are operating on Swan using a 150-watt Allied T-150 and a 500-watt Galaxy F for CW and SSB transmissions—all this according to P.M. Holebrook, ex-KS4CA, just back from the Swan where he and KS4CB, CC, and CD work as technicians for (I have a feeling this is gonna be hard to believe) R. Americas! All will QSL, and all have listings in the Callbook.

Holebrook says that anyone who worked him as KS4CA and didn’t get a QSL can QSL him through WA9OVE. He also says nitrate content used in making munitions. This certificate passed from hand to hand till the U.S. “sorta” owned the island. This is somewhat like the British on Falkland Islands which the Argentine Government claims. But as a professor of international relations once said, “So what are they going to do about it?”

The FCC doesn’t license the station, either. (So look at the money R. Americas has saved!) Also they don’t have to give the other side equal time. (Imagine giving equal time to Fidel! One of his “short” speeches lasted 4 hours!)

But back from philosophizing to some physical proof. Gordon Nelson and Bob

Though there is no Radio Swan these days, its direct descendant—R. Americas—is where R. Swan always was, says the author: namely, on Swan Island. Letter to author from R. Americas’ Florida studio included photos of Swan (technically called “Great Swan Island,” since a second island, thought to be uninhabited, is known as “Little Swan”) as well as the R. Americas’ transmitter site. Ham QSL card (below) is that of P. M. Holebrook, a former technician for R. Americas.

he is tired of all “controversy” over Americas. “It’s on Swan Island, and that’s all there is to that.”

I think Holebrook qualifies as an eye witness.

The political implications of a Swan location also add up. Swan’s ownership is questionable. Honduras says it owns it, though it’s been a while since Honduras sent a government official to the island to check on its holdings (like about 100 years). The U.S. is there by virtue of guano (more commonly called bird droppings).

Birds Yet. It seems Lincoln’s Secretary of State Seward issued a certificate for the island proclaiming it was a guano island. No one questioned Seward’s ability to spot a guano island when he saw one, and during the Civil War the North needed guano for its Keene, both top rate BCB DXers, took direction bearings on the station over a period of weeks from Boston and Houston, respectively. The results, computed by Nelson on a computer, show a square about 25 miles with a lot of water in it and, of course, Swan. This matches the comparative bearings Schatz took on the station and a few others near by. In short, R. Americas is either smack on Swan or it’s on a nifty little sub or maybe a flying saucer of sorts that’s but a stone’s throw away.

The final proof comes to me in the form of three photos sent by the chief engineer (see letter above). They match with a map of the island found and Xeroxed by Schatz in the New York Public Library.

And if you want a final final reason, it’s this: my mother thinks I’m right!
This Tapester Has Wings!

Bob Waters likes to take off with a tape recorder. The machine is an electronic memo pad, secretary, and thought-writer rolled in one. Flying his own Piper Apache on business trips, Bob enjoys shooting color slides from on high. But who can remember every last detail when the slides are shown later on the home screen? The tape recorder does.

An electronics manufacturer based in Wayland, Mass., Bob also finds tape just fine for recording passing thoughts or kicking around new ideas.

Where's he now? Bob may well be over the Amazon River, shooting crocodiles—on film and tape, that is.

Tape recorder sits in co-pilot seat atop Collins ham transceiver. Bob Waters, on mike, also enjoys aeronautical hamming. Bob is seen below loading Panasonic recorder.
Above, Bob talks into recorder mike; taping, not writing, lets him pay more attention to aircraft instruments shown below. At home, Bob edits tape before slide showing.
An Asiatic opening which SWLs should watch for occurs around 1800 EST and peaks during the fall equinox period. This opening is particularly important for listeners east of the Mississippi where Asian transmissions are scarcer than hair on a frankfurter. At the equinox, sunset in Eastern North America occurs simultaneously with sunrise in Asia. This combination produces good reception on 41 meters, especially just outside the band proper where QRM is less.

On rare occasions, when the noise level is unseasonably low, Asian stations can be logged as low as 4 MHz.

Interesting prospects include R. Peking's August /September, 1967 relay base (or bases) near the Soviet border on 4200, 4220, 6875 or 7350 kHz. Whether more than one site operates on these frequencies is a matter of speculation. Accurate information on Red Chinese stations is extremely hard to come by, which makes logging them all the more interesting. Another hot one to watch for is R. Moscow's transmission to Vietnam (complete with sound effects) on 6910 kHz from a Siberian or Central Asian location. A similar opening can be expected at sunrise EST (sunset Asian time). This period may be less convenient for late risers; however, more Far East stations are on the air at this time while North American QRM is considerably reduced.
The crow of a rooster at dawn may bring back fond memories of boyhood visits to grandfather’s farm. Promptly at sunrise every day a loud Cock-a-doodle-do would herald the coming of dawn. Unfortunately, a crowing rooster hardly fits into metropolitan living, but it’s still possible to get up at the crack of dawn. Since sunrise is variable from day to day, setting an alarm clock wouldn’t do at all. The alarm clock also sounds off on cloudy and rainy days which is enough to make any cat blow his cool.

The way out is to build the electronic rooster we’re about to describe. A cadmium-sulfide photocell can be used to detect sunrise, and by using a sensitivity control you can decide how bright you want the sunlight to be before it wakes you up. The alarm signal is provided by the 2800-Hz sound from a Sonalert operated by a built-in 14-volt mercury battery.

Because of the Sonalert’s high resistance, the photocell doesn’t operate the Sonalert directly. Instead, the photocell is used to trigger an SCR (silicon controlled rectifier), which in turn acts as a switch controlling the battery voltage.

The Chassis Box. Start the project by laying out the holes in the box. The Sonalert mounts in a 1\(\frac{3}{8}\)-in. hole in one end of the box; a suitable bracket should be made to mount the potentiometer. Though the unit will operate quite well on a 9-volt transistor battery, the Sonalert’s volume is dependent on voltage and we found a 14-volt battery preferable. The battery holder is eyeleted to the other end of the box. Be sure that the holes in the box top are marked out accurately so the adjustment hole is directly over the potentiometer.

The reason the sensitivity control is re-
CHANTICLEER

cessed is because everyone seeing the Rooster would have an impulse to turn the knob if the control were panel-mounted. The plug button can be pried out and a screwdriver adjustment made when you need to change the sensitivity. The on/off switch is an inexpensive slide switch and is necessary to keep the Sonalert quiet.

The Photocell. The mounting for the photocell (PC1) was made from a piece of ¾-in. diameter soft copper tubing and an aluminum can from a discarded fluorescent light starter. To mount PC1, first remove the phenolic end and all the inside parts from the starter can. Smooth the open end with a file and make a ¾-in. hole in the closed end. Paint both inside and out with flat black spray paint.

A panel bushing is mounted in the aluminum box and a shaft lock screwed into place on the bushing. The copper tubing is bent to shape and one end inserted into the shaft lock and tightened to hold the tubing in place. Another panel bushing is fastened into the hole in the starter can and a shaft lock screwed on. The shaft lock is then tightened up on the extended end of the tubing.

Flexible lead wire is soldered onto the PE cell wires and insulated and fed through the starter can and copper tubing into the aluminum box; a spot of model cement on the PE cell should serve to hold it in place in the panel bushing. The tubing is soft enough to permit bending if necessary when putting the Rooster into use. In addition, the shade over the PE cell will prevent unwanted light from possibly activating the Sonalert.

After you have fabricated the box you can add black decals or press-on letters to indicate the desired functions. A coat of Testor's clear spray will protect the lettering and prevent its wearing off.

Finishing Touches. Once you have completed assembly and wiring, check the unit very carefully. If everything looks AOK, you are ready for a test. Turn the switch on and point the PE cell towards a lamp bulb and adjust the sensitivity control until the Sonalert sounds off. Holding your hand over the PE cell should make no difference in the sound because once the SCR begins to conduct it will be necessary to turn the switch off to quiet the Sonalert.

(Continued on page 114)

CHANTICLEER PARTS LIST

B1—14-V mercury battery (Mallory RM411 or equiv.)
PC1—C1050C photocell (Clairex)
R1—500,000-ohm, linear-taper potentiometer (Mallory SU50 or equiv.)
S1—S.p.s.t. slide switch
SCR1—C106F2 silicon controlled rectifier (GE)
1—4 × 2 ¼ × 2 ¼-in. aluminum chassis box
(Bud CU2103A or equiv.)
2—Panel bushings (Mallory UB241 or equiv.; Newark 9F207)
1—Sonalert (Mallory SC628)
Misc.—Plug button, battery holder, shaft lock, rubber feet, wire, solder, hardware, etc.

Estimated cost: $15.00
Construction time: 2 hours

Schematic reveals extreme simplicity of Rooster's circuit. Sensitivity control R1 could be mounted in normal fashion, but author placed screwdriver pot beneath chassis for more permanent setting.
A modulator keying monitor and code practice oscillator
that'll cost you peanuts!

By Howard S. Pyle, W7OE

"Hey, Ed! I heard you working a guy in Texas the other night. Boy, did he have a rotten fist!"

"Yeah, Tom. His bug was really crawlin' all over him. Said he had no keying monitor, so I guess that was it."

Did it ever occur to you that far too many "rotten fists" stem from the fact that the offending operator has no means for monitoring CW transmissions? And could it be that you're a guilty "paddle slapper" yourself without even realizing it? Sure, a lot of guys listen to their sending by using their receivers as a monitor, but that method is makeshift at best. To make a long story short, why not do it right?

Solid, By Gum! Pick up a small, rock-hard plastic module about the size of an art gum eraser, and you've got the made-to-order answer. All of the basic components you'll need for perfect monitoring of your transmissions are completely imbedded within. You'll never know what's in the little hickey, though it's a pretty safe bet that there's a couple of transistors, plus some odds and ends of capacitance and resistance hiding out. All you'll need in addition is a single flashlight cell and any old odd-ball speaker you got laying in your junk box!

You'll find five spider-like wire legs protruding from the "Black Widow"; these are the external connections. As shown in the schematic, connect these wires to the battery, speaker, and a foot or so of hook-up wire for an RF "antenna." Five minutes should put you in business, listening to your own sending with no connections or modifications to either your transmitter or receiver!

The module can be secured from the Carl Cordover & Co., 104 Liberty Ave., Mineola, N.Y. 11501 for $3.50 plus 50c postage and handling. Ask for their Type CWM-1 Monitor Module. You can use it as it is, as shown in the photo. Or you can do as we did and give your monitor the professional touch by dressing it up in a suitable cabinet which will house not only the module but the flashlight cell and speaker as well. Or you can go even further, as the photographs show.

Meter Case. A Bud CM 1935 universal meter case easily accommodates the 3-in. Quam PM speaker shown. The module itself is mounted on a small piece of scrap bakelite after drilling five small holes for the module leads. A generous blob of epoxy
The Black Widow

The heart of the "Black Widow" is this little epoxy-covered module—it takes all the pain out of construction since all you need to make it work is a battery, an antenna and speaker.

cement on the base of the module firmly secures it to the bakelite plate. The plate is mounted to the small metal transformer bracket, which is part of the speaker frame, with a couple of 3/4-in. 6-32 machine screws. These should protrude far enough above the bakelite plate to provide mounting screws for a terminal tie-point strip to which all five leads from the module are soldered, thus providing a central termination point for all remaining wiring.

A volume control and a key jack (J1)

can be mounted on the cabinet face as shown. The jack is provided for insertion of a key so the monitor can double as a code practice oscillator. This is a fringe benefit of the little hickey; you can include or ignore it as you choose. The volume control can be almost anything you have on hand; we used a 2000-ohm pot which we had in the junk box. On the rear face of the cabinet mount an insulated binding post for connecting the external RF "antenna." A small, stiff wire a foot or so long is used

PARTS LIST FOR THE BLACK WIDOW

- B1—1.5-V flashlight cell
- J1, J2—Open-circuit phone jack
- P1—Two-conductor phone plug
- R1—Potentiometer (see text)
- T1—Universal output transformer
- 1—CWM-1 module (see text)

1—3-in. PM speaker
1—Universal meter case (see text)
Misc.—Wire, solder, knob, hardware, etc.

Estimated cost: $5.00
Estimated construction time: 1 hour

Black Widow circuit at left is author's version, providing options for code key, headphones, and volume control. Basic circuit at right will give good monitoring of CW.
as a mini-whip, though a short piece of hook-up wire is adequate.

Once the gadget is put together, you simply move it around the shack with the antenna hanging free, while keying your transmitter. It’s amazing how many places in the shack you’ll find plenty of RF floating around, coax cables or no coax! We found a dozen spots where the stray RF from our 40-watt transmitter was more than ample. However, right where we wanted to locate the monitor cabinet...no RF!

To solve this one, we simply placed the cabinet in the desired location and ran a couple of feet of hook-up wire concealed behind the equipment to a point of good pick-up and let it lie! The result was a perfect, completely clickless, easy-to-read tone of about 300 Hz every time the transmitter was keyed—perfect monitoring which follows a bug or code key as fast as we could make them go without burning out a bearing!

Other Options. We didn’t stop there, though. As habitual wearers of headphones, we wanted the monitor tone to appear in the phones as well as occasionally in the speaker. A simple modification fixed this in great style and permitted control of both speaker and headphone volume utilizing the installed volume control! We simply mounted

(Continued on page 112)
I qualified for this job by working two years at an International Intelligence Agency radio station near Miami, Fla., then by logging (with my camera) all 50 states on the VHF television channels. Because of my unique monitoring talents, I was given a Ph.D. by U. See and made chief inspector of SBTV (Society for Bland, Tasteless Video). By way of explanation, SBTV is a volunteer organization designed to protect such programs as "The Beverly Hillbillies," "Donna Reed Show," "Bonanza," etc., from illegal competition. In other words, our aim is to hunt down pirate TV stations.

We have chapters in every state and all 10 Canadian provinces. The moment one of these dangerous outlaw transmissions is spotted, I and my assistant, Mona Jones, are promptly dispatched to that part of the continent. All of which detracts considerably from my DXing time, but, on the other hand, traveling with Miss Jones does offer certain compensations.

So here I am on the morning of August 4th in Buffalo, N.Y. I have left instructions with Mona to meet me in the hotel parking lot at 9:00 a.m. Just to be certain I called her room around 7:00, woke and reminded her.

"What time is it?" Half whispered.
Double-checked my watch. "Exactly two minutes past seven."

What she said then even a master DXer like myself couldn't make out.

"You will be on time?" In my first year I tracked down only about 50% of those pirate stations reported. "You know how important this case is."

Mona hung up on me.

But when I arrived at our monitoring van, five minutes early, she was already there behind the wheel. Three rolls of extra film on the seat beside her.

I slid into the back. "Have breakfast?"

Picture tube, receiver, and antenna controls were mounted at my right.

Mona shrugged. "Can't eat this early in the morning." Small, with long dirty-blond hair and perfect figure.

The parking attendant appeared and I tipped him a ten for keeping a special eye on the van, a protection against possible pirate sabotage.

She drove us out of the lot and into traffic while I warmed up the monitoring gear.

Weird weather. A fog and cloud cover had descended on the city overnight. Morning, and the fierce August sun was still blocked off by those clouds. Mixed with smoke, dust, and exhaust resulting in overwhelming smog.

"Head north out Niagara." I put my receiver on Channel 9; a trace of CFTO from Toronto.

Mona stopped for a red light. "Do you know where you're going?"

(Continued on page 113)
Zeners are one of the handiest occupants of the semiconductor bandwagon but one of the most confusing to the experimenter.

As is the case with the old-fashioned vacuum tube rectifier, the semiconductor diode consists of two elements. One of these is a cathode and the other an anode (often called a "plate" in the case of tubes). Schematic representations of the two types of diodes are shown in Fig. 1.

In tube diodes, a filament heats the cathode, causing it to emit electrons. If the plate voltage is made positive with respect to the cathode, these electrons will flow through the vacuum from the cathode to the plate or anode. If the polarity is reversed and the plate is made negative as compared with the cathode, the electrons would form a cloud known as a "space charge" near the cathode. The end result is that no electrons will flow through the tube.

A similar situation exists with the semiconductor diode. If a battery were connected across the diode as shown in Fig. 2A, the anode would be positive with respect to the cathode and electrons would flow through the diode from the cathode to the anode. Should the battery be reversed as in Fig. 2B, no electrons would flow—supposedly, that is. But this "no electrons" business requires one big qualification and really furnishes the wherewithal for the zener diode.

**Current And Electrons.** Let's go one step further. As you may have noticed, the term "current flow" hasn't been used until now. A flow of electricity through the diode was referred to as "electron flow." Electrons flow from the negative (−) post of the bat-
Zener Supply

battery, through the diode or other load in any circuit, back to the positive battery terminal. At one time, current was considered as taking a reverse path, i.e., from the positive end of the battery, through the load or diode, to the negative terminal. Therefore, though the point of the triangle in the diode symbol points toward the negative battery terminal, current actually flows in the opposite direction. The direction of electron (i.e., current) flow is depicted by the arrow in Fig. 2A.

When the diode is connected as in Fig. 2B, however, no current will flow—at least theoretically. Still, there is always some leakage current flowing from the cathode to the anode of the diode. Further, if the size of the battery is increased beyond a specific safe voltage, the diode will "break down." The zener and avalanche breakdowns are the basis of operation of the so-called "zener" diodes.

Diode Curves. Not surprisingly, curves have been drawn to describe the action of semiconductor diodes. When they are forward biased, as in Fig. 2A, the curve is similar to that shown in Fig. 3. Fortunately, that curve contains a great deal of information about a given diode. For example, if a battery of $V_1$ volts were placed directly across the diode, $I_1$ amps (or milliamps) of current would flow. This can be seen from the intersection of the vertical and horizontal broken lines with the diode curve.

To use a curve such as this, first note the battery voltage impressed across the diode. Next, locate this voltage point on the horizontal axis, then draw a vertical broken line from the horizontal voltage axis until the line crosses the diode curve. From the point where the curve and broken line intersect, draw a horizontal line to the vertical current (I) axis. This is the current flowing through the diode.

The drawing also shows how to find current $I_k$ with a supply voltage $V_s$ across the diode (the procedure is identical to that for finding $I_1$ with $V_1$ volts applied).

Now let's go one step further. Suppose the circuit included a resistor, as shown in Fig. 4. What will the diode current be, and what will the voltage be across the diode?

Load Lines. The effect of the resistor on the circuit can be determined by constructing a resistance load line over the diode curve, as shown in Fig. 5. This can be accomplished very simply in a few steps.

1. Make a dot on the voltage (V) axis at the point representing the $V_s$ voltage supply.
2. Calculate the current that will flow when the voltage across the diode is zero, or all the voltage is across the load resistor, $R$. This current is $I_k = V_s/R$. Mark this point as $I_k$ on the I axis.
3. Connect the two points determined in steps 1 and 2 with a straight line.
4. The straight line drawn in step 3 will intersect with the diode curve at point Q. Draw a horizontal line from Q to the I axis.
5. Read the current I, on the I axis. This is the current that will flow through the diode.

6. Draw a vertical line from Q to the voltage axis. Vp is the voltage across the diode.

These steps may seem long and involved. However, given a few attempts the procedure becomes quite simple, and the revealed circuit information will be readily evident. True, the V-I plot of a diode may be curved, as shown in Fig. 5. However, it is possible to approximate the curve with two straight lines, as depicted in Fig. 6.

Note that one of the two lines is almost horizontal, while the other is almost vertical. Using the circuit in Fig. 4, assume V, is not a constant voltage. Let's say that it varies from V_a to V_b. It then becomes necessary to draw similar loadlines for the circuit with voltages V_a, V_b, and V_c. Then we can see how the current through the diode and the voltage across the diode will vary with the supply voltage V_s. To clarify matters, let's draw these load lines on the approximate curve, as shown in Fig. 7.

When the voltage is at its center value, V_c, the current through the diode is I_a, and the voltage across the diode is V_{ds}. If the supply voltage drops below its center value to V_a, the current through the diode drops to I_a and the voltage across the diode drops to V_{da}. Should the reverse happen and the supply voltage rises, the diode current increases to I_b and the voltage across the diode is V_{db}.

From this construction, we can easily see the action of the voltage regulator if we make two important mental notes.

First, the diode current varies considerably with the supply voltage. And second, the voltage V_{da}, V_{db}, and V_{db}, across the diode are almost identical. These voltages vary little with the voltage variations of the supply. To put it another way, the voltage across the diode is more or less constant (within limits, of course) regardless of the supply voltage.

If a load resistor, R_L, were placed across the diode, as in Fig. 8, the voltage across the load would be exactly equal to the voltage across the diode (voltages across all elements connected in parallel are always equal). Thus the voltage across the load, as is the case with the voltage across the diode, is reasonably constant. This is the basis of the voltage regulator.

**Regulator Secrets.** The mechanism of this arrangement is quite simple. As the supply voltage rises, the current through the complete circuit rises. An increase in current means in increase in voltage drop, IR, across the series resistor, R. The current through the circuit adjusts itself so that after the IR voltage drop across the resistor is subtracted from the total supply voltage, the constant voltage, V_o, always remains across the diode and consequently across the load, R_L.

Now if the current through R rises, the current through the parallel combination of the diode and R_L must also rise. If this is so, doesn't the IR drop across these two elements in the circuit also rise, and increase.
Zener Supply

the voltage across the parallel combination?
The answer to this may be derived from the construction in Fig. 7. As the supply voltage and circuit current rise, the diode current rises. However, the voltage across the diode remains unchanged. All the current-increase in the circuit passes through the diode and none through \( R_L \). The voltage across the diode remains relatively unchanged despite the increase in current.

The current through (and consequently the voltage across) \( R_L \) will remain constant for two reasons. First, the diode voltage remains unchanged regardless of the current change, and this voltage is identical to that across \( R_L \). Second, the diode absorbs all current change and there is thus no addition to the current through \( R_L \). Thus, if there is more than an average current flow through the combination, any excess will flow through the diode and not the resistor.

A similar case can be built for the condition where the supply voltage falls below its average value.

**AC Resistance.** One more characteristic of this circuit should be studied before we turn to the zener diode itself. Every diode behaves as a resistor, and its resistance varies with the slope of the curve. As you know, the resistance of an element is equal to the voltage across this element divided by the current passing through it. If this voltage and current vary for some reason or other—a change in supply voltage, say—the element will exhibit an AC resistance. This AC resistance is the variation or change of voltage across the element divided by the change of current.

In the example in Fig. 7, the AC resistance of the diode is

\[
\frac{V_{DB} - V_{DA}}{I_{D} - I_{A}}
\]

It is interesting to see that because \( V_{DB} \) and \( V_{DA} \) are almost identical, the difference between the two is practically nil. Substituting this into Equation 1, the AC resistance of the diode is found to be very low, approaching zero. When the resistance of the diode is low with respect to the resistance of the load, \( R_L \), the diode circuit dominates the situation and can therefore be used to regulate the voltage.

Diodes make good regulators when they are forward biased. Regulation obtained with a germanium diode is about 0.2 volts and across a silicon diode, about 0.6 volts. What happens if regulators of different voltages are required? Several diodes can be added in series, but the voltage range is extremely limited. Zener and avalanche diodes have been provided to take care of the large variety of voltage conditions needed in semiconductor circuits.

If diodes are reversed biased, as in Fig. 2B, extremely tiny currents will flow—in the order of microamps. As the reverse voltage is increased, a voltage is reached where the current will increase rapidly. This change from minute to large amounts of current flow is especially abrupt in zener diodes. A drawing of this is shown in Fig. 9. This voltage, \( V_z \), is the reverse breakdown voltage for the diode. In the case of zener and avalanche diodes, this breakdown is not permanent, but diode action is restored once this voltage is removed.

**Zener And Avalanche.** The breakdown voltage is one of two types. If the voltage is less than about 5 or 6 volts, it is a zener breakdown. Above this point, it is an avalanche breakdown. And around the 5- or 6-volt level, it is a combination of both.

Zener breakdown is caused by strong electric fields in the diode due to the reverse voltage. Avalanche breakdown is due to the collision of particles in the diode. In either case, the regulating element is referred to as the zener diode.

The zener regulator works better than the forward diode regulator however, the applied voltage is reversed. In Fig 10A, a circuit with a reversed biased zener diode is shown. The power supply is variable. The curve for the reverse biased diode is drawn in Fig. 10B with the load lines for the three extreme values of the applied voltage. (Note that the load lines are determined as out-
D1

(VARIES FROM
VA TO VB)

A

B

Fig. 10. Zener diode hooked up to voltage supply varying from VA to VB. Load lines resulting from supply voltage changes in A are illustrated in B.

In short, putting Ohms' Law into play, \( I_{RL} \) is equal to the zener voltage divided by \( R_L \).

The next problem is to determine the power dissipated by the zener diode. The maximum power is dissipated when the input voltage is at a maximum, \( V_B \).

Under this condition, the voltage across \( R \) is \( V_B - V_x \). Thus the current through \( R \) is \( (V_B - V_x)/R \). The current through the load remains \( I_{RL} \). Therefore the maximum current through the zener diode is the difference between the two currents or

\[
\frac{V_B - V_x}{R} = I_{RL}
\]

Since the dissipated power is the voltage multiplied by the current, the power dissipated by the zener is

\[
P_z = \left( \frac{V_B - V_x}{R} - I_{RL} \right) V_x
\]

For practical purposes, when choosing an appropriate zener diode, the calculated power should be doubled. Choose a diode rated

Fig. 11. Typical zener diode voltage regulator circuit. Voltage across diode is held constant despite variations from \( V_A \) to \( V_B \).
Zener Supply

at double the dissipated power. For powers on the order of several watts, an appropriate heat sink should be used.

Now what about the AC resistance of the zener? In the equations we just derived, we assumed perfect regulation. In other words, we assumed that the output voltage did not vary one iota with the variation of supply voltage. Unfortunately, this is an ideal but impossible situation.

Because of the AC resistance, there is always some output voltage variation with input signal, however slight. It is best to use a zener with a low AC resistance if this variation is to be maintained at a minimum.

Using The Formula. The equations presented here can be used in all practical designs of voltage regulators. And though results are approximated, they are more than adequate in most instances.

For example, suppose a 400-ohm load, \( R_L \), must be supplied 18 regulated volts. Assume a 30-volt unregulated supply is available and that the voltage on the supply varies from a low of 27 volts to a high of 33 volts. The problem is to determine an optimum value for \( R \), and the power dissipated by \( R \) and the zener diode. When this information has been determined, both components can be specified.

Since 18 volts must appear across \( R_L \), the current through \( R_L \) is

\[
I_{RL} = \frac{18}{400} = 0.045 \text{ Amps.}
\]

We now have all the required numbers and can turn to Ohms Law.

\[
V_a = \text{minimum supply voltage} = 27 \text{ volts.}
\]

\[
V_z = \text{zener diode voltage} = 18 \text{ volts (the same as across } R_L, \text{ since they are in parallel).}
\]

\[
I_{RL} = \text{the current through } R_L = 0.045 \text{ Amps.}
\]

Using Ohm's Law, we find

\[
R = \frac{V_a - V_z}{1.1 I_{RL}} = \frac{27 - 18}{1.1 (0.045)} = 33 \text{ ohms.}
\]

Since a 182-ohm resistor is not a readily available value, we can use a 180-ohm resistor for \( R \).

All the values for determining the maximum power dissipated by the zener diode are also known:

\[
V_a = \text{maximum supply voltage} = 33 \text{ volts.}
\]

\[
V_z = \text{zener diode voltage} = 18 \text{ volts (This is assumed constant under all conditions.)}
\]

\[
R = 180 \text{ ohms (just calculated).}
\]

\[
I_{RL} = 0.045 \text{ amps (calculated above).}
\]

Substituting these numbers into our power-dissipation formula provides us with a power dissipation figure for the diode under the worst conditions—at maximum line voltage.

\[
P_Z = \left( \frac{V_B - V_X}{R} \right) I_R = \left( \frac{33 - 18}{180} \right) 0.045 = \frac{15}{180} - 0.045 = 0.083 \text{ Amps.}
\]

\[
= (0.083) (180) = 1.24 \text{ watts.}
\]

The power dissipated by the resistor is

\[
I = (0.083) \times 180 = (0.0069) 180 = 1.24 \text{ watts.}
\]

The resistor should be capable of dissipating at least double this power to operate reliably. A 180-ohm, 2-watt unit should be used.

The calculations given are usually adequate to define the circuit. For more precise results, the load lines should be plotted on the curves, as previously described.

The complete circuit for this unit is shown in Fig. 12. The 400-ohm load is across the zener diode and the 180-ohm, 2-watt resistor is in series with the load and diode. The entire circuit is powered by a 30-volt unregulated DC supply.

Securing the proper zener diode may be a problem if you just look in the standard electronics catalog. Some catalogs list a

(Continued on page 62)
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series of JEDEC standard numbers for the zener diodes, but do not tell you any of the diode characteristics. Other catalogs list nothing at all.

Fig. 13 is a chart listing the most popular diodes and their JEDEC numbers. You need an 18-volt diode with a 750 mw rating in the problem just completed. Go down the first column until you find the zener voltage you are interested in. All items in this row are 18-V zener diodes. The third column is labeled 750 mw. In this column, the JEDEC number of the 18-V, 750-mw diode is 1N1515. Order your diode from the dealer under this number.

A Second Example. Now let's proceed to a second and somewhat more complex example. Assume you have the same 30-volt unregulated power supply as in the first problem, and the supply voltage still varies from 27 to 33 volts. Now you have a 200-ohm load resistor, and you need 6 regulated volts across the load. The problem is set up in Fig. 14A.

You scrutinize the chart in Fig. 13. You can easily get a 5.6-volt diode and a 6.8-volt diode. But there is no 6-volt diode. How is this to be handled?

The proper procedure is to choose a diode with the next higher voltage—in this case, the 6.8-volt diode. This diode, of course, will regulate 6.8 volts, but a resistor can be added in series with the 200-ohm resistor to drop the 0.8 volt excess.

The zener appears across the combination of the 200-ohm resistor and $R_A$ (Fig. 14B). The extra 0.8 volts is to be developed across $R_A$, which, in conjunction with the 200-ohm resistor, forms a voltage divider. From the voltage divider equations,

$$6 \text{ volts} = \frac{200}{(200+R_A)} \times 6.8 \text{ volts}$$

since the portion of the 6.8 volts across the 200-ohm resistor is the required 6 regulated volts. Cross-multiply and solve the equation for $R_A$:

$$6 (200+R_A) = 200 (6.8)$$

$$1200 + 6R_A = 1360$$

$$6R_A = 160$$

Fig. 15. Temperature compensation may be accomplished using a standard diode in conjunction with a zener. The two diodes can be obtained in a composite package, or a standard transistor can be used for the purpose.
The closest standard resistor—27 ohms—would be satisfactory. The power dissipated by the resistor is

\[
\frac{V^2}{R} = \frac{(0.8)^2}{27} = 0.0237 \text{ watts.}
\]

A 1/4- to 1/2-watt resistor can be used with complete safety.

The proposed zener regulated circuit is shown in Fig. 14C. The 227-ohm load is the sum of the 200-ohm load resistor and the 27-ohm resistor, \(R_a\), in series with it. If there is 6.8 volts across the combination, there will, of course, be the desired 6 volts across the 200-ohm load.

Since 6.8 volts must appear across the 227-ohm combination of load and resistor \(R_a\), the current through this load is

\[
I_{RL} = \frac{6.8 \text{ volts}}{227 \text{ ohms}} = 0.03 \text{ Amps.}
\]

The numbers for substitution into Ohm's Law are:

\[
\begin{align*}
V_a &= 27 \text{ volts} \\
V_x &= 6.8 \text{ volts} \\
I_{RL} &= 0.03 \text{ Amps.}
\end{align*}
\]

When substituted, these yield

\[
R = \frac{V_a - V_x}{1.1 I_{RL}} = \frac{27 - 6.8}{1.1 (0.03)} = 20.2 \text{ ohms}
\]

Since a 612-ohm resistor isn't standard, a 560-ohm, 10% resistor can be used instead.

The power dissipated by the zener diode can be determined as before. The numbers for substitution into our equation are

\[
\begin{align*}
V_n &= 33 \text{ volts} \\
V_x &= 6.8 \text{ volts} \\
R &= 560 \text{ ohms} \\
I_{RL} &= 0.03 \text{ Amps.}
\end{align*}
\]

Plugging these numbers into our equation, we solve for the maximum power the diode is called upon to dissipate.

\[
\begin{align*}
P_z &= \left(\frac{V_B - V_x}{R}\right) I_{RL} = 33 - 6.8 \\
&= 26.2 \\
V_x &= \frac{(6.8 - 0.03)}{560} = 0.017 \\
P_z &= 26.2 \\
P_z &= 0.017 \times 6.8 = 0.115 \text{ watts}
\end{align*}
\]

The commercially available 6.8-volt, 400-milliwatt unit can be used. From the chart in Fig. 13, the JEDEC number is 1N754. Order it by this number from your parts house.

The next task is to determine the power dissipated by the 560-ohm resistor. The maximum current flowing through this resistor is

\[
I^2 R = \left(\frac{0.047}{560}\right) \times 560 = 0.047 \text{ Amps.}
\]

The power dissipated by the resistor is

\[
I^2 R = \left(\frac{0.047}{560}\right) \times 560 = 0.047 \text{ Amps.}
\]

A 2-watt resistor should be satisfactory, though a 3-watt unit is more desirable.

The final circuit is shown in Fig. 14D. Temperature Compensation. For temperature-compensation purposes, a zener diode is frequently packaged in series with a forward biased diode, as shown in Fig. 15A. The forward biased diode develops a minute amount of voltage when compared to that across the zener. Its effect on the calculation of the regulator can be considered negligible.

In Fig. 15B, the composite diode has been drawn. Here, the zener and compensating diode are included in one package.

Fig. 15C contains a unique application of the transistor. If the base/emitter junction is reverse biased, it acts as a zener. However, the transistor is not calibrated for a standard zener voltage and the zener voltage must therefore be determined experimentally.

The base/collector junction in a transistor may be substituted for the temperature-compensating diode in A. Thus, with the base junction left open, a transistor may be used as a temperature-compensated zener diode. If the regulated voltage fits your requirement, it is a very good, convenient, and inexpensive zener.

The effectiveness of zener regulators can be extended through more complex transistor circuitry, though this topic must be left for another time.
A Tattletale for Tiros & Friend

Lotsa things have happened in the Buck Rogersville of outer space that John Q. Everyman's only contact with has been via newspapers and magazines. But now the tale is being tattled by RCA with replicas of some of the esoteric hardware that Uncle's gaping tax bite provides you, me, and the Great Society with. If you want to see for yourself what's happening, fly, run, or swim right over to Rockefeller Center in Fun City (New York) and take a good gander at the weather satellite ground station RCA has set up there.

You'll see how TV pictures are received and recorded from TIROS and NIMBUS satellites. It's an actual station resplendent with facsimile equipment that'll print out a high-flying bird's-eye-view of earth and cloud every time one of the satellites goes by overhead.

The satellite monitor is part of a new system by RCA that uses equipment that's sophisticated to the point of simplicity. Heart of the beastie is a new TV camera in the satellite that snaps a picture and stores it for 200 seconds while inexpensive, low-powered, narrow-band equipment leisurely scans the image and transmits it back to earth. There, a simple facsimile recorder prints-out the picture.

The system employs the most extensive assortment of integrated circuitry yet used in space. This has reduced size by about a third, and weight by roughly a half.

—Joe Craig

While you're waiting around for the picture show, you might have a look at the weather exhibit which includes a life-size model of the Nimbus II satellite and the whole big, wonderful story of how satellites spy on space.

The view from above is shown on 9 x 9 in. facsimile pictures taken every six minutes by a new, slow-scan RCA video camera. The orbit schedules are prominently posted in Rockefeller Center, so you won't miss the command performance (just don't expect an encore).
CB LAB CHECK

If there's one thing about CB that can be counted on, it's that no single transceiver will meet all operating needs under all conditions. As close as one type of operation comes to another, there always remain slight differences and conveniences better suited to one particular type of equipment than another.

For example, with most base station installations, it's generally assumed that the message must get through under virtually any condition of interference, whether made by man or nature; so we would tend to select a high-performance transceiver. On the other hand, while mobile operation also generally requires performance equal, or nearly equal, to that of a base station, it is often necessary to compromise performance and features. This would be the case if the transceiver were required to be easy-to-operate, and of such size that it didn't interfere with the passenger's leg room or the vehicle's operating controls.

Portable operating needs can generally be met by any walkie-talkie rated at 1 watt or higher RF output. But walkie-talkie often leave a lot to be desired in the way of operating features and performance when distance and freedom from interference are needed; a "standard" solid-state transceiver with a battery pack might often be the better choice.

As you can see, a complete CB operation can easily utilize three distinct transceiver types or models (i.e., base station, mobile, and portable). Because of this, our CB transceiver test reports are geared to a complete CB operation. While any of the three transceivers tested can be used for other purposes, we have checked them within the framework of mutual operational compatibility. The Realistic Americana 23-Plus was checked primarily as a base station; the Lafayette HB-525B was tested with an eye towards mobile operation; and the Knight Safari II was used with its auxiliary equipment which converts it into a portable transceiver.

Go Fixed Station with Radio Shack Americana 23-Plus

The Base Station. The Realistic Americana 23-Plus is a full-feature transceiver in every sense of the term. Among its many features are full 23-channel coverage through the use of crystal synthesis, a pi-net RF output circuit with "finger tip" external tuning controls (no alignment tools needed), a DX boost circuit which increases microphone sensitivity, fine-tuning to compensate for an off-frequency received signal, an S-meter, an ANL (automatic noise limiter) on/off switch, and both external speaker and headphone jacks. Other features include a CB/PA switch, a modulation indicator lamp, and the usual volume and squelch controls.

The receiver section is double-conversion with a 6-MHz 1st IF, followed by two stages of 455 kHz IF amplification. On the unit tested, this line-up resulted in a 0.9 uv sensitivity for a 10 db S+N/N (signal plus noise to noise) ratio. Selectivity, uncommonly high for just two stages of 455 kHz IF, was 50 db.

The receiver's AGC (automatic gain control) action checked out as 10 db for an input signal variation of 74 db (the input test signal ranged from 2 uv—simulating a weak signal—to 10,000 uv—simulating a very strong signal). In plain terms, this means that if you have the volume control cranked open to hear a weak signal, the speaker won't blast you out of the chair if a strong signal comes on the channel.

Incidentally, all noise limiters, because they clip the peaks of the received signal, generate some distortion. But while noise is always present in mobile service, this is not necessarily true for base stations, which can be loaded in an area of low noise. Under these conditions, the Americana's noise lim-
CB LAB CHECK

iter can be turned off to prevent possible distortion.

The audio power output (measured across the speaker), for a moderate strength signal of 100 µv, was 2.8 watts. Overall sound quality was very good. The S-meter is set to

Rear apron of the Americana 23-Plus. Phono jack at extreme right is for external speaker; male octal plug to left is for power supply.

indicate S9 when the signal at the antenna terminals is 2.8 µv. This means that virtually any usable signal will indicate as an "over S9" signal. The change in input signal per S-unit varied from between 1-3 db, meaning the S-meter is only useful (as are most others) as a relative signal-strength meter.

The pi-net-output transmitter, which is essentially of "standard" design, delivered 3.8 watts RF output to a 50-ohm load. The overall modulator sensitivity through the microphone was slightly higher than the aver-

IF transformers in 23-Plus are sealed against probing do-badders, but qualified technician can readily align set whenever required.

The HB-525B has a minimum of operating controls, the front panel containing only a volume and squelch control, the channel selector, and a Delta tuning switch that tunes the receiver ±2 kHz to compensate for off-frequency received signals. (The unit's S-meter is also front-panel mounted.) Exter-

The Mobile Station. The very small size of the Lafayette HB-525B (2½ x 6½ x 8¼ in.) makes it particularly attractive for mobile operation (it's easy to install and remove, and it takes up virtually no leg room).

Rear panel of HB-525B contains separate external and PA speaker jacks. Power plug accepts either positive or negative ground.
nal-speaker and PA-output jacks are provided; the 12 VDC power supply can accommodate either a positive or negative battery ground.

The receiver is a double conversion unit with a high-Q mechanical filter in the 455 kHz IF strip for good adjacent-channel rejection. The receiver's sensitivity for a 10 dB S/N/N ratio checked out at 0.45 UV. Adjacent channel rejection was 43 db; AGC action for the 74 db input signal variation test was 13 db—not outstandingly good but adequate.

The AF output power available for PA use was 2.6 watts into a 4-ohm speaker; the same power output is available for moderate (100 uv) strength signals. However, the small speaker built into the transceiver is incapable of handling this power level.

The overall sound quality, as would be expected from a small speaker, was crisp—lacking bass—and very "clean."

The S-meter, which indicates S9 with a 100-uv antenna input signal, is calibrated between the S4 and S9 marks at 6 db per S-unit.

When powered by 13.8 volts (to simulate the charging voltage of a vehicle-in-motion), the transmitter delivered 4 watts to a 50-ohm load. The overall modulator sensitivity was average for "100%" modulation, and the modulation is limited to 100%. A Range Boost built into the transceiver does provide some degree of speech compression, thereby increasing the average power.

The S-meter doubles as a relative power indicator when the transceiver is in transmit mode. While the final RF tuning control is inside the cabinet, the antenna loading control is accessible through a hole in the rear apron. The rear apron also contains external and PA speaker jacks, and a pre-wired socket for a selective call adaptor.

A converter unit is available for operating the transceiver from a 6-volt power source, as well as an AC power supply for 117-VAC operation.

The HB-525B is priced at $149.95, which includes all crystals, microphone, DC cable, and mobile mounting bracket. For additional information write to Dept. CP, Lafayette Radio Electronics Corp., 111 Jericho Tpke., Syosset, N.Y. 11791.

The Safari II is available as a semi-kit (with a transmitter that is completely factory-wired and aligned) or wired. Basically, the Safari II is a 5-channel version of the 23-channel Safari III. The only other important difference is that the Safari II doesn't have an S-meter. The transceiver is supplied with one to five sets of crystals, depending on user requirements.

Somewhat unusual is the fact that the Safari II doesn't have a speaker as such; instead, its microphone functions as the speaker, which means that it can be placed directly next to the ear; a particular advantage in areas of high ambient noise. It's sort of like having the intimacy of a walkie-talkie with the high-powered performance of a standard transceiver.

The front panel contains channel selector, volume and squelch controls. A fine-tuning
CB LAB CHECK

control adjusts the crystal frequency to compensate for off-frequency received signals.

Building the kit version, which sells for $59.95, is not particularly difficult, as the transmitter is pre-wired and most of the remaining wiring consists of pushing components into matching holes in the printed circuit board. There is no user alignment, since all receiver coils, with one exception, are supplied pre-aligned. A generator check of alignment after we completed the kit established that the coils were indeed peak-aligned. The oscillator coil adjustments, the

Two accessories for Safari II are combined AC power supply/battery charger (at bottom) and battery pack (shown with shoulder strap) at top. Finger points to meter which indicates condition of battery during charge.

only one made by the user, consists of simply adjusting the coil for received signals (of course, a generator can be used to adjust the oscillator coil).

The receiver is a single-conversion circuit of more-or-less straightforward design. It checked out very close to Knight's claimed specs. The sensitivity for a 10 db S+N/N ratio measured 1.9 uv. Adjacent-channel rejection was 35 db, while the AGC action was about standard at 10 db. Overall sound quality was similar to other good solid-state transceivers—crisp (almost no lows) and clean.

A healthy 3.7 watt transmitter RF output to a 50-ohm load puts this unit in the big-time. The microphone sensitivity was slightly lower than average, requiring that the mike be held almost against the lips; but then, the lower sensitivity reduced unwanted background noise. The modulation was limited to 100%, and no amount of microphone input level caused excessive modulation.

The power supply accommodates either a positive or negative ground 12 VDC hookup.

Accessories include a 117-VAC power supply and for portable use, a battery pack, a carrying case, and a 20-in. center-loaded portable antenna (any portable antenna can be used).

The battery pack is specifically designed for use with the Safari transceivers. A sturdy rubber strap, with steel hooks, clamps the battery pack to the side of the transceiver, thereby forming a single, integrated transceiver/pack assembly. A heavy-duty shoulder strap and arm cushion, supplied with the battery pack, clamps to the complete transceiver/pack assembly; the shoulder straps can be adjusted to any desired length.

The battery charger is the 117 VAC power supply; when it's connected to the transceiver, it is a power supply; when it's connected to the battery pack, it functions as a charger.

When used as a portable, the Safari's microphone hanger allows the user to reach down and pluck the mike off the cabinet. A downward motion secures the mike.

The Safari II is available from Allied Radio Corp., Dept. 20, 100 N. Western Ave., Chicago, Ill. 60680.
So there you sit with your SCR motor speed control, lamp dimmer, etc. and find that it's only variable from about 10 to 55 volts, after which it jumps the output to 117. So now you want double the control range to extend all the way to 100 volts smoothly in order to get that soldering iron just the right temperature, lights dimmed inconspicuously to just the right brightness for a special occasion, or your drill running at 7/8th normal speed. That's where our simple, inexpensive little Range Expander comes in. For a few bucks and an hour of your time, you'll get continuously variable voltage control from 20 to 100 volts. Sound handy? Here's how it's done.

Most SCR motor speed controls use a single silicon controlled rectifier in a half-

Knight KG-201 motor speed control circuit is typical. Output voltage to load is rectified half-wave and variable from approximately 10 to 55 volts. With addition of Range Expander to this type circuit, range of controlled voltage is effectively increased to roughly 20 to 100.
wave circuit. Typical, is Knight KG-201 shown in schematic. The output voltage is a half-wave rectified AC, variable from about 10 to 55 volts, followed by a voltage jump to 117 volts when switch S1 is closed by potentiometer R2 at the high setting.

As a result, continuous control of medium to high lamp brightness, motor speed, or heating element temperature is not possible with this half-wave SCR circuit. But, by rectifying the AC line voltage before applying it to the SCR, the SCR will control both half-cycles of the AC line voltage. The negative half-cycle, previously blocked by the SCR, now contributes to the output voltage.

So now, output voltage may be varied from about 20 to 100 volts DC. Some SCR control units may omit fifty-microfarad electrolytic capacitor C1. In this case, the voltage range can be varied from about 55 volts to 100 volts. Note: 150 watts is the maximum load you can use with the Range Expander.

Internal layout of Range Expander is uncluttered; all parts are mounted directly on sockets. Any handy case can be used.

Speed control plugs into Range Expander DC socket; AC socket bypasses Expander. (A reversed connection, though inoperable, won't damage the SCR control unit.)

For small universal AC-DC motors, use the Range Expander with the SCR control for control of medium to high speeds and use the SCR unit alone for the lower speeds.

Use the Range Expander with the SCR unit for controlling lamp brightness over the entire range. As with the SCR unit alone, flicker may be observed at very low lamp brightness.

(Continued on page 114)
You'll get dices wild with this electronic fatemaker

Pushbutton Highroller

By Ken Greenberg

Shooter's coming out—place your bets. Seven, eleven, easy eight, eight's the point—seven away, passline away. What's happening? Automated electronic dice, that's what's happening. You press the button, release it, and two illuminated numeral indicators tell you if you crapped out, made your point, or made that field bet. But it's not limited to craps—this cute gadget can be used in any dice game, from craps to Monopoly. And, the Highroller can be used for an electronic version of roulette, too, as well as any game requiring random numbers.

Clever Japanese numeral indicators make this electro-mechanical dice game unique. Unlike numeral readout (Nixie) tubes, which require costly and complicated actuating circuits, these indicators do essentially the same thing.

(Continued overleaf)
Pushbutton Highroller

in a much simpler manner. Etched numbers on clear plastic plates are individually edge-lit by tiny 6-volt bulbs.

Basically, the circuit consists of two motor-driven rotary switches which open and close the circuits of the numeral indicators. Releasing the pushbuttons allows the motors to coast to random stops, resulting in a number from 1 to 6 lighting up on each indicator. The odds for the game are the same as for regular dice. That is, 7 can be “rolled” by 6+1, 5+2, or 3+4.

Layout and Construction. With careful planning and squeezing, everything will fit into a 9x6x5-in. metal case. Mount the motors, rotary switches, and 6.3-volt filament transformer on the removable back plate of the case. The motors have threaded body holes to which you fasten two 2 1/4-in. right-angle irons (from hardware stores). The angle irons are then attached to the back plate.

The rotary switches are mounted through enlarged holes in the 1 1/2-in. right-angle irons. Remove the detent (click stop) mechanism from the switches before mounting them. It is also advisable to wire the switches before mounting.

The motor and switch shafts are coupled together with 3-in. long flexible shafts, which require a quarter-inch shaft coupling on each end. Avoid using motors that have other than 1/4-in. shafts as this will make coupling a problem. To make the game more compact, small flexible couplings (Allied Radio #47A2405) can be used instead of the 3-in. flexible shafts. In any case, the motor and switch shafts must be lined up as close as possible when mounted, to prevent binding. To use 3-in. flexible shafts within the 9 x 6-in. case, you’ll have to saw one-quarter inch off each of the shafts.

After mounting the motors, switches, and transformer, mount the indicators and the power on/off switch on the front panel. The indicators have mounting templates printed on their boxes to help you cut the proper size square holes for windows. The two motor-drive pushbuttons are mounted on the top of the case.

Wiring. After all the parts are mounted, wire the circuits as shown in the schematic diagram. The indicators have terminal numbers from 0 to 9; use only the connections for numbers 1 through 6. Pushbutton S2 is s.p.d.t. so that when
Interior layout of Highroller isn’t critical. Photo at left gives you a general idea of where to put things. When coupling switches to motors, the two should line up to prevent binding of switch shafts.

it is depressed to start motor B2, the indicator lamp circuits are open, and the numbers will remain unlit while the motors are operating. Releasing S2 energizes the light circuits while the motors are coasting to a stop.

Each rotary switch has 24 lugs (two decks of 12 each). As shown in the schematic, groups of four consecutive lugs are connected together to form six separate lug groups. Each group will actuate a number from 1 to 6 on the indicators. Though the diagram shows the indicator terminal light numbers wired in sequence to the switch lugs, this isn’t necessary. Any indicator terminal number can be connected to any one of the six groups of lugs. The leads from the switches to the indicators should be made long enough to allow easy wiring to the front panel which is installed later.

One thing to bear in mind—there are many possible variations to this unit, and you can easily substitute parts. Nothing in this gadget is critical, so don’t be afraid of using what’s readily available. The Highroller shown is the author’s prototype and can be followed exactly, or you can use your imagination—variations are limited only by your ingenuity.

First Shooter, Coming Out! After the wiring has been completed, switch S1 on. Push S2 and S3 and watch the motors turn the rotary switches. The shafts must be lined up reasonably well so there is no binding, and the motors can start instantly. This is important also to prevent undue wear on switch shafts, which are not designed for heavy loading or continuous duty. Put a drop of oil on the shafts to reduce friction.

To simulate rolling a pair of dice, push both S2 and S3 for a few seconds. Release the buttons and the motors will coast to random stops. Each indicator will show a single number from 1 to 6. Occasionally, the switch wiper arm may stop between two lugs and no number will appear on the indicator. If so, “roll the dice” again. This will occur after the rotary switches have been used for some time.

To roll only one die, push either S2 or S3 individually. If you use S2, the indicator will run through lighted numbers as the motor operates. Using S3 only, the indicator lights will remain off until the button is released. This feature allows a number of different games to be played—including ones that require only one die.

To use the Highroller for electronic roulette, simply read the actual number on the indicators—5 and 2 being S2, not 7.

While this game may not replace the dice at the tables in Las Vegas, it’s an impressive display and might make a good science fair math project in the study of probability. In any case, it’s an interesting, unique conversation piece for the guy that has everything. But if you “lose your shirt,” don’t blame us, that may be the price of being the first of the Electronic Highrollers!
Zippy Signal Grabber

How would you like to build a radio bug’s dream—a free antenna that works on all bands from broadcast right up to the TV “spectrum”? You would? OK, here goes.

The Zippy Signal Grabber is free only if you happen to have 6 feet of lamp (zip) cord and a plug on hand—otherwise you’ll have to spend a few cents to buy the stuff. Also, it can be used only for receiving, it probably won’t work in apartment houses which have BX cables all over the place, and it doesn’t seem to do much for FM-stereo and color-TV reception. But with these exceptions, the ZSG is really swell.

The idea is to inductively couple the receiver into the power lines of your house and use the lines as the antenna. No fooling, the power line makes a good antenna and seems to drag in DX over a wide span of frequencies; the antenna isn’t really resonant on any particular frequency but works by means of the massive “capture area” of the hundreds of feet of wire involved.

Constructing the ZSG is a cinch. Take the 6 feet of zip cord and snip 6 inches off one wire at one end. Next, snip 6 in. off the other wire at the other end of the 6-ft. length. The power plug connects to either end; only one of the prongs is connected.

Your antenna is now complete (mostly). Attach the “free” end to the antenna terminal of your receiver, insert the plug in any convenient outlet, and you’re ready to start pulling ‘em in. If your receiver has provision for a ground connection, run a short wire from the ground terminal to the screw on the wall socket faceplate (sometimes this helps, sometimes it does absolutely nothing, and sometimes it actually seems to impair reception). If it does no good, remove it. (Under no circumstances should you attempt to ground an AC/DC receiver!)

A hint on obtaining the raw materials free: if you have an old and unused radio or electrical appliance lying around the attic, closet, or basement, simply swipe its line cord. Clip the cord at the point where it enters the appliance, then proceed as outlined above. About the only way you can botch up this antenna is to make like stupid and accidentally connect the power line to the receiver’s antenna terminal. Would you believe instant chaos?

—Jim Gibson.

Stereo When Mono Must Do

Though stereo’s all the rage these days, there are still times when you want to make a mono tape recording from a stereo broadcast or record. To do so, you’ll need two .02-mf, 200-V (or more) capacitors and two 180k, 1/2-w resistors, wired up as shown in the schematic diagram.

The foil ends of the capacitors connect to the speaker voice coils, while the ground connection from the tape recorder’s high-level input is attached to the remaining speaker leads.

One word of caution: check the two units carefully to make certain that the chassis of neither unit is connected to one side of the 117-volt AC power line.

—Hugh Gordon.
Anyone who has picked up a pile of nails with a horseshoe magnet will surely admit that there is something almost magical about magnetism. But few would be so bold as to actually define magnetism as "magic."

Yet that definition would fit about as well as any other. And in some respects it is a better definition than you can find in a dictionary or in most physics textbooks. What is "magic?" One definition: "A power brought into play by the secret forces of nature." Certainly magnetism is a power created by the forces of nature. Is it "secret?" Definitely. No one yet really knows what magnetism is. Admittedly this definition also fails to reveal what magnetism is, but it at least has the uncommon virtue of stating honestly that the fundamental character of magnetism is still a deep, dark mystery.

Authoritative references are rarely that candid. Most physics textbooks sneak past the definition and "define" magnetism by telling how it is generated and what it can do. But that is not the same thing as telling what it is. As for the dictionary definition, that can only be called a masterpiece of double-talk. Magnetism is defined as "the property of some molecules that enables them to become magnetized." So what does "magnetize" mean? You guessed it: "To acquire the properties of magnetism."

Atomic Generators. Any bright schoolboy knows that if you break a magnet in half you then have two complete magnets, each with its own north and south pole. And you can keep on breaking the magnets into smaller and smaller pieces and still wind up with complete magnets. Eventually the magnets become so small they would be called magnetic "domains" by physicists. These domains are the ultimate magnetic memory elements that still exhibit uniform magnetism. Each of these magnetic domains
MAGNETISM

is made up of literally billions upon billions of atoms.

If you break up the domains into their component atoms, you find that the atoms are also magnetic. Certain electrons orbiting about the nuclei of the atoms generate magnetism in much the same way magnetic fields are produced when electricity is passed through a wire loop. Moreover, the electrons spin, and thereby produce additional magnetism that becomes a component of the total atomic magnetism.

Not all atoms are magnetic. In some cases the electron magnetisms cancel each other. In other atoms—notably those of iron, cobalt, and nickel—the electron magnetisms are not balanced out and each atom as a whole exhibits detectable magnetism.

The magnetic atoms can be thought of as being extremely small dynamos. Pack a lot of these atomic dynamos together in the correct arrangement, and you wind up with a magnetic domain. Stack a large number of domains together in orderly fashion, and you have a magnet that can be used to pick up nails or run a motor.

Though you may not have realized it, we have gone down to the electron and back again. But we unfortunately haven’t found out what magnetism really is. Once again we have only shown how it is produced.

Force Fields. Since we’ll necessarily be referring to “force fields” and “lines of force,” it might be a good idea to first decide what they are. Unhappily, this problem is just as perplexing as the one we’ve just muddled through.

The dictionary offers us the same semantic jabberwocky as before. A line of force is “a line in a field of force, whose tangent at any given point gives the direction of the field at that point.” A field of force is “a region or space traversed by lines of force.”

Ask a physicist what a force field is and he’ll probably say that it is “something” outside a magnet that has form or symmetry and which can act to influence material objects such as a compass needle. But what is that “something?”

Interestingly enough, physicists have actually engaged in considerable philosophical debate about whether a force field is “real.” Some argue that it isn’t, that it’s only a complex system of directions followed by magnetic forces exerting their influences outside of the magnet. As astrophysicist Donald Menzel puts it: “Magnetic lines of force have no more objective existence than lines of latitude or longitude, or the contour lines that designate altitude. They are, however, a convenient fiction (emphasis added) for describing certain of the properties of magnetic fields.”

Others argue that the magnetic force field cannot be just “nothing” in the sense that direction is nothing; there is at least “energy and motion,” hence the force field is “real.”

Look at it this way. Magnetism works in a vacuum where there is no air—no atoms of any kind. Hence it seems obvious that the magnetic field in a vacuum cannot possibly be “real” as we generally understand real things. But put a compass or some iron filings into the force field in the vacuum and you have incontrovertible evidence that “something” must be there to push the compass needle and the iron filings about. How could “nothing” push about physical objects exhibiting mass and/or frictional inertia? Ipso facto: a magnetic field is “real.”

Having now established the basis for some endless debates about the reality or nonreality of magnetic fields, let’s call a truce by labeling the whole thing “magic” so that we can go on to things we really know more about.

Discovery of Magnetism. No one is sure just when man first discovered the mysterious force we call magnetism by stumbling onto magnetite, an oxide of iron commonly called lodestone. But it is certain that Persian and Arab sailors were using crude lodestone compasses—pieces of the magnetic mineral floating on slabs of wood (Fig. 1) or suspended from strings—at least by the 11th century. By the 14th century, these primitive devices had been replaced by sim-
which referred to around Fig. 2. nets and showed
the pole correctly concluded the earth.

In 1269 a French soldier-scholar, Pierre de Maricourt (pen name, Petrus Peregrinus), experimented with lodestones and magnets and showed that compass needles roughly indicate directions paralleling the pole-to-pole directions of the earth’s meridians (Fig. 2). But it wasn’t until 1600 that Sir William Gilbert, physician to Queen Elizabeth, made the first truly scientific study of the compass and correctly concluded that the earth itself behaves as a huge magnet. Gilbert erred, however, in explaining that magnetism was caused by large amounts of magnetic substance, like lodestone, buried deep within the earth.

The Earth Dynamo. Our knowledge of the earth’s interior structure derives from secondary information and scientific reasoning, since no one is able to burrow into the bowels of the earth to see what is there. But it is generally accepted that much of the interior of the earth is fluid and very hot.

For this reason, Gilbert’s idea that the earth contains a solid magnet must be dis
counted. The favored theory now is that the earth is a gigantic dynamo whose electric currents constantly generate the planet’s magnetic force field. This concept is more easily understood by analogy to a simple dynamo invented by Faraday (Fig. 3). A copper disc, rotating between the poles of a magnet, delivers a direct current from the axle shaft to a rim contact—or in the opposite direction, depending on the direction of rotation of the disc. (In practice, the best location for the rim contact is between the arms of the magnet, at the point closest to the two eddy currents.)

The earth consists of a thin outer crust about 10-25 miles thick that covers a solid rock mantle extending almost half way to the center of the earth. The central core is

thought to consist of a solid inner core surrounded by a liquid core probably composed of nickel-iron materials.

In theory, the liquid core flows slowly with respect to the surrounding rock mantle, and in so doing generates electric currents which encircle the core (Fig. 4). The core thus becomes an electro-magnet exhibiting a magnetic force field detectable on the surface of the earth.

Eddy currents in the liquid core are believed to generate localized electric currents whose attendant magnetic effects are added to the primary dipole field. Probable irregularities in the eddy currents help to partly explain some of the random fluctuations observed in the earth’s magnetic field patterns.

Imaginary Magnet. Even after one accepts the dynamo theory, it is still convenient to cling to the acknowledged fiction that a chunky bar magnet is buried close to the center of the earth. Such pretending makes it easier to talk about the earth’s magnetic fields, and to point out some of the common
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misconceptions pertaining to the earth's magnetic core.

This seeming bar magnet does not extend completely from one side of the globe to the other; it is actually relatively short as proved by magnetic dip experiments to be discussed later. The "ends" of the magnet are far beneath the surface of the earth, though the north and south magnetic effects extend to the surface and far into space.

The locations on the surface of the earth that we call north and south poles are displaced from the geographic poles representing the axis of rotation of the earth. This is generally understood. But it is not as widely known that the magnetic axis does not pass through the center of the earth. The magnetic north pole is located on Prince of Wales Island in northern Canada (about latitude 70°N, longitude 100°W). The magnetic south pole is located in Antarctica (latitude 68°S, longitude 143°E). These points are marked on any reasonably good desk globe. Examination of such a globe will reveal immediately that the earth's magnetic axis is displaced to one side of the geographic axis, in the direction of the Pacific Ocean.

It is now easy to understand why the earth's magnetic equator, which lies in a plane at right angles to the magnetic axis, does not coincide with the earth's geographic equator. The two equators are quite close together in South America, but the magnetic equator is much further north in Africa. What's more, it passes through Arabia, India, and several other Asian countries that are far from the geographic equator.

Declination. Since the geographic and magnetic poles do not coincide, there are relatively few places on earth where compass readings will indicate true north without correction for declination—the angular variation of magnetic north from true north.

Figure 5 shows the geometric principles involved; in practice, the application of declination corrections is a bit trickier. A compass reading taken at a point such as A would indicate true north because the magnetic and geographic poles are aligned along the same meridian as the observer. No declination correction is needed. In theory at least, there would be a series of similar zero declination positions extending from the north to the south pole on the other side of the globe.

When a compass reading is taken from a position such as B, the indicated magnetic pole is to the right (east) of the geographic pole. A declination correction must be applied. Note that any other position on the same meridian would require an angular correction in the same direction, but to a different degree. At point C the compass would point to the left (west) of true north, and a declination correction in the opposite direction would be required.

If the magnetic fields around the globe were uniform in distribution, the matter of declination correction would be an easy matter. Unfortunately, the earth's magnetic field is very irregular—partly because of the eddy currents mentioned earlier, partly because of other factors, such as the presence of large underground iron deposits.

Fig. 5. Geographic and magnetic poles lie at different points. Compass at A would point toward true north, but compass at either B or C would require some correction.

Figure 6 is a much simplified isogonic map of compass declinations throughout the world. Compass readings taken from all points along any given line will require identical declination corrections. Note particularly what happens in the case of the zero ("agonic") declination line. In the western hemisphere this line extends fairly evenly to the south through the United States and South America.

But notice what happens in the eastern hemisphere! Beginning at the magnetic south pole, the agonic line cuts through Australia into Indonesia, then swerves eastward through the Pacific and up through the eastern tip of Russia to the top of the world. It has almost reached the magnetic north pole when it swoops southward again through the heart of Russia, ducks under Arabia, clips off a part of Africa, and takes the grand tour through central Europe and Scandinavia before heading for the Arctic regions again!
To complicate matters further, the declination at any given spot changes gradually as the position of the magnetic north pole shifts. For example, in the New York area the declination change amounts to about 1 angular minute per year—approximately 1 degree every 60 years.

Dip! In 1576, Londoner Robert Norman, a compass maker, first demonstrated the use of a dip needle (Fig. 7). This consists of a perfectly balanced and magnetized compass needle pivoted on a horizontal (rather than vertical) axis so that it can swing in a vertical plane. The dip needle immediately revealed that the earth's polar magnetism is concentrated inside the earth and not on the surface of the earth.

Anywhere along the magnetic equator the dip needle assumes a level, horizontal position because the attractions of the north and south poles are equalized. As the dip needle is moved northward from the equator, the north-seeking end of the needle tilts more...
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and more downward until it stands vertically at the magnetic north pole. If the needle is moved southward from the magnetic equator, the other end of the needle dips gradually to a vertical position at the magnetic south pole.

Figure 8 shows a simplified isoclinic map consisting of a series of lines, each representing a certain degree of dip or "inclination." Note that the lines do not parallel the earth's longitude lines, but weave up and down as they circle the earth.

An ordinary compass does not indicate dip, though this downward pull does tend to reduce the overall sensitivity of the delicate instrument.

More expensive compasses have adjustable weights attached to the needles; these can be moved to counteract the downward pull and thus improve the balance—hence sensitivity—of the instruments. Alternatively, simple dip meters can be used by prospectors to locate ore bodies underground.

Magnetic Intensity. A common misconception is that the earth's magnetic field must be very powerful if it can act over thousands of miles to activate a compass. Actually, the earth's field is very weak, having a maximum intensity of about 0.70 oersted near the magnetic south pole. (The oersted is a centimeter-gram-second electromagnetic unit of magnetic intensity.) Even a child's toy magnet may have an intensity of several hundred oersteds.

You can prove this point by bringing the weakest available horseshoe magnet near a compass; it will easily overpower the effect of the earth's magnetism.

Though the earth's magnetic field is weak, the earth dynamo that produces it must be very powerful. This may seem contradictory until it is remembered that magnetic intensity—like that of light—falls off rapidly with increasing distance; yet the earth's magnetic field is of enormous size.

Figure 9 shows an isodynamic map of magnetic intensities around the world. The area of lowest intensity (about 0.25 oersted) is on the west coast of South America; from here the magnetic intensity increases gradually in all directions to reach maximum values at the poles.

Magnetic Flip-Flops. It might be a bit disconcerting to think that some day the earth's magnetic north pole may just take off and wander down to Little America. But it could happen! In fact, it has now been proved quite conclusively that the earth's magnetic field has reversed itself a number of times during the geologic ages. The evidence supporting this theory has come from a study of the magnetic characters of volcanic rocks containing iron and titanium oxides.

Fluid lava is nonmagnetic; but it becomes partly magnetized by the earth's magnetic field as it cools past a critical "Curie Temperature." The magnetic "domains" in the rock become locked into positions conforming to the lines of magnetic force that induced their magnetism. The positions of the domains are unalterable except for normal geologic disturbances such as uplifts.

In this way nature has catalogued and preserved a record of the earth's magnetic fields.

Fig. 9. World map shows relative strength of earth's magnetic field at various locations. Numbers along isodynamic lines, which reveal points of equal strength, are expressed in oersteds. Strongest intensity is .70, which is weak compared to a small bar magnet which might measure 100 or more oersteds.
throughout the ages. Scientists can now measure magnetic orientations of the rocks and correlate them with the geologic periods when they were laid down. It is now quite certain that only periodic reversals of the earth's magnetic field can explain the magnetic orientation of certain lava beds.

How rapidly can such pole reversals take place? Almost instantaneously—if one can accept the fact that a mere 5000 years represents hardly more than an instant in terms of geologic time. That reversals have occurred in such short time has been proved by the discovery of a few lava beds which were laid down during times when reversals were actually taking place.

These studies may seem rather esoteric until it is realized that the information gained may yet throw a great deal of light on many puzzling phenomena including rates of sedimentation, stratigraphic correlations between continental and marine rocks, continental drifts, and the curious magnetic "bands" that have been discovered at the bottoms of the oceans.

The studies may even reveal something about the origins and evolution of life on this planet. Mutation rates may have been altered significantly during the reversal periods because of increased cosmic ray penetration permitted by a weakened magnetic envelope around the earth.

The Magnetic Envelope. It was only a short decade ago that man discovered that planet earth is surrounded by a toroidal magnetosphere where hot, ionized gases originating from the sun strike the earth's atmosphere and magnetic force field with turbulent impact. Figure 10 represents a thin vertical slice through this magnetosphere whose doughnut-like shape extends out to perhaps 40,000 miles from the earth's equator.

The total diameter of the magnetosphere is highly variable. Solar wind consisting of hydrogen travelling at the fantastic rate of about 900,000 miles per hour strikes the magnetosphere, compressing it to half its usual thickness during times of intense solar activity. The wind sweeps past the magnetosphere and extends it out to perhaps 100,000 miles on the side of the earth opposite the sun.

Inside the magnetosphere are two other doughnut-shaped areas known as the Van Allen belts. The nearer of these arches about 2000 miles above the earth; it contains entrapped high-energy protons. The other belt extends out to 10,000 miles or more; it contains high-energy electrons.

Atmospheric Dynamo. As it turns out, we earthlings are actually sandwiched between two gigantic dynamos that are generating magnetic force fields. There is the one inside the earth. There is another in the ionosphere, the upper part of the atmosphere, 50 miles and upward from the surface of the earth. Here the sun's energy acts upon atmospheric gases to release free electrons which flow in circular patterns to form dynamo systems generating electric currents. There is one huge ionosphere dynamo in the northern hemisphere, another in the southern hemisphere.

The magnetic forces produced by these dynamos are superimposed on those produced by the earth dynamo. But the magnetic fields produced in the atmosphere are highly variable because they are directly dependent on solar energy; they are more pronounced on the sunlit side of the earth than on the dark side. Hence there is created a rhythmic undulation associated with daily and annual solar cycles. These undulations are manifested as periodic fluctuations in the intensity of earth magnetism, and as variations in observed magnetic declinations.

Top of the Doughnut. It will be recalled that the magnetosphere was described as a huge doughnut wrapped around the earth's magnetic equator. The "holes" in the doughnut, which lie over the polar regions, are of particular interest because such phenomena as magnetic storms and the Aurora Borealis
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and Aurora Australis are concentrated in these regions.

The doughnut holes can also be thought of as huge funnels that suck in solar energy as it whizzes by in space. During solar flares, streams of “plasma” (consisting of electrons and protons) leave the sun and strike the earth’s magnetic envelope where the lines of force guide the particles earthward toward the polar regions. This streaming of particles produces an intensification of the lines of force which may last for hours, even days.

Magnetic storms are especially likely during periods of high sunspot activity. One effect of magnetic storms that is familiar to any radio fan is the interference with radio communications—especially those involving shortwave transmissions.

Other electromagnetic effects associated with magnetic storms include the increase in detectable X rays, intensified auroral displays, and the induction of electric currents in the earth’s crust. Transatlantic communications cables have had voltage surges in the order of 2000 volts at precisely those times when magnetic storms have been most pronounced.

**Whistlers.** Radio buffs are familiar with another magnetic phenomenon called “whistlers”—long, wailing sounds that often follow the crackling noises heard on AM radios after lightning discharges.

The lightning discharge generates radio waves which can be picked up by an antenna and converted and amplified into audible sounds. The crackles are caused by radio waves traveling directly from the point of origin to the receiving set. Whistlers are radio waves that originate from the same source, at the same time, which travel a far longer, more circuitous path before arriving at the radio’s antenna.

Referring to Fig. 11, assume that an electrical discharge occurs in the area marked A. The generated radio waves travel along the earth’s magnetic lines of force to the “conjugate point” B, from whence they are reflected back to A along the same path. Since this trip takes some seconds to occur, there is time enough for the radio waves to be dispersed into a spectrum of wavelengths; the shortest waves travel fastest, hence return to the point of origin first, while the longest waves return last because they travel slowest.

What was initially heard as a sharp crackle has now been time-stretched to reveal the various component frequencies in the form of a descending wail or whistle. This time-stretching might be compared to the familiar tape-recording technique in which a relatively short-duration sound is played back at slower than normal speed; by thus stretching the sound, its component characteristics are made more readily detectable.

The whistlers generally rebound back and

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**Fig. 11.** Whistlers heard on AM radio are triggered by lightning. It produces radio waves which travel along magnetic lines of force and rebound between points A and B. A time delay divides the wave into separate frequencies which travel at different speeds. This produces the long whistling sound in a receiver located in the middle latitudes.
forth several times giving a series of whistles of diminishing intensity. Fig. 12 shows the time intervals at which whistlers will be heard with a receiver at the point of origin, and with a receiver at the conjugate point where the signal rebounds. Whistlers are spaced at time interval ratios of 2:4:6:8:etc. at or near the lightning discharge; they are spaced at time interval ratios of 1:3:5:7:etc. at the conjugate (rebound) point in the other hemisphere. For example, if it takes a radio signal 2 seconds to reach the conjugate point, sets within 500 miles of the lightning will detect whistlers after 4, 8, 12, and 16 seconds after the lightning discharge.

Whistlers are heard only in the middle latitudes. Near the polar regions the magnetic field paths are too long for signal transmission; near the equator they are too short.

**Ships and Mines.** The average landlubber undoubtedly believes that about all you need do is plunk a compass into the ship's binnacle and set off unerringly to the far corners of the earth. It isn't that easy, largely because every steel ship that is constructed acquires a magnetism that could make the best compass virtually useless.

When a steel ship is being made, it is subjected to a lot of pounding, riveting, and heating. During this process the magnetic domains in the steel are joggled about sufficiently to enable them to align themselves with the earth's magnetic field, thus making the ship a large magnet. The magnetic pattern acquired by a ship is called the ship's "signature."

Figure 13 shows what happens if the ship is pointed north while on the ways, during construction. The ship becomes magnetized in such a way that the bow and bottom become the north pole, and the top and stern become the south pole. But a ship is usually floated before the final construction and fitting is completed. This work also requires heating and pounding which to some degree alters the original magnetic arrangement.

Two things can be done to nullify the effect of the ship's magnetism on the compass. It is normal practice to orient the ship by reference to external direction indicators such as the stars or some known reference points on land. When the heading of the ship is known, the compass can be adjusted to indicate as it should by the addition of a number of permanent magnets in the binnacle, underneath the compass.

The other expedient is to demagnetize the ship. This is done by winding coils of wires around the ship in various directions, and then sending electric currents through the wires. This procedure eliminates at least part of the initial magnetism acquired by the vessel. But additional magnetism can be picked up by the ship while in motion on the seas. This is often compensated by the use of electric coils strategically and permanently located aboard the ship.

The need to demagnetize all ships became vital during World War II after the Nazis invented the magnetic mine. The mines could be dropped to the bottoms of harbors because they did not require physical contact with the ship to detonate them. The mere passage of a ship over the mine was sufficient.

How does a magnetic mine work? By the use of a dip needle linked to a relay system that electrically detonates the charge when the needle is disturbed! While the mine is awaiting a victim ship, the dip needle points downward toward the point of greatest magnetic intensity within the earth. When a magnetic ship passes over the mine, the ship's magnetism partly counteracts the earth's magnetic attraction and causes the dip needle to move slightly. When it does, the relays close the detonating circuit and— **Blam!**—no ship.

**Magnetic Myths.** No general article about magnetism would be complete without at least passing mention of the mythology and superstition that has been fostered by the magic of magnetism. Some of it persists today.

It is to be expected that the ancients would associate magnetism with the work of the gods. But in time, simple awe gave way to flagrant opportunism on the part of quacks and pseudo-philosophers.

Paracelsus, a Swiss-born alchemist and physician living during the early 16th cen-

(Continued on page 114)
We've seen many CBers spend a fortune trying to "soup up" a CB rig to run a few extra watts of illegal power when they could have accomplished their goal by the simple feat of putting up a good antenna. In fact, the antenna is such a major factor in the makeup of a CB installation that, regardless of the amount you have spent on a rig, if the antenna isn't a good one—or if it's installed improperly—or it's not properly "matched" to the CB rig—or if it's old and corroded—then you've got a lot of expensive junk sitting in your shack or under your dash.

Just as there are many different CB rigs, there are also many antennas. Each has its own characteristics, and it's interesting to see how each of the manufacturers has applied his individual approach to the same basic types. You'll find that for each basic type of antenna, there are about a dozen variations on the theme. Why so many? Well, antennas are one of the few aspects of electronics where there is room for experimentation in wild, far-out designs—the antenna engineer has a chance to try his own approach.

Which approach is best? They're all good when installed properly. But first, you must know which mobile or base station antenna is the best basic type to fill the bill at your station.

**Antenna Gain.** The antenna is the component of your station which flings your CB signal out into the ether, so you can see why we place such emphasis on it. The difference between one antenna and another is its ability to concentrate your signal into
a radiation pattern where it will do the most for your coverage—an antenna can even provide actual amplification of your signal. Some antennas can take your 3.5-watt signal and boost it to the point where it is the equivalent of 120 watts! This amplification factor is known as "gain," and you'll find that it's a magic word when it comes to the subject of antennas.

Gain ratings are shown in terms of decibels (DB), and you'll see few ads or antenna spec sheets which don't make frequent references to the DB gain of a particular antenna. Trouble with these figures is, there are several different ways to measure or rate the gain of any given antenna, and the various manufacturers always seem to manage to find the measurement method that makes their product look the best. Every once in a while we've seen a few gain rating figures which, quite frankly, look as if they may have been helped along by a few DB's. Our point is, you should keep these things in mind when shopping for an antenna and not get too carried away with the published statistics.

Another thing to watch for is the term "up to" (also called "as much as"). When these words prefix antenna gain ratings (You get up to 12 DB gain), you should realize that they mean you'll definitely get some gain—possibly as much as 12 DB (but not more than 12 DB under any circumstances). But you may only get 3 DB gain.

An antenna which offers 3 DB gain will effectively double your signal, 6 DB gain means your signal is multiplied 4 times, 7 DB is 5 times, 10 DB is 10 times, and so on.

**Base Station Antennas.** There are two basic families of base station antennas: omni-directional (sometimes called non-directional) and directional.

Directional antennas are usually called "beams" or "Yagis," (although a few directional types don't fit into these two categories). They concentrate a CB signal in one particular direction.

Omni-directionals radiate your signal equally in all directions. Within this family are ground planes, coaxial antennas, and collinears.

**Omni-directional Types.** The basic omni-directional antenna is the half-wave dipole—in pure form, it exists mainly in theory

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**Hy-Gain's Magna Topper (top)**

antenna attaches to car roof with magnet.

**E-Z Mobile Mount (bottom)** attaches to trunk opening, requires no holes in car.
insofar as CB is concerned. The coaxial type antenna fits into this classification; however, it is little used for some unknown reason.

One step fancier than the coaxial type is the so-called ground plane antenna. This antenna consists of a vertical “whip” with 3 or 4 horizontal whips extending out from the base. Because this antenna has a low radiation angle (it keeps the signal aimed along the surface of the earth so that none is wasted in an upward direction). Four additional horizontal whips are sometimes added below the first set at the base of the vertical, this gives the antenna an even lower angle of radiation (and further range).

The ground plane was the original smash hit of CB; in the days before the exotic antennas appeared on the market everybody used one. There are still many in use today—it’s well liked because it’s efficient, inexpensive, and simple to erect.

As CB became more sophisticated, so did the antennas, and today we are in a wonderland of gain-producing omni-directional antennas. While many of these antennas look like overgrown ground planes, they are quite different from an engineering standpoint. The difference in operation is, that if you have a ground plane which will let you just barely work your mobile unit at 10 miles out, one of these will make the contact handily, without the grief of trying to hear somebody through tons of noise and static. The antennas that fit into this category include units such as the Hy-Gain CLR-II, Hy-Gain Vertipole, Astro Super Star Burst, Antenna Specialists Super Magnum, Mark Products Mark II, Shakespeare Long Ranger, Cush Craft Ringo, Webster BCL-I, New-Tronics Pro-27, Antenna Specialists Speakin’ Beacon (the top of the antenna lights up when you transmit), Mosley Devant I, among others.

Several smaller antennas for portable or temporary use (or apartment dwellers who don’t have access to the roof) have shown up during the last year. These are clever units and fill the bill nicely. If you’re interested in such an antenna, we suggest you seek out data on the following antennas: Elenex Tiger-Tail, Cush-Craft Trik Stik, or the DPZ Corporation’s Sky Top.

Omni-directional antennas should be considered for any station intended to be used for communications with roving mobile units, or with other base stations located in different directions.

Directional Antennas. For communications over great distances, it is usually worthwhile to use a directional antenna of one type or another. Not only do these antennas concentrate your signal in a powerful beam towards the desired direction, they also reduce interference from other stations on the channel which are not in the direction of the beam. The directional antenna may be mounted on a rotor, a device which permits you to turn the antenna so as to aim your signal in any desired direction. The rotor is controlled electrically from your operating position.

Beam antennas (or “Yagis”) start with the most basic type having 2 “elements.” This

New-Tronics comes on strong with a wide variety of CB gear and accessories. Left, is the TGM-1 trunk groove mount for the CBer not eager to drill holes in his chariot. The ZM-60 AM/CB Matcher below allows your CB antenna to simultaneously be used for the car radio. At right is the Hustler C-29-32 adjustable whip-antenna mount which incorporates a stainless-steel spring.
BASE STATION ANTENNAS

Hy-Gain's Duo Beam 10 is a twin-driven, 10 element beam with tremendous gain.

Antenna Specialist's Match-Maker beam offers both vertical and horizontal polarization.

Antenna Specialist's Scanner features 'electrical' rotation.

looks like the letter "H" mounted on a mast; it provides adequate directivity for most non-critical installations.

The trick is to keep adding elements to further sharpen the beam and directivity, and CB has its share of 3, 4, and even 5 element beams for those who want intense signal concentrations in a particular direction. For those who seek even further boost to their signal, the beam antennas may be matched (or "stacked," as it is known) with a second beam on the same mast. Such stacking produces really fantastic signals for those who want the ultimate in coverage. The largest commercially available pre-stacked beam is the Hy-Gain Duo-Beam 5, which has 10 elements.

Beams are available direct from most manufacturers. However, electronics parts catalogs list many antennas offering a wide choice.

There are several other interesting approaches to the problem of aiming your signal in one direction and since they are available to CBers, we might take a look at them.

The Cubical Quad (or just plain Quad) is a type of beam which has as its basic construction 2 gigantic "X" frames made of Fiberglas. It has good directivity, is inexpensive, is lightweight, and offers little wind resistance. A complete line of Quads is produced by Cubex and Master Mobile.

The polar diversity loop is something brand new to CB. Looking something like a Quad, it differs in the basic fact that you can switch your signal to either vertical or horizontal polarization. Since almost all CB transmissions are in the vertical plane, switching over to horizontal (both stations in the contact would have to do this for
maximum results) will cut out a considerable amount of interference from other stations using your channel. A polar diversity loop is now on the market from Avanti Research & Development, Inc.

A novel approach to directional antennas is in an antenna consisting of 3 vertical dipoles mounted on a frame that looks like an airplane prop. Down at your operating position, a control box permits you to selectively run your signal into any one of the dipoles and use the other two to reflect and amplify your signal in the desired direction. The antenna itself does not physically rotate, only your signal does. The antenna is available from Antenna Specialists under the trade name Scanner, and from Master Mobile Mounts under the name CB-47 Orbiteer.

Another method of rotating the signal without physically turning the antenna is by the so-called "phasing" method. This calls for the use of 2 standard omni-directional antennas placed in strategic proximity to each other. They are connected by a co-phasing control box which jockeys around the amount of signal to be fed into each of the antennas. The co-phasing control box is manufactured by Hy-Gain Electronics.

Last on our list of off-beat approaches to the directional antenna situation is the Antenna Specialists Match-Maker. This one is a cross between a beam and a ground plane, allowing you not only to rotate the antenna, but also switch its polarization from vertical to horizontal.

Base Station Installation. Installing your antenna shouldn't post any problems of traumatic proportions. The one thing to keep in mind is the fact that CB stations are regulated by the FCC as to the height of the antenna installation.

The rules, as presented by the FCC, have proven somewhat confusing. We suggest that you read over the antenna height section of Part 95 of the FCC's rules and regulations—then try to figure it out for yourself.

To help you out, we offer this interpretation: The maximum permissible height of a CB antenna is determined by the height of the specific structure upon which the antenna is mounted. If it is on a building, the antenna can extend only 20 feet above the top of a previous structure on the building (usually a vent pipe, chimney or water tower). If on its own pole or mast resting on ground level (even if braced to a building), it may not protrude more than 20 feet above the ground level. If on a pole, mast, or tower used for other transmitting antennas, the CB antenna may not exceed the top of the structure.

(Continued on page 110)
An up-to-date Broadcasting Directory of North American AM, FM and TV Stations, including a Special Section on World-Wide Shortwave Stations

In this issue of White's Radio Log we have included the following listings: U.S. AM Stations by Frequency, Canadian AM Stations by Frequency, U.S. Commercial Television Stations by States, U.S. Educational Television Stations by States, Canadian Television Stations by Cities, and World-Wide Shortwave Stations.

In Our Next Issue, October-November, 1967, the Log will contain the following listings: U.S. AM Stations by Location, U.S. FM Stations by States, Canadian AM Stations by Location, Canadian FM Stations by Location, and an expanded Shortwave Section. The shortwave listings are always completely revised in each issue of Log to insure 100 percent up-to-date information.

In the year-end December-January issue of RADIO-TV EXPERIMENTER, the Log will contain the following listings: U.S. AM Stations by Call Letters, U.S. FM Stations by Call Letters, Canadian AM Stations by Call Letters, Canadian FM Stations by Call Letters, and an expanded World-Wide Shortwave Section.

Therefore, in any three consecutive 1967 issues of RADIO-TV EXPERIMENTER magazine, you will have a complete cross-reference listings of White's Radio Log that is always up-to-date. The three consecutive issues are a complete volume of White's Radio Log that offers up to the minute listings that are not to be found in any other magazine or book. If you are a broadcast band DX'er, FM station logger, like to photograph distant TV test patterns, or tune the shortwave bands, you will find the new White's Radio Log format an unbeatable reference.

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Every effort has been made to insure accuracy of the information listed in this publication, but absolute accuracy is not guaranteed and, of course, only information available up to press-time could be included. Copyright 1967 by Science & Mechanics Publishing Co., a subsidiary of Davis Publications, Inc., 505 Park Avenue, New York, New York 10022.
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**KTIT Chehalis-Centralia, Wash.**
**KREN Renton, Wash.**
**KUJ Walla Walla, Wash.**
**WPLY Plymouth, Wis.**

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**1430—209.7**

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**KFWI Pull City, Ala.**
**Kittelton, Ariz.**
**KALX San Gabriel, Calif.**
**KJAC Santa Clarita, Calif.**
**KOSI Aurora, Colo.**
**MLB Stephendale, Ind.**
**WLAK Lakeland, Fla.**
**WPCG Panama City, Fla.**
**WQCD Covington, Ky.**
**WRCO Dalton, Ga.**
**WTTI Titusville, Fla.**

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**1450—206.8**

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**WDOB Aniston, Ala.**
**WDIG Dothan, Ala.**
**WLAG Muscle Shoals, Ala.**
**KLAM Cordova, Alaska**
**KAMT Douglas, Ariz.**
**NOT Present, Ariz.**
**KJW Camden, Ark.**
**KSYB Sylaca, Calif.**
**KWBN Enid, Okla.**
**KNYV Estevan, Col.**
**KPAL Palis Springs, Calif.**
**KSSL San Francisco, Calif.**
**KXEN Ventura, Calif.**
**KGMW Alamosa, Col.**
**KYOU Greenly, Colo.**
**WILM Wilmington, Del.**
**WGGB Montclair, Eng.**
**WGJB Brookville, Fla.**
**WGCN Miami, Fla.**
**WBNR Pensacola, Fla.**
**WSTU Stuart, Fla.**
**WGPS Alabany, Ga.**
**WCOU Corvallis, Ore.**
**WYAN Clearfield, Utah.**
**WHX Blue Oxen, Va.**
**WYGI Pittsburgh, Wisc.**
**WJWI Cleveland, Ohio**

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**August—September, 1967**
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August-September, 1967
Canadian AM Stations by Frequency

Canadian stations listed alphabetically by call letters within groups. Abbreviations: kHz, frequency in kilocycles; W.P., power in watts; d., operates daytime only; n., nighttime only. Wave length is given in meters.

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**U. S. Commercial Television Stations by States**

U. S. stations listed alphabetically by cities within state by states. Territories followed: see lists.

**Location**

- **C.L. Chan.**
- **Location**
- **C.L. Chan.**

**ALABAMA**

- Anniston: WHMA-TV 40
- Birmingham: WAPI-TV 12
- Decatur: WMSL-TV 23
- Dothan: WTVV-13
- Florence: WOWL-TV 13
- Huntsville: WVTW-10
- Mobile: WARA-TV 2

**ARIZONA**

- Flagstaff: KOVL-10
- Phoenix: KPHO-15
- Tucson: KGUN-6
- Yuma: KBLU-TV 13

**ARKANSAS**

- El Dorado: KTEV-10
- Ft. Smith: KJTV-4

**CALIFORNIA**

- Bakersfield: KBAK-20

August-September, 1967
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**U. S. Educational Television Stations by States**

Includes Non-Commercial Stations. U. S. Stations listed alphabetically by cities in state groups. Territories and possessions follow states.

Abbreviations: Chan. = channel; C.L. = call letters.
The Great DX Competition. Here we go again with another installment of the exclusive RTVE DX competition—no prizes or awards, just pride in seeing how high a score you can run up against your fellow DXers in a real fight to the finish.

The stations you'll be trying for aren't the run of the mill ones which everybody reports, they are real toughies—and they require some listening patience on your part. Scoring rules are listed at the end.

1. Can you hear the English language transmission on 6106 kHz at 1730 GMT? It's the way from Radio Mogadiscio in the Somali Republic of North Africa—a political hot spot and rare DX country.

2. Try digging Radio Uganda (in Kampala, Uganda) out from under Radio Ghana. Check 4976 kHz (Ghana is on 4980 kHz) at 2000 GMT. English starts at 2105 GMT.

3. Here's a rare one to add to your country collection, station VSI35 run by Cable & Wireless W. I. Ltd., Grand Turk, Turks & Caicos Islands. They are on 8000 kHz with 100 watts at 1830 daily (except Sunday). They're only on for about 15 minutes so don't dilly-dally! They QSL too.

4. How about Male Sinico Radio in the obscure Maldives Island? Look for them on 3290 kHz at 1600 GMT, 7225 kHz at 1300 GMT, 9540 kHz at 0830 GMT.

5. If you haven't yet heard Yemen, now is your big chance. Watch for Radio Sanaa. They have been heard at 1730 GMT on 5805 kHz announcing (in Arabic) "Idhaatul djamhourit el arabaya finnali yemeni min Sanaa."

6. A real mystery station broadcasting from an unknown location is Radio Peyk-Ye-Iran; look for it on 9560, 11410 and 11695 kHz at 1400 to 1830 GMT.

7. Goteborg Radio is a coastal station transmitting news and other data to ships from a location 20 miles south of Goteborg, Sweden. It can be heard on 11120 kHz at 0700, 1223, 1715 GMT.

8. An interesting and unusual catch is station HL2AW, the Voice of Chung Goo, Taegu, Republic of Korea. The station is operated by the students of Chung Goo College. It's heard on 7125 kHz from 0830 GMT.

9. How many ships can you hear on 2182 kHz in a 5 minute period? Try it and see.

10. How many Civil Air Patrol stations can you hear on 26620 kHz in a 1 hour period?

Scoring: 10 points each for numbers 1 through 8, 1 point for every station heard in number 9 and 10. A score of 30 is good, 50 is great.

Let us know how you made out!
### 90-Meter Band—3200 to 3400 kHz

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### 60-Meter Band—4750 to 5060 kHz

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### 49-Meter Band—5950 to 6200 kHz

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- David L. Cross, Barrie, Ont.
- Charles Gebbert, Washington, D. C.
- Larry Nelson, Chicago, Ill.
- Billy Gwipia, Glen Cove, N. Y.
- Richard Walsh, Harmony, R. I.
- Carl Durnavich, Riverdale, Ill.
- Robert Menn, Sr., Hialeah, Fla.
- Edward Cotton, Chesapeake, Va.
- Charles Fallon, Old Bridge, N. J.
- David Scott, Pusakli, N. Y.
- Tom Kroenel, New York, N. Y.
- Ronald Renegar, Huntsville, Ala.
- Steve Grizzle, Ashland, Ky.
- Rick Slattery, Key West, Fla.
### 25-Meter Band—11700 to 11975 kHz

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### 16-Meter Band—17700 to 17900 kHz

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### 13-Meter Band—21450 to 21750 kHz

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<td>25100</td>
<td>LBA</td>
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LITERATURE

* Starred items indicate advertisers in this issue. Consult their ads for additional information and specifications.

LIBRARY

108

CB AMATEUR RADIO—SHORTWAVE RADIO

121. Going CB? Then go CB Center of America. Get their catalog and discover the big bonus offered with each major product—serves all 50 states.

107. Get with the mobile set with Tram's XL-100. The new Titan CB base station, another Tram great, is worth knowing about.

116. Pep-up your CB rig’s performance with Turner's M-2S mobile microphone. Get complete spec sheets and data on other Turner mikes.

103. Heath Co. has a new 23-channel all-transistor 5-watt CB rig at the lowest cost on the market, plus a full line of CB gear. See their new 10-based AM/FM/Shortwave portable and line of shortwave radios.

101. If it's a CB product, chances are International Crystal has it listed in their colorful catalog. Whether it or you’ve been looking for it, this CB-oriented company can be relied on to fill the bill.

89. Hy-Gain's new CB antenna catalog is packed full of useful information and product data that every CBer should know. Get a copy.

111. Get the scoop on Veesatronics’ Versa-Tenna with instant magnetic mounting. Antenna models available for CBers, hams and mobile units from 27 MHz to 1000 MHz.

45. CBers, get World Radio Labs catalog—a big first for WRL. If you need anything for base mobile use, WRL has it. Best catalog buy there is and it's free.

115. Get the full story on Polytronics Laboratories' latest CB entry—Carry-Comm. Get Full 5-watts, great for mobile, base or portable use. Works on 12 VDC or 117 VAC.

50. Make your connection with Amphenol—tune in to the latest on CB product news with specs and pics on new gear. Keep informed on Amphenol’s new products.

100. You can get increased CB range and clarity using the "Cobra" transceiver with speech compressor—receiver sensitivity is excellent. Catalog sheet will be mailed by B&K Division of Electrosonic Corporation.

54. A catalog for CBers, hams and experimenters, with outstanding values. Terrific buys on Grove Electronics' antennas, mikes and accessories.

96. If a rugged low-cost business/industrial two-way radio is what you've been looking for, be sure to send for the brochure on E. F. Johnson Co.'s brand new Messenger "202.

102. Squires-Sanders would like you to know about their CB transceivers, the "23'er" and the new "S55." Also, CB accessories that add versatility to their 5-watters.

46. A long-time builder of ham equipment, Hallicrafters will send you lots of info on ham, CB and commercial radio-equipment.

KITS

104. Here's a colorful 108-page catalog containing a wide assortment of electronic kits. You’ll find something for any interest, any budget. And Heath Co. will happily send you a copy.

117. EICO's new 48-page 2-color, kit-size short form catalog is just off the press. Over 250 products: Ham radio, CB, hi-fi—in kit and wired form—are illustrated. Also, discover EICO's new experimenter kit line.

ELECTRONIC PRODUCTS

66. Try instant lettering to mark control panels and component parts. Datak's booklets and sample show this easy dry transfer method.

108. Get the facts on Mercury's line of test equipment kits—designed to make troubleshooting easier, faster and more profitable.

57. "Get the most measurement value per dollar," says Electronics Measurements Corp. Send for their catalog and find out how.

92. How about installing a transistorized electronic ignition system in your current car? AEC Laboratories will mail their brochure giving you specifications, schematics.

109. Seco offers a line of specialized and standard test equipment that's ideal for the home experimenter and pro. Get specs and prices today.

ELECTRONIC PARTS

1. Allied's catalog is so widely used as a reference book, that it's regarded as a standard by people in the electronics industry. Don't you have the latest Allied Radio catalog? The surprising thing is that It's free!


103. No electronics bargain hunter should be caught without the 1967 copy of Radio Shack's catalog. Some equipment and kit offers are so low, they look like misprints. Buying is believing.

5. Edmund Scientific's new catalog contains over 4000 products that embrace many interests and fields. It's a 146-page buyer's guide for Science Fair fans.

106. With 70 million TV's and 240 million radios somebody somewhere will need a vacuum tube replacement at the rate of one a second! Get Universal Tube Co.'s Tube Cross Reference Chart and facts on their $1 flat rate per tube.

4. Olson's catalog is a multi-colored newspaper that's packed with more bargains than you ever thought had names. Don't believe us? Get a copy.

7. Before you build from scratch check the Fair Radio Sales latest catalog for electronic gear that can be modified to your needs. Fair way to save cash.

6. Bargains galore, that's what's in store! Poly-Fak Co. will send you their latest eight-page flyer listing the latest in available merchandise, including a giant $1 special sale.

10. Burstein-Applebee offers a new giant catalog containing 1000's of big pages crammed with savings including hundreds of bargains on hi-fi kits, power tools, tubes, and parts.

11. Now available from EDI (Electronic Distributors, Inc.): a catalog containing hundreds of electronic items. EDI will be happy to place you on their mailing list.

12. VHF listeners will want the latest catalog from Kuhn Electronics. All types and forms of complete receivers and converters.

10. Tab's new electronics parts catalog is now off the press and you're welcome to have a copy. Some of Tab's bargains and odd-ball items are unbelievable.

117. Harried by the high cost of parts for projects? Examine Biyelaw's 13th Anniversary catalog packed with "Lucky 13" specials.

HI-FI/AUDIO

85. Need a tuner? Preamp? Amp? Tape deck? Then inspect Dynaco for kilowatt or wired units. It's worthwhile looking at test reports Dynaco sends your way.

119. Kenwood puts it right on the line. The all-new Kenwood stereo-FM receivers are described in a colorful 16-page booklet complete with easy-to-read-and-compare spec data. Get your copy today!

15. Acoustic Research would like to send you a copy of their fact-packed "Stylus Force" booklet—must reading for hi-fi bugs.

16. Discover why Lab 80 by Garrard offers top dollar value. 32-page Garrard Comparator Guide will make you a wiser buyer.

17. Electro-Voice has two new, pocket-size, four-color product guides for you. One covers speakers and components; the other, microphones and accessories.

19. Empire has made exceptional advances in speaker cabinet design you should read about. Also, Empire's successes in the turntable and cartridge fields are worth discovering.

24. Need a hi-fi or PA mike? University Sound has an interesting microfont booklet audio fans should read before making a purchase.

27. 12 pages of Sherwood receivers, tuners, amplifiers, speaker systems, and cabinetry make up a colorful booklet every hi-fi bug should see.

95. Confused about stereo? Want to beat the high cost of hi-fi without compromising on the results? Then you need the new 24-page catalog by Jensen Manufacturing.

99. Get the inside info on why Acoustech's solid-state amplifiers are the rage of the experts. Colorful brochure answers all your questions.

TAPE RECORDERS AND TAPE

113. Get a packet full of facts and tape data from Scotch-3M and learn all about your tape recorder and the tape it needs.

31. All the facts about Concord Electronics Corp. tape recorders are yours for the asking in a free booklet. Portable, battery operated to four-track, fully transistorized stereo covers every recording need.

32. "Everybody's Tape Recording Handbook" is the title of a booklet that Sarkes-Tarzian will send you. It's 24-pages jam-packed with info for the home recording enthusiast. Includes a valuable table of recording times for various tapes.

33. Become the first to learn about Norelco's complete Carry-Corder 150 portable tape recorder outfit. Four-color booklet describes this new cartridge-tape unit.

34. "All the Best from Sony" is an 8-page booklet describing Sony-SuperScope products—tape recorders, microphones, tape and accessories. Get a copy before you buy!

35. If you are a serious tape audiophile, you will be interested in the new Viking of Minneapolis line—they carry both reel and cartridge recorders you should know about.

91. Sound begins and ends with a Uher tape recorder. Write for this new 20 page catalog showing the entire line of Uher recorders and accessories. How to synchronize your slide projector, execute sound on sound, and many other exclusive features.

HI-FI ACCESSORIES

112. Telez would like you to know about their improved Serenata Headset—and their entire line of quality stereo headsets.

98. Swinging to hi-fi stereo headsets? Then get your copy of SupereX Electronics' 16-page catalog featuring a large selection of quality headsets.

104. You can't hear FM stereo unless your FM antennas can pull 'em in. Learn more and discover what's available from Fisco's 6-page "Third Dimensional Sound."

SCHOOLS AND EDUCATIONAL

61. ICS (International Correspondence Schools) offers 236 courses including many in the fields of radio, TV, and electronics. Send for free booklet "It's Your Future."

74. Join the troubleshooters! Let CIE (Cleveland Institute of Electronics) train you to keep our electronics world running.

114. Prepare for tomorrow by studying at home with Technical Training International. Get the facts today on how you can step up in your present job.

59. For a complete rundown on curriculum, lesson outlines, and full details from a leading electronic school, ask for this brochure from the Indiana Home Study Institute.

105. Get the low-down on the latest in educational electronic kits from Trans-Tek. Build light dimmers, amplifiers, metronomes, and many more. Trans-Tek helps you to learn while building.

TOOLS

76. Need a compact screwdriver kit? Xcelite's 99PV-4 and 99PV-6 consists of handle, 3 and 5 blades, respectively, in "see-thru" zipper case. Get Xcelite's catalog 166.

118. Secure coax cables, speaker wires, phone wires, etc., with Arrow staple gun tackers. 3 models for wires and cables from 3/16" to 3/4" dia. Get fact-full Arrow literature.

TELEVISION

70. The Heath Co. now has a 19" color TV to complement their 21" and 25" models. A new B&W portable model will be a hot seller for the mobile set. Get the facts today!

97. Interesting, helpful brochures describing the TV antenna discovery of the decade—the log periodic antenna for UHF and VHF-TV, and FM stereo. From JFD Electronics Corporation.
Mobile Antennas. Mobile antennas, like base station antennas, come in all shapes, sizes, and forms—in almost all instances they are of the omni-directional type.

The type of antenna you use depends on the mounting position you have selected. In the section of this book called "Your Mobile Station" we discuss the merits of the various mounting locations on your car.

While there are many mobile antennas to choose from, they aren't quite as mysterious as the base station giants.

All mobile whip antennas are an electrical quarter-wavelength—whether they are 19 inches long or stretch out for 108 inches. The usual rule is the more steel you can hang, the better the signal output—however, that rule (which is parroted by most CBers) is a fallacy!

A quarter-wave antenna radiates primarily from the high current area which happens to be at the base of the antenna. If the lower half of the antenna is replaced by a loading coil, the predominant radiation is from the loading coil and that hasn't too much area. This is true despite the fact that many people report results with loaded antennas which rival full length (108") whip antennas—mainly because the loaded antennas can be placed in a better location on the vehicle than can a long whip.

Teeny 'Tennas. Hy-Cain holds down the fort in the tiny antenna sweepstakes with their 19 inch Shorty Roof Topper, a performance-packed antenna with a solid state loading coil at the top. It's about the smallest thing we've seen on CB yet—a good bet for folks who want their mobile installation to be as unobtrusive as possible.
Speaking of being unobtrusive, you can be a full fledged mobile CBer without any external advertising on the car by means of the so-called CB-AM antennas, which are available from several manufacturers. These antennas replace the existing car radio antenna on your car, and then provide double service as the CB antenna and the car’s broadcast antenna. You can even play the car radio while you transmit on CB—there’s no interference.

For those of you who shrink at the thought of drilling holes in the family chariot, there’s always the old reliable bumper mount for full length whips. Many of the shortened whips are available with non-hole mounts, which call for the antenna to be mounted in the car’s rain gutter, on the upper edge of the trunk lid, or permit the antenna to be held to the car by means of powerful magnets. Most manufacturers now carry a selection of no-hole antennas and mounts.

Coaxial Cable. We don’t want to sign off here without kicking around the subject of coaxial cable; that’s the stuff you will use between your CB rig and antenna as the feed line or lead in. It can affect your signal as much as any other component in the system.

Coaxial cable seems to constantly be the subject of great misinformation. In CB, it makes no effective difference what the dickens you use as transmission line. True, some power is lost in the transmission line, but it’s a spit in the ocean. Ordinary RG-58A/U coaxial cable has a loss of 2 DB per 100 feet. The receiving station can only notice a change of 3 DB or more—so big deal! If you have a 100 foot transmission line the loss is less than the receiving station can hear. You’re fussy? So go ahead and use that heavy, unwieldy and expensive RG-8/U cable, it only has a 1-DB loss per 100 feet; let’s see the receiving station that can hear that. And how many CB installations have runs of 100 feet—very few. The usual installation of RG-58A/U would most likely have a loss of ½ DB or less.

And don’t believe that old wives’ tale about getting a better match between the rig and antenna by trimming the coaxial cable to a certain length. That’s hogwash! Any time you can change your signal by trimming a few feet of cable you’ve got something wrong with your antenna. While it’s true that if you insert an SWR meter in varying lengths of cable between the same rig and antenna, you’ll possibly get different meter readings, this is only because the meter is being “tricked”—you’ve still got the same signal.

Another thing: don’t worship the readings of an SWR meter. While a perfect reading is almost impossible to obtain, we have seen excellent signals pouring forth with readings as high as 3 to 1.

The main thing to keep in mind about transmission lines in CB is that the cable should be changed and replaced every two or three years—the weather eventually gets to it and screws it up. Replace it if there are any cracks or breaks in the outer coating.

Be careful when attaching connectors to the cable. Very often a poor connection is the result of careless or sloppy soldering—and the connection can totally ruin what might have been a healthy signal.

Hy-Gain’s Balun coil is designed to properly match unbalanced coaxial cable to the balanced input of beam antennas for CB use.

This neat Hy-Gain co-phasing control box lets you aim your signal electronically when used with two omni-directional antennas.
Black Widow
Continued from page 51

a small universal output transformer on the inside face of the cabinet and connected the lowest impedance tap of the primary winding in series with the speaker voice coil. A conventional phone plug and cord can be fed through a grommeted hole in the rear face of the cabinet and connected to the lowest impedance tap on the secondary of the transformer; a phone jack (J2), which is wired in series, is installed on the rear cabinet face as shown in photo. It is then only necessary to insert plug (P1) into the receiver output jack and push the phone plug into phone jack J2 on the rear of the monitor cabinet.

Another fringe benefit: turning the volume control counter-clockwise increases headphone volume and decreases that of the speaker. Clockwise rotation of the volume control produces the opposite effect; speaker volume goes up and headphone volume down. What could be more perfect?

Incidentally, a key may be left continuously plugged into the jack on the panel face if desired for code practice, and it will not interfere with the monitor in any way.

So why not get with it? Build yourself a little gadget like this, either mounted on a breadboard or dressed up like we did. In no time, you'll be able to really listen to your CW style when you're batting it out!

Positive Feedback
Continued from page 11

him to "do better and I'll buy them!"
That's right, Mitchell, Tom did do better. Eventually, Tom quit his job with a famous movie company to enter the editorial field. Tom went on to become the greatest CB'er in America. And would you believe this, Mitchell? Tom called when he saw the same article and gave us the exact same pitch you did—except he still reads Radio-TV Experimenter.

There is one other clown you have to know about, Mitchell. That's Herb Friedman, W2ZLF. Herb walked into our Editor's office about nine years ago and said our Editors were the world's worst construction projects. Our Editor said, "Nuts!" (He always liked Army talk) "Do better!" No sooner were the words spoken than Herb began to unpack the box he had with him. Since Herb was a head taller than our Editor plus 50 pounds to the good, his story was published.

Believe it or not, Mitchell, a kit manufacturer still sells it! Also, Herb is now the most published electronics construction author in America today. Herb's comments about the FCC article was "... maybe you should have run some girlie pictures instead!" (Herb still reads Radio-TV Experimenter.)

Now what are we driving at, Mitchell? We're trying to tell all the special and esoteric hobby groups to keep an open mind to the opposition. After all, if all the dyed-in-the-wool hams gave up anything and everything that opposed or interfered with their hobby—byes, sex, then how will they perpetuate their kind???

Red Cycles in the Spectrum. Those readers who have built our long-wave VLRF receiver (featured in the April-May 1967 Radio-TV Experimenter) have a treat in store for them. Mao's pals in Chop Suey Land have put a powerful long-wave transmitter on the air around 16 kilohertz (kc). It has been reported that England's GRB on 15.975 kHz has suffered interference as far away from China as South America and Iceland.

This Asian newcomer is tough station to DX and QSL. The Chinese Reds come on for a few minutes at a time and then get off. There is no apparent schedule. Also, if you hear them, who do you send your verification to? Until that question can be answered we would like to receive reports from our readers. Try to pinpoint the exact frequency, if possible, and record exact times. Use GMT for reporting. Send your reports to the Editor, c/o Radio-TV Experimenter. In the meantime, here's soy sauce in your eye!
"Not really, until I pick up the signal."
It changed to green; she stepped lightly on the gas. "What channel are you on?"
"The pirate was reported on 9 shortly after nine." I did know my business, really.
"Well, this early in the morning I don't feel like just playing games." Traffic heavier now, slower, and still more smog. "Check the other channels." Determined. "It won't hurt nothing."

Decided to humor her. 8, image of local 7. 9 again, still CFLO. 10, absolutely nothing. 11, CHCH from Hamilton. 12, WICU, Erie.
Stopped on a yellow light. Somebody behind us banged his horn.
I switched to 13, the jackpot. A test pattern from "EARTHVISION, illegal TV and proud of it!"
"I've got them!" In color, no less. Pointed my camera at the screen and snapped it five times. EARTHVISION, one of many aliases used by Reality Anonymous, the secret society responsible for all my SBTV failures so far. From New Orleans they broadcast as Muddy Video, Inc.; from Seattle as Quake TV; from Honolulu as Typhoon Television—all pirates we hadn't been able to catch.
Mona nodded and we were moving again.
Now on my screen, a shot of the sun—flirt. Then the camera penetrates it. Inside a paradise, lush garden with transparent creatures flitting around.
"It's starting to fade."

Mona swung east onto Tupper.
A silver space ship blasts off, complete with transparent crew. Earth, which is shrouded in smog. Closeup of miserable humans like Gomer Pyle, Hogan's Heroes, and Gilligan groaning around in the dark. Spaceship to the rescue, lads! My camera was clicking like a spastic slot machine in a Las Vegas jail.
Signal no better, no worse as we crossed Main Street.
Spaceship takes grateful humans off this foul planet. Takes them back to the sun. Where they are BARBECUED.

Frantically, I maneuvered the direction finder but couldn't hit anything approaching a permanent fix. Back to a test pattern. Picture deteriorating into the ignition noise.

"Go back downtown."
Mona swung south into Michigan Avenue. EARTHVISION improved noticeably, then held at constant level.
"It must be moving, too. Can't you go any faster?"
"Not in this." Laughed, deep, defiant. "You want me to fly?"

We approached a demolition area. The city had cleared a block of old buildings, smashed them, leaving giant heaps of rubble burning. The smog got thicker; Mona switched on the headlights but it didn't help much.

EARTHVISION switched test patterns. This one read "Help stamp out Sunlight."
Mona glanced over her shoulder at me. I'd begun to sweat. We passed a bus; its ignition system drove the vertical control crazy for a moment.
"Don't work so hard. It's not that big a thing."

She looked me by surprise. I considered it briefly. "We're protecting our nation—civilization." Recalled one of those great lines from situation comedy. "We must struggle toward the light." Tried to remember some gem of positive thought from BONANZA.
Outside we could barely see 10 feet ahead of us.
Her softly from the front. "I don't know. Sometimes the dark is better."

I never played on the job, regardless of the invitation. "Not when you're chasing pirate television transmitters." Out of film, I reached into the front seat for another roll, and spotted it.

Beside Mona on the front seat was a tiny remote control unit. She tapped it, the picture improved. "Are we gaining on them?" More of that soft feminine tone.

I leaned back quickly so she wouldn't know I had seen. "Pull over to the curb."

She obeyed, simultaneously tapping her control. EARTHVISION faded, but this time Mona caught me watching her. She hit it one more time and our "pirate" left the air.

Like I was in shock. "Where's the transmitter?"
Mona deadpan. "Under the front seat along with a video tape recorder." She held up the control unit so I could get a better look. The lettering on it read R-E-A-L-I-T-Y. Her defiant laugh again. "And what are you going to do about it, Mr. Censor?"
Magnetism
Continued from page 83

tury, is credited with beginning the mystic

cult generally known as the "magnetisers."
The magnetisers claimed they could perform
all sorts of miracles with the aid of magne-
tism. For example, Paracelsus proclaimed
his ability to cure any ailment and stop the
process of decay. He even boasted that it
was possible to transplant diseases from hu-
mans to the earth by the use of magnetic
substances mixed with pulverized mummies
and other exotic materials.

Other magnetisers carried on the quack-
ery far into the 17th century, long after Wil-

liam Gilbert had discovered the existence
of earth magnetism. But we shouldn't be too

ready to jeer at the ancients who, after all,
knew far less about magnetism than we do.
Even our so-called civilized societies still
have cults proclaiming the mystic powers of
magnetism.

Magnetism also crops up in the pseudo-
science invented by the more fanatic element
of the flying saucer cult. Others who sim-
ply know little or nothing about magnetic
phenomena are ready to read great signi-
ficance into the most ordinary and almost
commonplace happenings.

A case in point was the recently televised

interview between a panel of science experts
and Mr. and Mrs. Barney Hill—the couple
claiming to have been captured by the crew
of an Unidentified Flying Object. The pan-
elists who examined the Hills' story included
three professors from leading universities
and science writers of a well-known maga-
zine and newspaper.

At one point Mrs. Hill made much of her
observation that a compass behaved very
erratically when it was held near some mys-
terious spots that had appeared on her car
after the alleged UFO encounter. One of
the learned panelists hastened to warn Mrs.
Hill that a compass could not possibly detect
radioactivity, if that is what she was sug-
gestng. The panelist concluded that perhaps
there was some sort of mysterious "dynamo"
effect in the car.

It seems incredible that not one of the
five science experts could provide the ob-
vious explanation of the compass' behavior.
Try putting a compass near anything made
of iron or steel and see what happens. Start
with your own car and work down to an
eight-penny nail. The results will always be
the same; you may end up proving that
UFOs have irradiated your nail box!

The TV incident is relevant to our discus-
sion of magnetism for one reason. It un-
derscores the fact that magnetism is still
"magic" to many people—even college pro-
fessors!

Electronic Rooster
Continued from page 48

You will have to set your alarm clock to
get you up early one morning so that you
can set the Electronic Rooster. First, place
the unit on a window sill or on a table near
the window. Be sure the lights in the room
are off, that the PE cell is aimed out the
window towards the east, and that switch S1
is on.

As the sun comes up, adjust sensitivity
control R1 until the Sonalert comes on. You
can experiment with different angles for the
PE cell housing and different control settings
until the alarm works as you want it to.

When you go to bed at night, turn switch
S1 on (with the room lights off) and in the
morning when the sun rises, Rooster will
wake you up. Just keep in mind that like all
roosters, he'll skip cloudy and rainy days and
let you sleep in on those mornings.

SCR Range Expander
Continued from page 70

For controlling heat of soldering pencils
and irons, use the Range Expander for con-
trol over the entire range of heats. The me-
dium to high heat range obtainable when
using the Range Expander makes it possible
to control heating to help retard tip oxida-
tion and component damage while provid-
ing enough heat to do the job (don't try to
solder with a cool iron).

As the load current becomes larger, the
knob rotation required of R2 to go from
minimum to maximum output becomes less.
Though not usually required, the control
of a larger load can be spread out over more
of the dial by connecting a one-watt resistor
of from 120 to 390 ohms across the ends of
R2. If you do this, you may want to include
a toggle switch to switch the resistor in and
out.
THERE IS NO CHARGE FOR THE ZIP CODE — PLEASE USE IT IN YOUR CLASSIFIED AD

August-September, 1967

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How to get into
One of the hottest money-making fields in electronics today—
servicing two-way radios!

More than 5 million two-way transmitters have skyrocketed
the demand for service men and field, system, and R&D engi-
neers. Topnotch licensed experts can earn $12,000 a year
or more. You can be your own boss, build your own com-
pany. And you don't need a college education to break in.

How would you like to start col-
lecting your share of the big
money being made in electronics today?
To start earning $5 to $7 an hour...
$200 to $300 a week... $10,000 to
$15,000 a year?
Your best bet today, especially if you
don't have a college education, is prob-
ably in the field of two-way radio.

Two-way radio is booming. Today
there are more than five million two-
way transmitters for police cars, fire de-
partment vehicles, taxis, trucks, boats,
planes, etc. and Citizen's Band uses—
and the number is still growing at the rate
of 80,000 new transmitters per month.

This wildfire boom presents a solid
gold opportunity for trained two-way
radio service experts. Many of them are
earning $5,000 to $10,000 a year more
than the average radio-TV repair man.

Why You'll Earn Top Pay
One reason is that the United States
Government doesn't permit anyone to
service two-way radio systems unless he
is licensed by the Federal Communica-
tions Commission. And there simply
aren't enough licensed electronics ex-
erts to go around.
Another reason two-way radio men earn so much more than radio-TV service men is that they are needed more often and more desperately. A home radio or television set may need repair only once every year or two, and there's no real emergency when it does. But a two-way radio user must keep those transmitters operating at all times, and must have their frequency modulation and plate power input checked at regular intervals by licensed personnel to meet FCC requirements.

This means that the available licensed experts can "write their own ticket" when it comes to earnings. Some work by the hour and usually charge at least $5.00 per hour, $7.50 on evenings and Sundays, plus travel expenses. A more common arrangement is to be paid a monthly retainer fee by each customer. Although rates vary widely, this fixed charge might be $20 a month for the base station and $7.50 for each mobile station. A survey showed that one man can easily maintain at least 100 stations, averaging 15 base stations and 85 mobiles. This would add up to at least $12,000 a year.

**Be Your Own Boss**

There are other advantages too. You can become your own boss—work entirely by yourself or gradually build your own fully staffed service company. Instead of being chained to a workbench, machine, or desk all day, you'll move around, see lots of action, rub shoulders with important police and fire officials and business executives who depend on two-way radio for their daily operations. You may even be tapped for a big job working for one of the two-way radio manufacturers in field service, factory quality control, or laboratory research and development.

**How To Get Started**

How do you break into the ranks of the big-money earners in two-way radio? This is probably the best way:

1. Without quitting your present job, learn enough about electronics fundamentals to pass the Government FCC Exam and get your Commercial FCC License.
2. Then get a job in a two-way radio service shop and "learn the ropes" of the business.
3. As soon as you've earned a reputation as an expert, there are several ways you can go. You can move out and start signing up and servicing your own customers. You might become a franchised service representative of a big manufacturer and then start getting into two-way mobile sales, where one sales contract might net you $5,000. Or you may even be invited to move up into a high-prestige salaried job with one of the major manufacturers either in the plant or out in the field.

The first step—mastering the fundamentals of Electronics in your spare time and getting your FCC License—can be easier than you think.

Cleveland Institute of Electronics has been successfully teaching electronics by mail for over thirty years. Right at home, in your spare time, you learn electronics step by step. Our Auto-Programmed™ lessons and coaching by expert instructors make everything clear and easy, even for men who thought they were "poor learners." You'll learn not only the fundamentals that apply to all electronics design and servicing, but also the specific procedures for installing, troubleshooting, and maintaining two-way mobile equipment.

**Get Your FCC License... or Your Money Back!**

By the time you've finished your CIE course, you'll be able to pass the FCC License Exam with ease. Better than nine out of ten CIE-trained men pass the FCC Exam the first time they try, even though two out of three non-CIE men fail. This startling record of achievement makes possible the famous CIE warranty: you'll pass the FCC Exam upon completion of your course or your tuition will be refunded in full.

Ed Dulaney is an outstanding example of the success possible through CIE training. Before he studied with CIE, Dulaney was a crop duster. Today he owns the Dulaney Communications Service, with seven people working for him repairing and manufacturing two-way equipment. Says Dulaney: "I found the CIE training thorough and the lessons easy to understand. No question about it—the CIE course was the best investment I ever made."

Find out more about how to get ahead in all fields of electronics, including two-way radio. Mail the bound-in postpaid reply card for two FREE books, "How To Get A Commercial FCC License" and "How To Succeed In Electronics." If card has been removed, just send us your name and address on a postcard.

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