HOME COMPUTERS THAT CAN TALK–AND WORK!
Page 35

elementary Electronics

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Move up to the all-new Cobra 29GTL. It's the third generation of the trucker-proven Cobra 29. And like the 29 and the 29XLR before it, it advances the state of the art.

Transmitter circuitry has been refined and updated to improve performance.

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By improving the transmitter circuitry the 29GTL keeps you punching through loud and clear. By incorporating new features for better reception everything you copy comes back loud and clear.

So if you're having second thoughts about your first CB, make your next CB the Cobra 29GTL.

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But more important than that, we sell it at a price you won't have second thoughts about.

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CIRCLE 9 ON READER SERVICE COUPON

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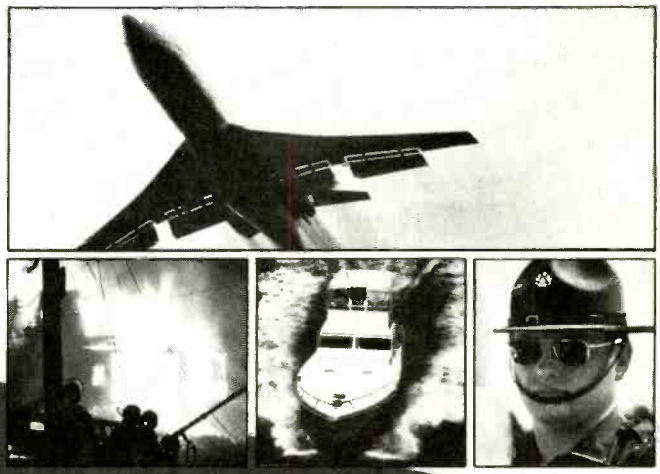
Only the incredible, new, no-crystal Bearcat 220 Scanner tunes in all the real excitement of the entire AM aircraft band—plus every FM public service frequency—with pushbutton ease.



Now.
Tune in all the real excitement of the wild blue yonder, at the touch of a button.

The new, no-crystal Bearcat 220 Scanner searches and tunes in the entire aircraft band. Jets at 30,000 feet. All the tense tower talk. Everything is pre-programmed in space-age memory banks.

Only the 7-band Bearcat 220 Scanner also brings home every public service frequency, too. Pre-programmed Marine frequencies. Police action. Fire calls. Weather warnings. You name it.

The new Bearcat 220 has all the features and quality Bearcat Scanners are famous for. Track tuning. Decimal display readout. Automatic Search. Selective Scan Display. Automatic squelch and lockout. Priority. And much, much more.

After all, Bearcat invented Scanning. And we'll stop at nothing to bring you all the excitement—of land, sea, and air.

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Follow the leader to real excitement.

CIRCLE 4 ON READER SERVICE COUPON

elementary electronics

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Volume 20, No. 5

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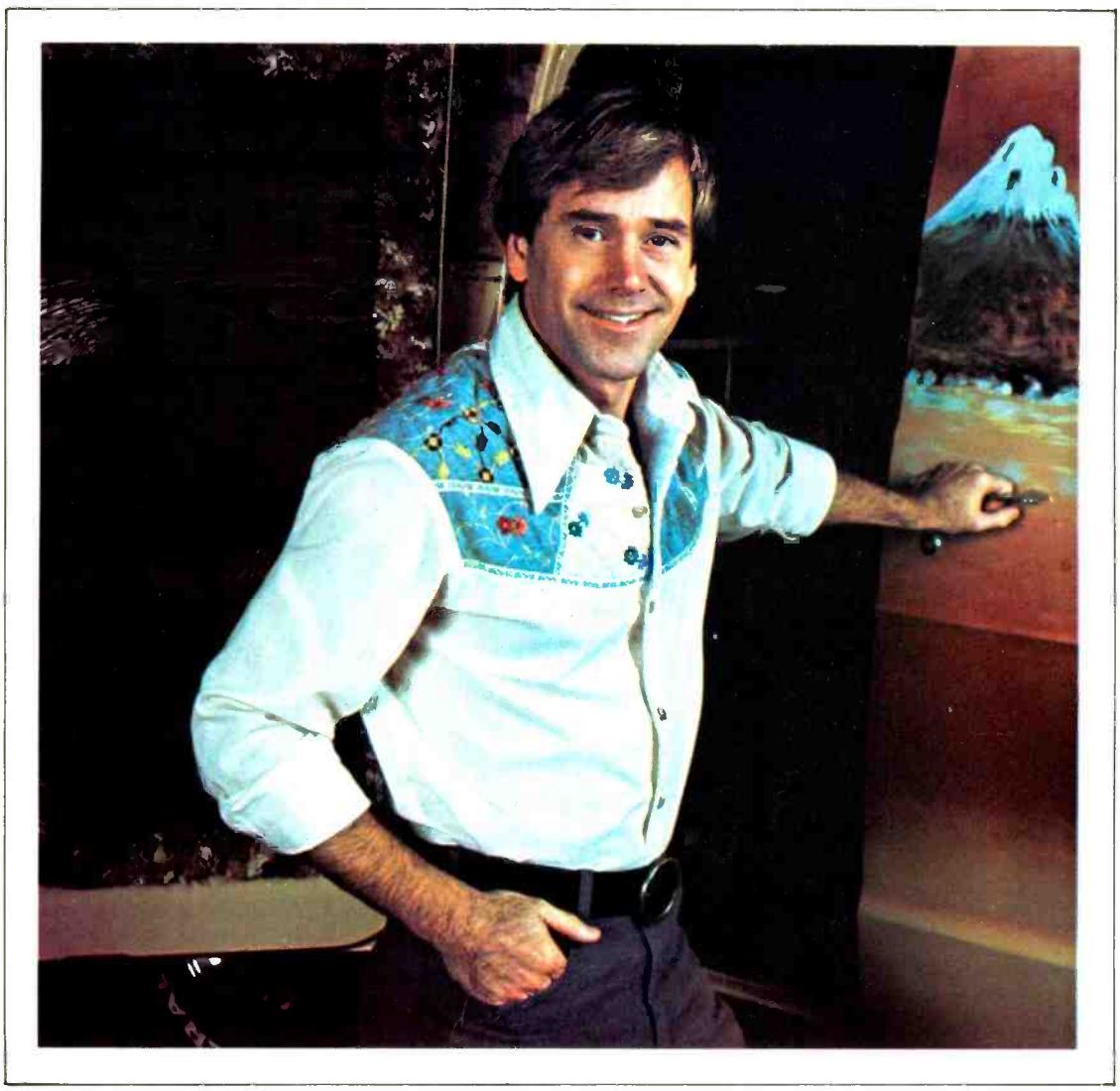
Cover photo by Dave Niedo

You gotta shop around.



When you do, you'll probably pick CIE. You can't afford to settle for less when it comes to something like electronics training that could affect your whole life.

When you shop around for tires, you look for a bargain. After all, if it's the same brand, better price—why not save money?

Education's different. There's no such thing as "same brand." No two schools are alike. And, once you've made your choice, the training you get stays with you for the rest of your life.

So, shop around for your training. Not for the bargain. For the best. Thorough, professional training to help give you pride and confidence.

* * *

If you talked to some of our graduates, chances are you'd find a lot of them shopped around for their training. They pretty much knew what was available. And they picked CIE as number one.

Why you should shop around yourself.

We hope you'll shop around. Because, frankly, CIE isn't for everyone.

There are other options for the hobbyist. If you're the ambitious type—with serious career goals in electronics—take a close look at what we've planned for you at CIE.

What you should look for first.

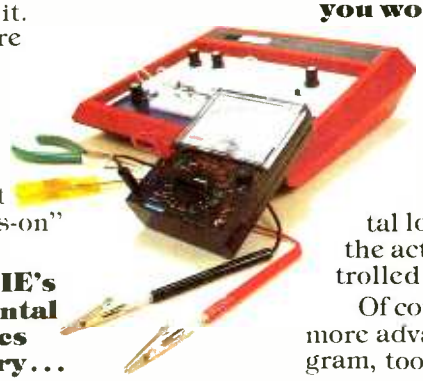
Part of what makes electronics so interesting is it's based on scientific discoveries—on ideas! So the first thing to look for is a program that starts with ideas and builds on them!

That's what happens with CIE's Auto-Programmed® Lessons. Each lesson takes one or two principles and helps you master them—before you start using them!

How practical is the training?

This is the next big important question. After all, your career will be built on what you can do—and on how well you do it.

Here are ways some of CIE's troubleshooting programs help you get your "hands-on" training...



With CIE's Experimental Electronics Laboratory... you learn and review the basics—perform dozens of experiments. Plus, you use a 3-in-1 precision Multimeter to learn testing, checking, analyzing!

When you build your own 5 MHz Triggered-Sweep, Solid-State Oscilloscope you take your first real professional step. You use it as a doctor uses an X-ray machine—to "read" waveform patterns... lock them in... study, understand and interpret them!

When you get your Zenith 19-inch Diagonal Solid-State Color TV you

Pattern simulated.

apply your new skills to some real on-the-job-type troubleshooting! You learn to trace signal flow... locate malfunctions... restore perfect operating standards—just as with any sophisticated electronics equipment!

When you work with a completely Solid-State Color Bar Generator—actually a TV signal transmitter—you study up to ten different patterns on your TV screen... explore digital logic circuits... observe the action of a crystal-controlled oscillator!

Of course, CIE offers a more advanced training program, too. But the main point is simply this:

All this training takes effort. But you'll enjoy it. And it's a real plus for a troubleshooting career!

Do you prepare for your FCC License?

Avoid regrets later. Check this out before you enroll in any program.

For some troubleshooting jobs, you must have your FCC License. For others, employers often consider it a mark in your favor. Either way, it's government-certified proof of specific knowledge and skills!

More than half of CIE's courses prepare you for the government-administered FCC License exam. In continuing surveys, nearly 4 out of 5 CIE graduates who take the exam get their Licenses!

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removes recorded material in two seconds and the background noise levels are reduced to below normal head level. It is available at audio salons nationwide for about $20.00. For further information on this product, write to Robins Industries Corp., 75 Austin Blvd., Commack, NY 11725.

Lightweight Magnet

Edmund Scientific is offering a magnet with a 150-pound pull that won't chip, peel or harden. Coated for protection against chemicals, it can be used for treasure hunting at the bottom of a river, a lake or even an ocean! Just tie a line to this lightweight magnet (weighs one pound) and drop it over the side of the boat. There's no telling just what metal treasure you might uncover. This

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Edmund exclusive magnet has six strong ceramic magnets stacked for strength with steel pole pieces, and an aluminum

(Continued on page 10)

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3600A	$199.95	50Hz - 600MHz	Oven .5 PPM 17° - 37°C	10MV	10MV	50MV	8	.5 Inch	115 VAC or 8.2 - 14.5VDC	2⅛"H x 8"W x 5"D
3550W	$149.95	50Hz - 550MHz	TCXO 1 PPM 65° - 85°F	25MV	25MV	75MV	8	.5 Inch	115 VAC or 8.2 - 14.5VDC	2⅛"H x 8"W x 5"D
3550K	$ 99.95									

1 HZ Resolution to 55 MHZ • 10 HZ Resolution to 550 MHZ • .1 and 1 Sec. Gate Time • Auto Zero Blanking

3550K Kit	**$99.95**
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HEY, LOOK ME OVER

(Continued from page 8)

frame and bar handle for easy carrying. Everything but the 3¼-inch-square gripping surface is covered with an ⅛-inch-thick, special heat-fused PolyVinyl Chloride that protects the magnet from corrosion by chemicals, acids, alkalis, plating solutions and some organic solvents. The magnet (No. 71,135) may be ordered by mail from Edmund Scientific, 7782 Edscorp Bldg., Barrington, NJ 08007. It sells for $19.95. Edmund's latest catalog containing five pages of various kinds of magnets, can be obtained free by writing to the same address.

Programmable Calculator with Constant Memory

A Texas Instruments programmable calculator, the Programmable 58C, with a Constant Memory feature, allows the calculator to retain program steps and data when turned off. The TI Programmable 58C adds the Constant Memory feature to the already powerful capabilities of the original TI Programmable 58. This new feature allows the calculator to retain data, program steps, and memory partitioning information when the unit is turned off. The new TI-58C calculator

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offers the flexibility of user-selectable partitioning of memory. This allows a maximum of 480 program steps or up to 60 memories, depending upon a program's requirements. The calculator can also use Solid State Software modules. The unit comes equipped with the Master Library Solid State Software module and may also be used with any one of 11 other optional modules. Solid State Software modules contain up to 5,000 program steps. The optional libraries offer the user access to a large number of programs without the need to write extensive software on his own. The suggested retail price of TI's Programmable 58C is $125.00. Get all the facts direct from Texas Instruments Inc., Consumer Relations, (Att'n: TI-58C), P.O. Box 53, Lubbock, Texas 79408.

Wrap It Up

The compact, WSU-2224 wire wrapping combination tool does the job of three tools at a fraction of their comparable prices. The tool wraps, unwraps and even strips wire thanks to a unique built-in stripping blade. Designed for use with

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22-24 AWG (0,65-0,50mm) wire on standard .030 x .060-inch (0,76 x 1,52 mm) and .045-inch (1,44mm) square posts. Takes minutes to learn to use and makes perfect connections in seconds without solder. Priced at $12.75 each, the WSU-2224 is available from stock. Write to O.K. Machine and Tool Corporation, 3455 Conner Street, Bronx, NY 10475.

Big Go Around

Avanti has a unique rotor and control system for CB and amateur communications. Called the Moonrotor, this new space age system is a natural companion to its namesake, the Moonraker, and the popular P.D.L. II (Polar Diversity Loop) antennas, also made by Avanti. Developed with design and production specialists at Cornell-Dubilier, the world's leading builders of antenna rotors, Moonrotor features an advanced solid state control system. A tough aluminum housing unit holds a double row 98-ball bearing support system that is driven through steel intermediate and ring gears by a stainless steel main drive. Moonrotor features a four pole high torque electric motor with a safe low voltage control which provides turning

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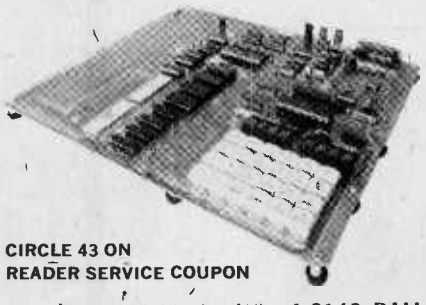
power for the big beams—up to 8.5 square feet of wind load area. A switch actuates precision beam positioning on any one of five preselected station directions. Both the directional control and the special azimuth memory circuits select the shortest direction of rotation to turn to the desired position. The product sells for $129.95. For more information on the Moonrotor, write to Avanti Research & Development, Inc., 340 Stewart Avenue, Addison, IL 60101.

8086 Microcomputer Kit

Intel now has a complete 8086 microcomputer system on a board with memory and I/E systems in kit form. This stand-alone 16-bit microcomputer, the SDK-86, provides designers and hobbyists with valuable hands-on experience with Intel's 8086 16-bit HMOS microprocessor. The kit includes an 8-digit LED display, a 24-key keyboard, and all other necessary components from resistors and crystal to CPU, and can be assembled in a day with only a few tools and a soldering iron. Once completed and connected to a power supply, the SDK-86 is ready to go. For data memory, there are 2K bytes of 2142 RAM which can be doubled by adding devices in the board. There is also room for 8K bytes of program memory using either or both of the keyboard and TTY/CRT 4K ROM-resident software monitors included in the kit, or a 2716/2316E EPROM/ROM combination. There is a fully-buffered system bus and 22 square inches of the printed circuit for developing prototype circuitry. Included in the kit is a high-performance 8086 CPU; 8K bytes of 2316 or 2716 ROM; 2K



CIRCLE 43 ON READER SERVICE COUPON

bytes (expandable to 4K) of 2142 RAM; 48 parallel I/O lines implemented through two 8255A Programmable Peripheral Interface devices; an RS232 or current loop serial I/O structure implemented via an 8251A USART; a selectable baud rate from 110 to 4800 baud; TTL compatible bus signals and parallel I/O signals; 24-key hex data and control keyboard, 8-digit hex display, and control implemented through an 8279 programmable keyboard/display controller; and 256 vectored interrupts. It sells for $780. For the complete facts, write to Intel Corp., 3065 Bowers Ave., Santa Clara, CA 95051.

SUPER DEAL FROM SHAKESPEARE

Shakespeare has announced a limited, direct-from-manufacturer offer to buyers of *Super Big Stick* antennas for the *Defender*, a CB base station antenna test instrument. The Defender tunes out high SWR, monitors modula-

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tion and power output, and allows the user to select either of two different antennas without having to plug and unplug clumsy coaxial connectors. The normal retail price for this sophisticated antenna matching and monitoring system is $99.95, but it will cost you only $29.95 during this limited-time offer. For more details, contact the Shakespeare Antenna Co., P.O. Box 50623, Columbia, SC 29250, or circle number 66 on the reader service coupon.

HEY, LOOK ME OVER

CB Transceiver with Looks

Rounding out the NDI CB line is the PC-100, a mobile, 40-channel AM transceiver. Cosmetically outstanding with satin chrome bezel and bright chromed knobs, PC-100 simplifies control with dual-function concentric knobs; Volume/Squelch on one, RF/Microphone gain on the other. Individual knobs are provided for Delta Tune (Clarifier) and Tone control. The latter can often prevent annoying background noise. Ignition

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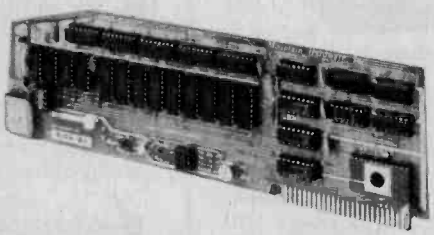
noise reduction is afforded by ANL or ANL/Noise blanker in combination. Instant shift to Channel 9 is provided by panel switch. Performance is monitored by back-lighted meter reading "S/Power Out," by "TX" modulation indicator and by "RX" lamp showing receiver status. A photoelectric-cell-controlled system controls meter illumination and LED digital readout brightness in accord with ambient lighting conditions. PA/Hailer operation is available using auxiliary speaker. Operates on 13.8 VDC, positive or negative ground. Suggested retail price is $119.95. Write to NDI at 22125½ So. Vermont, Torrance, CA 90502.

The Apple Clock

Mountain Hardware's new Real-Time Calendar/Clock for Apple II computers keeps time and date in 1 ms increments continuously for over one year. Calendar, clock, and event timer functions are easily accessed from BASIC using routines carried in on-board ROM. Crystal controlled for accuracy. On-



CIRCLE 37 ON READER SERVICE COUPON

board rechargeable battery to keep the clock running during computer down times. Software for calendar and clock routines, as well as an event timer, are contained in on-board ROM. Unlimited applications: Program a morning printout of appointments, date transactions, create games in which elapsed time is important, time events. Price of the Apple Clock is $199 assembled and tested. For more information, write to Mountain Hardware, Inc., 300 Harvey West Boulevard, Santa Cruz, CA 95060.

TRS Hard Copy

Radio Shack, manufacturer of the TRS-80 Microcomputer System, has introduced a printer that produces hard-copy output on 2⅜-inch-wide aluminum coated paper. The new Radio

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Shack TRS-80 Quick Printer II prints both upper and lower case characters, as well as double-size characters and double-spaced characters to allow for special effects such as titling

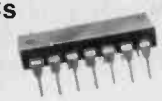
(Continued on page 14)

Radio Shack: No. 1 Parts Place™

Why Wait for Mail Order Delivery? You'll Find Friendly Salespeople, Low Prices and New Items Everyday at Our Store or Dealer Near You!

Low-Power Schottky ICs

Low As **49¢**



100% Prime Guaranteed Specs

These improved versions of standard 5-volt logic devices use Schottky diode technology for minimum propagation delay. High speed with minimum power requirements.

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74LS27	276-1913	.69
74LS30	276-1914	.59
74LS32	276-1915	.69
74LS47	276-1916	1.29
74LS51	276-1917	.59
74LS73	276-1918	.69
74LS74	276-1919	.69
74LS75	276-1920	.99
74LS76	276-1921	.79
74LS85	276-1922	1.29
74LS90	276-1923	.99
74LS92	276-1924	.99
74LS93	276-1925	.99
74LS123	276-1926	1.19
74LS132	276-1927	.99
74LS151	276-1929	.99
74LS157	276-1930	1.19
74LS161	276-1931	1.49
74LS164	276-1932	1.49
74LS175	276-1934	1.19
74LS192	276-1935	1.49
74LS193	276-1936	1.49
74LS194	276-1937	1.49
74LS196	276-1938	1.59
74LS367	276-1835	1.19
74LS368	276-1836	1.19
74LS373	276-1943	2.39
74LS374	276-1944	2.39

4000-Series CMOS ICs

Type	Cat. No.	EACH
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4013	276-2413	.99
4017	276-2417	1.69
4020	276-2420	1.69
4021	276-2421	1.69
4023	276-2423	.69
4027	276-2427	.99
4028	276-2428	1.29
4046	276-2446	1.69
4511	276-2447	1.69
4049	276-2449	.79
4050	276-2450	.79
4051	276-2451	1.49
4066	276-2466	1.39
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28-Range Multitester with 10-Megohm Input

Save 33%

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- *Dual FET Input*
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- *Overload Protected*
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High-accuracy 25 µA meter with single-knob range selector measures DC Volts: 0-.3-1-3-10-30-100-300-1000 at 10 Megohms. AC Volts: 0-3-30-100-300-1000 at 10 kΩ per volt. DC Current: 0-100 µA, 3-30-300 mA, 10A. Resistance: Rx1, Rx10, Rx1000, Rx10k, Rx1M (10 ohms center scale). dB: −20 to +62 in 5 ranges. Accuracy: ±3% DC, ±4% AC. 7x5½x3⅛" overall. With leads, test probes, batteries. **22-208** ..... Sale 39.95

6-Digit Frequency Counter

Save 50%

Reg. 99.95 **49.95**

Measures 100 Hz to 45 MHz with 3 ppm accuracy! Lead zero blanking. kHz and MHz decimals.
22-351 ..... Sale 49.95

Pocket Multitester

Save 20%

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Just 3½x2½x1¼". Measures AC, DC volts to 1000; DC current 0-150 mA, resistance. 8 ranges. 1000 ohms/volt. **22-027** ..... Sale 7.88

Heavy-Duty 12VDC Power Supply

Save 16%

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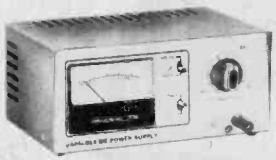
Rated 8 Amps Continuous!

Converts 120VAC to 12VDC for powering high power car stereos, CB and other accessories at home. Delivers up to 8 amps. 3¾x8x6⅝" U.L. listed. **22-125** ..... Sale 49.95

Variable 0-24VDC Power Supply



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Reg. 39.95 **29.95**

Ideal for solid-state projects and servicing. Delivers up to 1 amp with automatic current limiting. Meter reads 0-25VDC or 0-125A. 3-way binding posts. 3⅞x9⁹⁄₁₆x6¼" U.L. listed AC operation. **22-123** ..... Sale 29.95

Low-Power Static RAM

Save 24%

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Under 450 nS Access Time

Type 2102L. 1024x1 bytes of memory in a 16-pin DIP. Single 5V supply operation. Reliable NMOS design.
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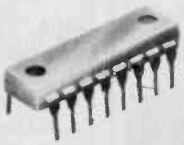

Two 512-stage shift registers for echo, reverb, and phase shift effects. 16-pin DIP. With data.
276-1761 ..... 10.95

10-Position BCD Switch

NEW!

2.99

Full 0-9 binary-coded outputs for logic circuits. Fits 8-pin DIP socket or mounts on PC board.
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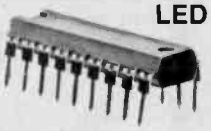

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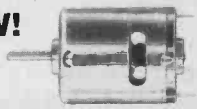

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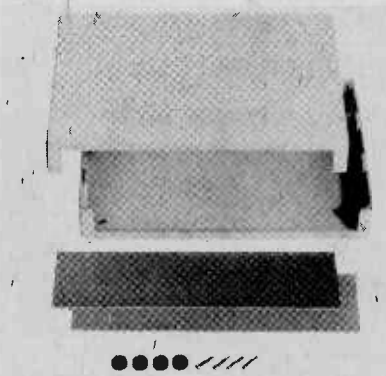
HEY, LOOK ME OVER

(Continued from page 12)

pages or printing headings. Automatic "wrap-around" prevents data loss due to overflow when the text exceeds the maximum line length. The printer is software selectable for 16 or 32 characters per line, and produces 120 lines per minute, 64 characters per second. Character set is a modified subset of ASCII, 96 characters with upper and lower case, 5 x 7 dot matrix, with 6 lines per inch vertical spacing. It can produce all 32 ASCII control codes in addition to codes for the printed characters. The Radio Shack TRS-80 Quick Printer II is priced at $219.00 and is available from Radio Shack Computer Centers and participating Radio Shack stores and dealers, nationwide. It can interface with computers with RS-232C and 8-bit parallel busses.

The Benchtopper Case

Largest in terms of room and capacity of all the new cases offered by Continental Specialties is CTB-1, The Benchtopper Case. This 10 x 3 x 7-inch grey plastic case comes complete with blank faceplates and hardware at a suggested



CIRCLE 44 ON READER SERVICE COUPON

U.S. resale of just $11.95. The case comes complete with front and back fitted aluminum faceplates, four rubber feet and all mounting screws. At home on the bench or in dressier domains, The Benchtopper Case offers the perfect housing for instrumentation, audio equipment, amateur and professional communications equipment, small computers and peripherals, intercoms, radios and more. For additional information or the name of the stocking CSC distributor nearest you, call Continental Specialties Corporation toll-free at 1-800-243-6077 or write to 70 Fulton Terrace, New Haven, CT 06509.

Pistol Grip Microphone

A hand held, noise cancelling microphone from JMR Systems upgrades the communications performance of most transceivers or transmitters. The JMR Model 45 Silencer is a compact microphone that utilizes a noise cancelling electret capacitor to permit clear, crisp voice transmission in noisy environments. It features a slim cartridge design for maximum noise cancelling (more than 15 dB) and a pistol-grip shape that places the talk switch and variable gain control at your fingertips. It is offered in rising frequency or flat-response models for radios with or without voice processing. Incorporating an FET transistor amplifier, the JMR Model 45 Silencer adapts to any transceiver impedance. It is conveniently stored on

CIRCLE 42 ON READER SERVICE COUPON

a velcro pad, or on a standard mounting lug. The microphone is compatible with CBAM, SSB, GMRS, VHF, amateur radios, and Walkie Talkie transceivers The JMR Model 45 Silencer sells for $54.95. Literature is available on request from JMR Systems Corporation, 168 Lawrence Road, Salem, NH 03079.

Digital Pulser Probe

B&K-Precision's new digital pulser probe, designated Model DP-100, is an aid to fast analysis and debugging of integrated circuit logic systems. The DP-100 generates a single pulse in the "one shot" mode or a 5 Hz pulse train in the continuous output mode. The DP-100 can be used alone, or in conjunction with a logic probe or oscilloscope. When the probe output is applied to a circuit, it will automatically pull an existing logic low to a high state or an existing high state to a low. By observing the circuit's output, the user may isolate faulty circuits and components. Test energy is limited to one-third of the normal power dissipation of a good device ensuring that circuit damage cannot result. The DP-100 is compatible with DTL, TTL, RTL, and CMOS logic circuits. Operating power is derived from the circuit under test, so batteries are not required. The

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user net is $80. For additional information, write to B&K-Precision, Dynascan Corporation, 6460 West Cortland Street, Chicago, IL 60635. ■

newscan

Electronics in the News!

Can My Baby Hear?

When a child is born, hundreds of questions pop into the new parents' minds. Will he grow up handsome? Will she be smart in school? Does he have his father's smile? But there's one important and hard-to-answer question that often goes without a reply: Can my baby hear?

Thanks to a portable, computerized testing unit made by volunteers at Western Electric's Indianapolis Works, parents will be able to answer that question within days after birth. The unit, originally conceived by Dr. Philip Peltzman, a research faculty member of the University of California's San Francisco Medical School, measures the brain wave activity of a sleeping infant in response to a series of sounds transmitted to the child through earphones. The brain wave is recorded on magnetic tape for computer analysis. A hearing professional can determine a change in brain electrical activity caused when an infant hears a sound. The test can be given as early as one day after birth.

"The beauty of this unit," explains Dr. Peltzman, "is that it's portable and can be built at a fraction of the cost of any existing equipment capable of performing the same test." At present, commercial equipment can usually be found only in major medical centers.

No, this baby isn't listening to the radio. He's being tested for possible hearing loss. Using a portable computerized unit built by volunteers at Western Electric's Indianapolis Works, this Telephone Pioneer volunteer at Mt. Diablo Hospital in Concord, California, is measuring the brain waves of the sleeping infant to evaluate his hearing ability.

The development of this unit should eventually make it possible for more and more hospitals to offer this highly sophisticated testing. "In addition," Dr. Peltzman went on, "the fact that the unit is portable and the results can be transmitted over the telephone for analysis, makes it practical for use in a doctor's office or a clinic in a rural area."

Why is Western Electric, a manufacturer of telecommunications equipment, making a hearing test unit? To begin with, this project involves volunteers not only from Western Electric, but from the entire Bell System. Two Pacific Telephone engineers designed the unit, Bell Labs and Western engineers worked together to refine it for manufacture, and employees and retirees from every Bell System unit have agreed to act as volunteers administering the program.

All of this is being done as part of the Infant Hearing Assessment-Program (IHAP), a project of the Telephone Pioneers of America with national potential. Telephone Pioneers are long-service Bell System employees who engage in a variety of community service activities. ■

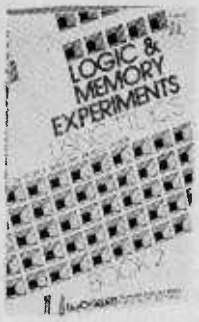
BOOKMARK
BY BOOKWORM

Learning the 7400's. When you are active building receivers, amps, and other similar projects, your experience in logic and memory circuits can suffer. Rejoice, experimenters, a new book covers the concepts of light-emitting diodes and displays, bussing, flip-flops and monostable multivibrators, semiconductor memories, registers, counters and more! It's all in *Logic & Memory Experiments Using TTL IC's, Book 2* by Peter R. Rony and David G. Larsen. This book is a lab oriented text, so plan to invest in a solderless breadboard with a built-in or outboarded regulated 5 VDC power supply. Soon you will be an expert in the 7400 series of TTL IC decoders, counters, multiplexers, shift registers, memories and arithmetic elements in the 7400 series chips. The text is part of the Blackburg Continuing Education Series published by Howard W. Sams & Co., Inc., 4300 West 62nd St., Indianapolis, IN 46268.

Learning to use the 7400s.

Soft cover
382 pages
$9.95

CIRCLE 33 ON READER SERVICE COUPON



Bookkeepers' Delight. *General Ledger*, the third Osborne & Associates' series of BASIC business program books by Lon Poole and Mary Borchers, has just been published. The book includes program listings with remarks, descriptions, discussion of the principles behind each program, file layouts, and a complete user's manual with step-by-step instructions, flow charts, and sample reports and CRT displays. The program listings in *General Ledger* are in Wang Laboratories' extended BASIC. The book describes how these listings can be made compatible with other versions of BASIC. *General Ledger* has been written to share common files with Osborne & Associates' two other books in the BASIC program series: *Payroll with Cost Accounting* and *Accounts Payable and Accounts Receivable*. *General Ledger* can also be used independently of the other two books. Available by direct mail from Osborne & Associates, P.O. Box 2036, Berkeley, CA 94702, or through local computer stores and book dealers.

Give your hobby computer an instant business degree.

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160 pages
$15.00

CIRCLE 36 ON READER SERVICE COUPON

In the Wall. Thomas Jefferson said that nothing is really complicated. "Everything can be simplified and understood if the right person explains it." In *Interior Wiring*, the author, Norman Smithson, is certainly the right man. The text is a thorough manual on the design, layout, installation, and maintenance of electrical wiring systems designed for the competent layman. *Interior Wiring* begins with fundamentals and procedures of electrical wiring and describes the tools needed. There is an entire chapter on safety. Other chapters deal with design and layout, open wiring, knobs, tubes, cable wiring, and conduit wiring—rigid conduit installation, as well as thin wall and flexible conduits. Published by Sterling Publishing Co., Inc., 2 Park Avenue, New York, NY 10016.

An excellent primer for the aspiring electrician.

Soft cover
119 pages
$4.95

CIRCLE 34 ON READER SERVICE COUPON

Bugbook on PLL. *The Phase-Locked Loop Reference Book with Experiments*, written by Howard M. Berlin, covers the operation of the phase-detector, voltage-controlled oscillator, loop filter, frequency synthesizers, and monolithic systems for both TTL and CMOS integrated circuits. In addition, there are over 15 experiments that demonstrate the concepts presented throughout the book. For this reason, the book is useful to the experimenter, hobbyist and CBer who wants to learn by self study, or it can easily serve as an addition to any of the college courses on control systems or linear integrated circuits, especially those which have a laboratory section. A strong attempt has been made to keep the use of mathematical equations to a bare minimum, giving only the essential relationships. All calculations can easily be performed using a simple pocket calculator. Published by E&L Instruments, Inc., 61 First St., Derby, CT 06418. ■

Unlock the mysteries of PLL circuitry.

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270 pages
$8.95

CIRCLE 35 ON READER SERVICE COUPON

DX central reporting

A world of SWL info!

BY DON JENSEN

HAVE YOU EVER SEEN The Count? You know, he's the spooky looking character with the Transylvanian accent on the kids' TV show, Sesame Street.

The Count gets his jollies by counting—"vun cookie, two cookies, tree cookies"—this and that. Anything that's countable, The Count will count.

And, for that reason, I'd like to see The Count tackle the job of counting how many shortwave listeners there are.

Frankly, it's a tough job, even for an old pro like the Transylvania tabulator. SWLs are not licensed; there's no government agency to tally up the count. Few radio receivers tune SW exclusively, so even manufacturers don't have a handle on how many of their sets are sold to persons with shortwave DXing on their minds. And because an SWL may be using a receiver that is 20, 30, or 40 years old, who knows just how many sets out there are benig tuned to programs coming in from foreign SW stations?

Okay, there are people other than The Count who make those sort of counts, professional poll takers who'll ask the right questions of enough folks and statistically come up with an answer. But being pros, they charge, and charge well, for their work.

Info Seekers. For instance, in 1977, an unidentified American electronics company commissioned the research firm of Yankelovich, Skelly and White to measure the size of the SWL audience. The electronics firm paid a nice chunk of change for this survey and, understandably, has not made the results public information.

Two years earlier, Radio Canada International commissioned a Gallup survey of audiences for various major international broadcasting stations, including itself. It is a limited purpose study and, of course, doesn't tell us everything about SWLing that we'd like to have known. But, last fall, RCI did make the survey public, giving us some numbers to consider.

For instance, how many persons in the U.S. adult audience listen to the British Broadcasting Corporation's shortwave services? The '75 Gallup study says there are 710,000 who listen once a week or more often; another 1,278,000 who tune in one, two or three times a month plus 2.5 million more who listen, but less than once per month. Togther they total over 4.5 million BBC listeners in the U.S.

The commissioning RCI placed about the same with 2.3 million listeners who tune in at least several times a month or more and 2.1 million who listen, but less than once a month.

How do some of the other international broadcasters fare in the 1975 survey? Considering only the regular listeners who tune a station at least a couple of times a month, West Germany's Deutsche Welle has nearly a million listeners in the U.S. adult population. (If you're a teen, and we know many of our SWL friends and readers are under 18, you're not even included in that tally!) Using the same measuring stick, Radio Moscow also has about a million regular listeners; Radio Havana Cuba over 850,000 and Radio Nederland tops the half million regular listener figure.

Insider information suggests that a couple of the big shortwave broadcasters will be taking another similar count of listenership perhaps about the time you are reading this. Whether this data will be made public remains to be seen.

These statistics don't, of course, tell us everything we want to know about our listening hobby—how many of us there are out there and who we all are. But until The Count gets around to his "vun SWL, two SWLs, tree SWLs" tally, it's about the best data we have.

(Continued on page 22)

DX Glossary

DX, DXer, DXing = Distant stations; one who listens to distant or hard-to-hear stations as a hobby; the hobby of listening to such stations.

GMT – Greenwich Mean Time, a universal time reference equivalent to EST+5 hours, CST+6 hours, MST+7 hours or PST+8 hours.

IRC = International Reply Coupon, exchangeable abroad for postage stamps of other countries. IRCs are a practical way to provide return postage to those living abroad who, of course, cannot use U.S. stamps. IRCs are available at your post office.

kHz = kilohertz, a unit of frequency measurement equivalent to 1000 cycles per second, formerly expressed as kilocycles per second or kc/s.

SW, SWL = short wave; shortwave listener.

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25" DIAGONAL color TV that tunes by computer, programs an entire evening's entertainment.

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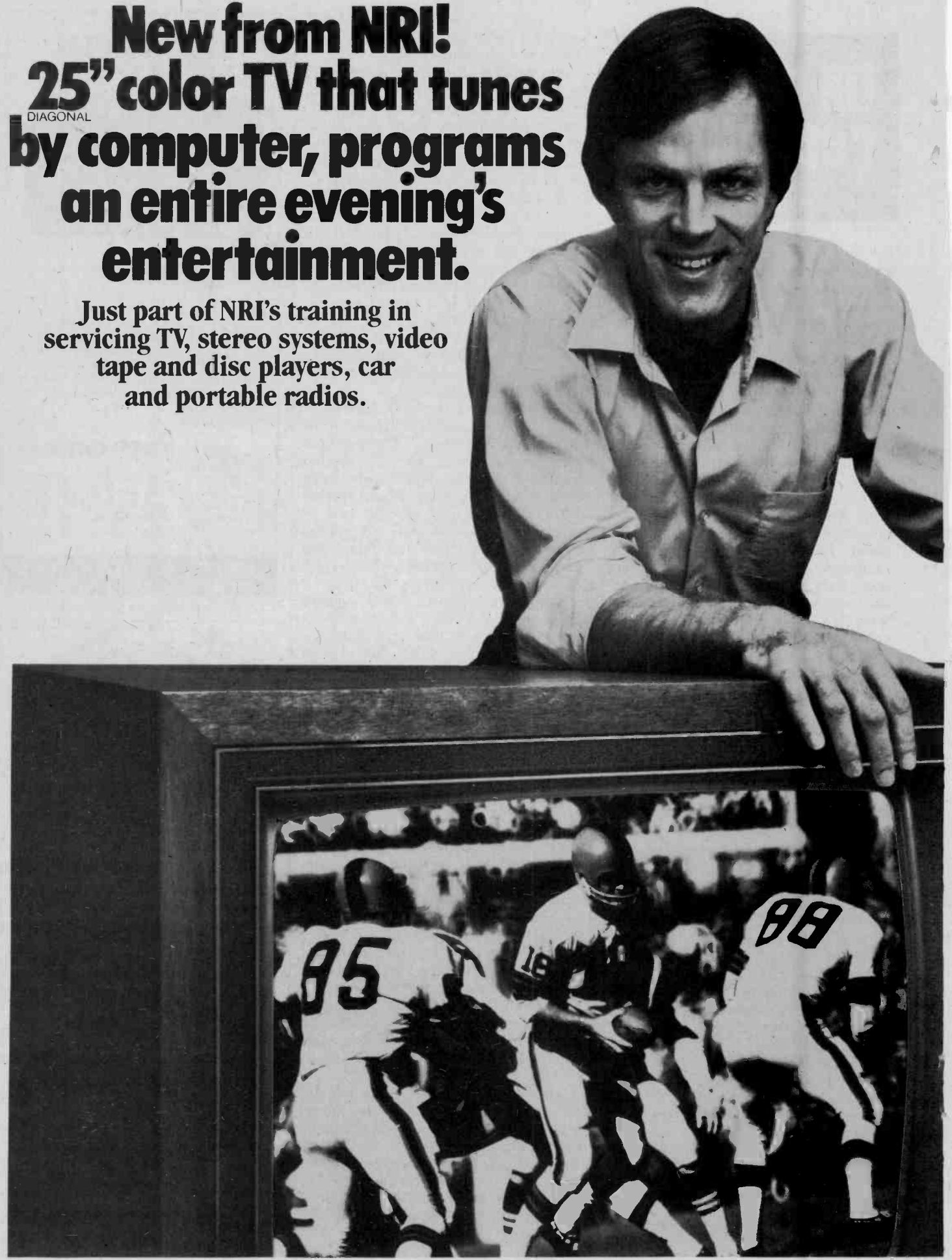
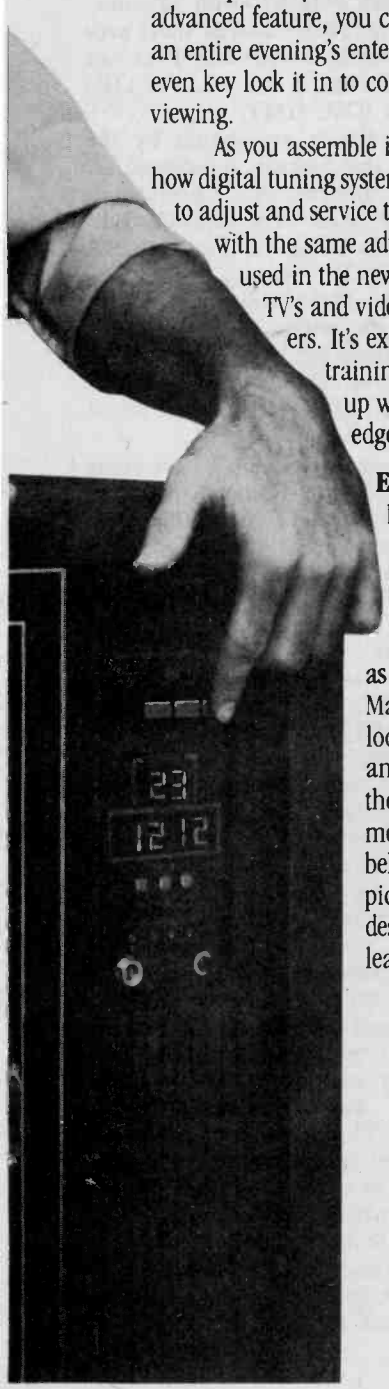


Only NRI home training prepares you so thoroughly for the next great leap forward in TV and audio... digital systems. Already, top-of-the-line TV's feature digital tuning, computer programming is appearing, and new digital audio recording equipment is about to go on the market.

NRI is the only home study school to give you the actual "hands-on" training you need to handle servicing problems on tomorrow's electronic equipment. Because only NRI includes this designed-for-learning, 25" diagonal color TV with electronic tuning, built-in digital clock, and computer programmer as part of your training. With this advanced feature, you can pre-program an entire evening's entertainment... even key lock it in to control children's viewing.

As you assemble it, you learn how digital tuning systems work, how to adjust and service them. You work with the same advanced features used in the new programmable TV's and video tape recorders. It's exclusive NRI training that keeps you up with the leading edge of technology.



Exclusive Designed-for-learning Concept

The color TV you build as part of NRI's Master Course looks, operates, and performs like the very finest commercial sets. But behind that pretty picture is a unique designed-for-learning chassis...

the only such unit in the world. Rather than retrofit lessons to a hobby kit or an already-built commercial set, NRI instructor/engineers have designed this television so each step of construction is a learning experience.

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Complete, Effective Training Includes Video Systems

Using NRI's exclusive methods, you learn far more than TV servicing. You'll be prepared to work with stereo systems, car radios, record and tape players, transistor radios, short-wave receivers, PA systems, musical instrument amplifiers, electronic TV games, even video tape recorders and tape or disc video players. Your training covers just about every kind of electronic entertainment equipment available now or in the near future.

And because NRI has unmatched experience gained in over 60 years and a million students worth of training, your course is designed for ease of learning and practical utility. You need no previous experience of any kind. Starting with the basics, exclusive "bite-size" lessons cover subjects thoroughly, clearly, and concisely. "Hands-on" experiments reinforce theory for better comprehension and retention. And your personal NRI instructor is always available for consultation, ready with explanations, answers, and advice.

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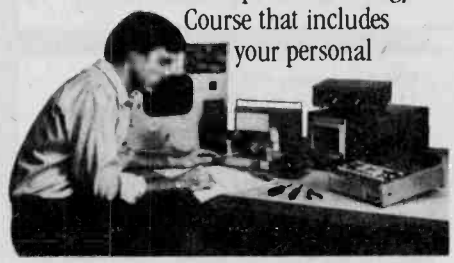

microcomputer. Or Complete Communications with 2-meter transceiver that gets you ready for opportunities in broadcasting, 2-way radio, microwave, and other growing fields. If card has been removed, write to:

NRI Schools
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3939 Wisconsin Ave.
Washington, D.C. 20016

DX CENTRAL

(Continued from page 17)

Another Look. One of our DX Central Reporting readers has an interest in another aspect of the "who-is-out-there-in-SWL-land" question.

Mrs. Grete Osmundsen writes from Norway: "I have often wondered why DXing is a male-dominated hobby. So for the last year I have been trying to get in touch with female DXers from all over the world.

"My request for girls in the DX hobby to write to me was printed in several club newsletters and SWL bulletins all over the world. Quite a number of radio stations also mentioned it in their SWL programmes or mailbag programmes on the air.

"So far I have received letters from 70 girls and women from all corners of the earth who are listeners to shortwave.

So, gals, if you'd like to contact other female DXers, why not drop a line to Mrs. Grete Osmundsen, Grenavegen 7, N-5500 Haugesund, Norway.

What's New. In the last DX CENTRAL REPORTING I suggested readers interested in tuning for one of the handful of private Canadian SW broadcasters, Toronto's CFRX on 6,070 kHz would have to hurry because there were plans afoot to drop this shortwave relay of the station's CFRB medium wave station by this autumn.

Now the word out of Toronto is more favorable. The purpose of the SW relay originally was to serve outlying Canadian audiences, beyond the normal range of the medium wave station. This is no longer considered necessary by the folks at CFRB/CFRX.

But, recognizing that there is an interest in hearing the station among U.S. and Canadian SWL fans, the station decided to renew its SW license and continue with its ancient shortwave transmitter until it finally breaks down.

About the first of March, Radio Nacional in Brasilia, capital of Brazil, returned to shortwave with its international service, including an hour long daily English program. It has been two years since this popular program was on the air.

The English program, with announcer John Morris, has featured short program bits about Brazil and Brazilian music. It is heard on 15,280 kHz, beginning at 0200 GMT.

Listeners' letters are sought by the station and the address announced is: Radio Bras, International Correspondence Service, P.O. Box 040340, Edificio Venancio 2000, 1st Floor, 70323 Brasilia, Federal District, Brazil.

Back Talk. More and more letters are arriving from you readers here at DX CENTRAL. Keep 'em coming!

Walter Kunz, Dunmore, PA, writes to report some of the stations he's heard recently on the air.

"A few new ones which I have come up with lately are Radio Kuwait, in English at 1730 GMT on 12,082 kHz; SRS, Surinam on 4,850 kHz, from whenever the band opens up to South America, about 2330 or so GMT, later if you live further west, until 0330 GMT signoff." Thanks for the report.

Finally, a letter from Tony Camillocci, Berwick, PA. "In the May-June 1978 issue of DX CENTRAL REPORTING you said there was a shortwave outlet in Antarctica called AFAN, the American Forces Antarctic Network. Can you tell me the address of this station? I haven't heard it yet but I want the address just in case."

My tip for hearing this one, if you're lucky, is to try during the very early morning hours, say between about 0800 and 1100 GMT, during October, November and December.

If you do manage to log this one—and be very careful of the identifications since other American Forces Radio and TV Service transmissions can be heard in the 49 meter band—reports can go to the following address: Station Manager, AFAN McMurdo, US Naval Support Force Antarctica, FPO San Francisco, CA 96601.

Good luck and good DXing to everyone until next time. ■

HI•FI REPORTS

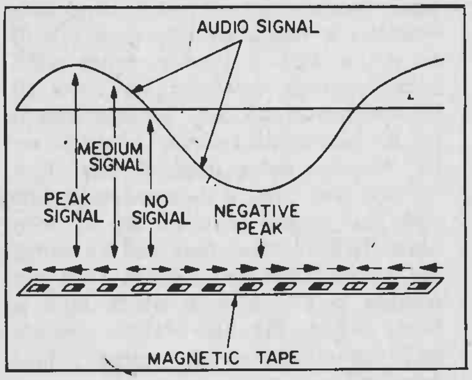
A biased look at the problems of selecting cassette tape

by Gordon Sell

IF YOU'RE NOT GETTING the kind of audio action you expected from your cassette deck don't be too quick to criticize the machinery—it may not be totally at fault. A cassette deck's sound can only be as good as the tape that is passing across its heads.

How Tape Tapes. In order to better understand what is wrong with your set-up you need to know how tape works. First of all, what is tape? Tape is a strip of mylar coated with a thin film that is embedded with billions of microscopic needles made of a magnetizable material. These needles are lined up parallel to the direction of tape movement. As the audio signal changes polarity and intensity, the needles change magnetic polarity and intensity. The diagram on this page shows how the polarity of the magnetic needles varies with the audio signal.

To record a signal on tape the cassette deck has a small, powerful electromagnet (i.e. tape record head) that energizes the needles as they pass by. Another head for playback, has a sensitive coil that picks up the variations in the magnetic field of the passing tape. Record and playback heads form the indispensable tape team.



This diagram shows how the magnetic needles in the tape vary their magnetic polarity and strength with the incoming audio signal. When the signal level is zero, the particles are not magnetized; when the signal is strong, the polarity is strong in one direction or the other. The needles don't move.

About Bias. This simple recording team works pretty well at low audio frequencies but above 10 or so kilohertz the response begins to fall off. Up there those needles are a little reluctant to magnetize; they need shaking up so that they can follow the high frequency, polarity signals. To do this engineers have discovered that if you add an ultrasonic signal of about 60 to 100 kilohertz the frequency response improves dramatically. This signal is called *bias*, and the level of the bias signal is critical to achieving good frequency response from tapes.

Most cassette decks, as I'm sure you've noticed, have a bias switch with two, three and sometimes four positions. Some decks supplement this switch with a variable bias trimmer. The switch positions are usually labled as follows: (1) *normal, ferric* or *FeO_2* for iron oxide (that's rust, in case you didn't recognize it) tapes, (2) *high* or *CrO_2* for chromium dioxide tapes, (3) *ferrichrome*, and on some of the newer decks, (4) *metal* for the new 'pure' metal tapes. By putting the switch in the correct position for whatever tape you are recording, the machine will automatically provide a bias signal of the correct level for that tape type—at least that's what is supposed to happen.

Sony not only makes nice tape decks, they also make the tapes. This ferrichrome tape costs about $4.60 in the C-60 length. For more information circle number 54.

In real life most cassette decks don't always provide the correct bias level for all tapes of the same type because all like-tapes are not equal. Some chrome and iron oxide tapes have different bias requirements from other chrome and iron oxide tapes. Most are within 10 or 15 percent of each other which isn't close enough for precision audio recording. On some of the early metal tapes the bias levels vary greatly from one brand to the next. With this kind of situation it's up to the machine to take care of the problem.

Back at the Lab. To understand more about cassette decks and their biasing problems, it is helpful to examine the results of our laboratory testing. Each year we put dozens of cassettes through

HI-FI REPORTS

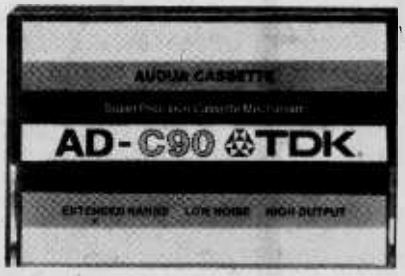
the electronic wringer, and the results, especially the frequency response figures, shed some light on the bias situation. We have often found that some cassette decks get better frequency response from rusty, "low-performance," iron oxide tapes than from some fancy, five-dollar-an-hour, chromium dioxide jobs. It's absolutely mind boggling to watch a 500-dollar wonder machine fall flat on its anodized aluminum face with fancy tape then purr like a kitten with a cartridge of plain Jane tape. At first we thought the machines were at fault, until we tried different brands of tape. It soon became clear that one brand of ferrichrome was not always equal to another even though they were both good tapes.

This doesn't mean you can get away with buying cheapo tapes. They are often right out of the ballpark and the bias level requirement often varies from one inch of tape to the next. In a recent test of Hitachi's new D-5500 cassette deck with automatic, computerized bias adjustment we found that with some tapes the computer couldn't find a single correct bias level so it just picked an average. On some of the two-for-a-dollar cheapo tapes the machine defaulted because it couldn't even determine a bias level. The cheapo's frequency response was bumpy but still within 3 dB from 20 Hz to 700 Hz (700 not 7000) by the time the oscilloscope trace got out to 5000 Hz the signal was 15 dB down. The same machine was able to tune in a cassette of Maxell UD/XL Type I so that the response was never more than 2 dB down from 25 Hz to 20000 Hz, a tribute to both tape and machine.

Maxell's UD/XL Type II is a high-performance chrome-type tape, requiring a high-bias setting. Their C-60 sells for about $5. Circle reader service number 53 for information.

Two to Tango. While there are many features that will affect your cassette deck buying decision I will stick to bias here. As you might have guessed, I wouldn't recommend any deck that doesn't have a bias adjustment of some sort, preferably it should have a bias adjust switch plus a variable bias trim control.

When choosing a machine you have to keep the cost of tape in mind. Are you always going to use the best or will economics force you to buy a lower priced type of tape? Be realistic about your needs. If you do a lot of recording tape costs can mount up fast, and you may not have to sacrifice much if you match the right tape to the right machine. If you want to use low cost tapes look around for a machine that tests well with them. Most good equipment reviews will tell you what tapes work best. I've reviewed a few in this column in the past. Our laboratory also does re-before. Our laboratory also does reviews for HI-FI STEREO BUYERS' GUIDE and these give in-depth reports about tape compatability.



When it comes to high-performance at low cost, TDK's AD, normal bias tapes really shine. A 60-minute tape is about $2.90. Circle number 52 for more information.

Check It Out. If you already have a machine and want to match the tape to the recorder then you'll have to do a little bit of experimenting. Go out and buy a selection of tapes that fit your price restrictions. Be sure to include any types that might be recommended by the maker of your machine. Also, buy the shortest lengths available, you don't need much of each.

Pick out a good cut for a test recording; preferably a demonstration record, but if you don't have one, a good symphony orchestra recording with lots of high-frequency content will do pretty well. Record each test tape with the same selection and with all the controls at the same settings, except for the bias control which should be set for the tape being used. If there is a variable bias control then test each tape with the control in a variety of positions. This all takes time but it's worth the effort. Take notes about each cut making sure you note which tape is being tested, the bias switch position and the setting of the variable bias trimmer.

Don't be surprised if you end up with two or three tapes that give equal performance at the same settings, and count yourself lucky that you can use more than one tape type.

(Continued on page 82)

elementary Electronics September/October 1979

ROARING TWENTIES RECEIVER

by Charles Green

Capture the technology that drove a generation wild!

DURING THE ROARING 20's, the crystal set graduated from the experimenter's oatmeal box-breadboard, to wood-cabinet construction, as the quality of radio station broadcasting improved enough to interest the entire family. The crystal receiver was moved to the living room from the basement laboratory, and therefore had to appear attractive, as well as operate properly. The style of radio cabinet construction resembled the popular style of furniture of that era—heavy, ornate wood with a walnut veneer finish.

You can build a crystal set receiver similar to the ones in use during the twenties, a wood cabinet model with a lift-up lid as shown in the photos. All of the circuit components are mounted in the back of the front panel like the old-time receivers.

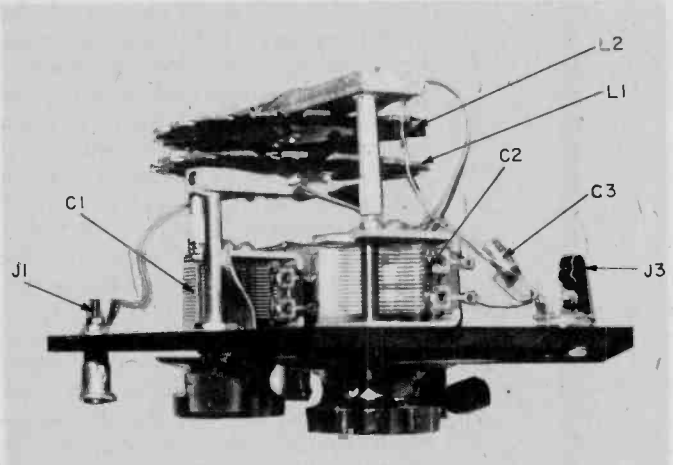
The Receiver Circuit. The crystal set uses two hi-Q spiderweb coils with variable coupling in a two-circuit tuner for maximum selectivity and sensitivity. Antenna signals at J1 are series-tuned by C1/L1 for maximum RF gain. L1 acts as the primary winding of a tuned RF transformer, with L2/C2 as the tuned secondary. Coupling is variable for best selectivity. D1 detects the signals, and the audio is fed to the headphones at J3.

Cabinet Construction. As you can see in the photos, the design of the crystal set cabinet is similar to the old radios of the 20's. The top and bottom wood sections extend outward from the cabinet sides and have rounded edges. The top section is used as the cabinet lid, and is held on to the back of the box with two metal hinges. A section of black plastic is used for the front panel in place of the bakelite used by the early constructors. If black plastic is not available, you can substitute black-painted hardboard.

Begin construction of the cabinet by cutting the wood sections to the sizes indicated in the construction drawing. Then fasten the sections together with small finishing nails and glue. The front panel should not be fastened, but should be able to move free in or out of the cabinet. Position the corner moldings, before glueing them. Notch the top of the rear panel to allow clearance for the metal hinges.

After construction of the cabinet is completed, check for any rough edges and sand the wood surface. Then stain or paint the cabinet. Our model has a walnut stain with a clear plastic finish.

Spiderweb Coil Construction. As shown in the drawing of the spiderweb coil form, there are seventeen "vanes," ⅞-inch long, and each approximately ¼-inch wide, positioned around the perimeter of a 3⅝-inch disc. The coil form is made from the type of sheet



Follow the exploded parts diagram on the next page for assembly of the mounts for L1 and L2. The picture at left gives a top view of the assembly, while the drawing gives a side view. If your variable capacitor doesn't have a tapped hole for the spacer screw, drill an ⅛-inch hole in its side, and use self-tapping screw.

plastic used for printed circuits (but without the copper coating) and is approximately 1/16-inch thick.

The easiest way to start construction of the coil forms, is to trace the outline of the spiderweb coil form drawing and then temporarily paste the tracing onto the plastic sheet. Fasten the plastic sheet firmly in a vise, and then cut out the vanes with a hacksaw. Remove the tracing paper from the pastic, and round off any rough edges with a file.

Carefully drill two small holes at the center of the coil form, and mount two solder lugs. Wind as much #28 enameled magnet wire around the coil forms as possible (winding over one vane, then under the next, etc.) and solder the wire ends to the solder lugs. It is not necessary to count the turns of wire, as the coils can be pruned later after testing in the receiver.

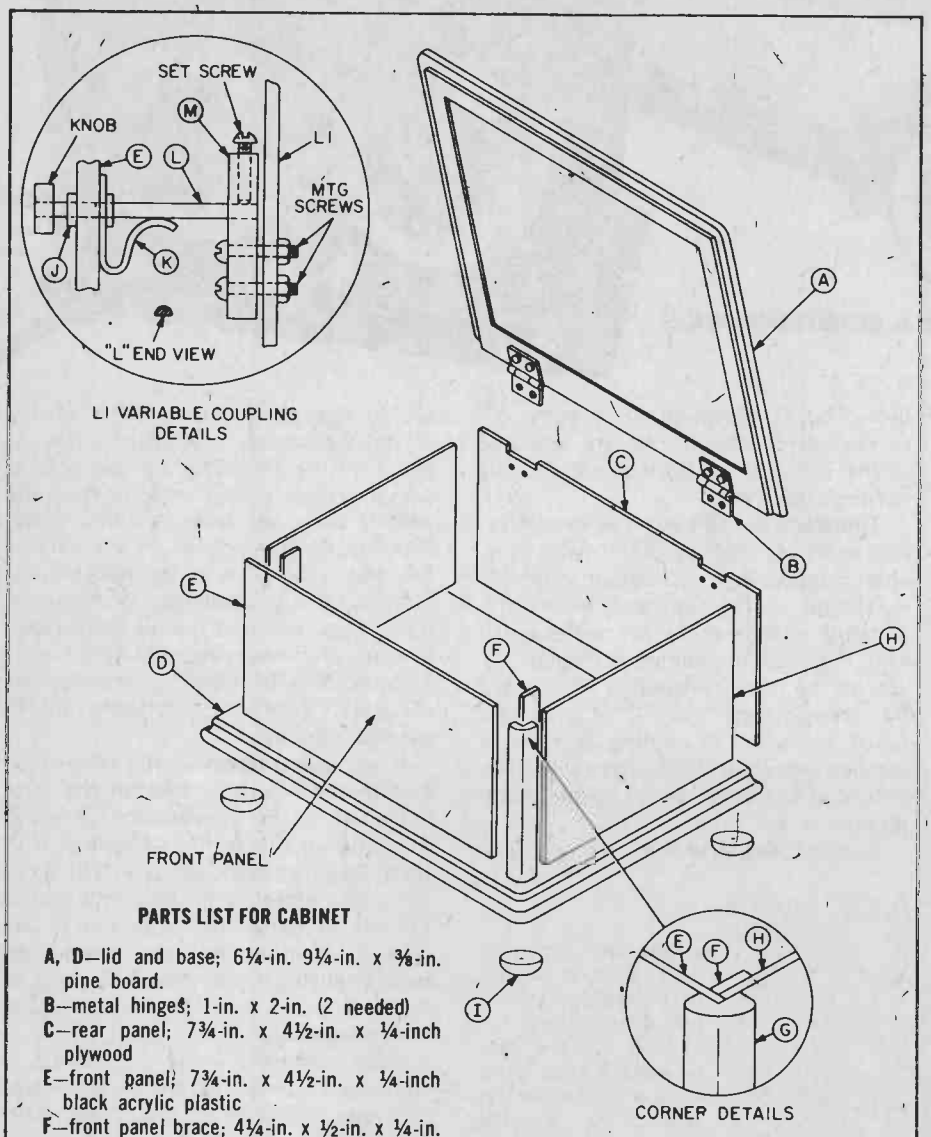
Receiver Circuit Construction. All of the receiver components are mounted on the black plastic front panel. The layout of the parts is shown in the photos. Start construction by taping a section of graph paper to the panel and locating the mounting holes for the components. Install the two tuning capacitors (C1 and C2) on the panel after making allowances for the diameter of the tuning knobs.

Next, drill a hole for the shaft bushing of the L1 variable coupling rod (L). The one on our model came from a discarded volume control, with a three-inch flat (on one side) shaft. Bend a section (K) of sheet aluminum (after drilling a hole to fit the bushing) to fit against the flat side of the shaft, and install the metal tensioner and bushing on the panel. The metal section is required to keep the coupling rod from rotating as it is pushed in and out. Drill a hole to fit the shaft near one end of a block of wood (Section M in the cabinet construction drawing detail) and install a set screw to hold the shaft in place. Install the block of wood with two screws and nuts on to the spiderweb coil L1 and insert the rod end into the panel bushing. Make sure that the coil can be pushed freely in and out to vary the coupling.

Install the other spiderweb coil (L2) on a wood section that is mounted on the rear panel with spacers and screws. The mounting of the wood section will depend on the size and shape of the variable capacitors in your model. The two spiderweb coils should be positioned so that they are approximately ¼-inch apart when the coupling rod is pushed all the way in. The wood section on our model was supported by two screws set in 1½-inch metal spacers mounted on tapped holes in the rear of the two tuning capacitors. If the two capacitors in your model can not be used in this way, increase the length of the wood section and the mounting screws as necessary and mount the wood section in the back panel.

Install the remaining parts onto the front panel as shown in the photos. If necessary, file down the head of the crystal cup screw to allow proper seating of the crystal. Wire the components as shown in the schematic. Use flexible stranded wire for the leads to L1, and position them so that there will be no interference with the tuning capacitors as L1 is moved in or out. Install solder lugs as required on all of the components, and use bare solid wire for the connectons (for an antique wiring look; make square corners).

Next, install the knobs on the controls. Old-style knobs can be found at flea markets and hamfests. If none can be found, do what the old experimenters did—make your own. The big tuning knobs can be made with painted



PARTS LIST FOR CABINET

A, D—lid and base; 6¼-in. 9¼-in. x ⅜-in. pine board.
B—metal hinges; 1-in. x 2-in. (2 needed)
C—rear panel; 7¾-in. x 4½-in. x ¼-inch plywood
E—front panel; 7¾-in. x 4½-in. x ¼-inch black acrylic plastic
F—front panel brace; 4¼-in. x ½-in. x ¼-in. pine strip (2 needed)
G—front corner molding; 4½-in. x ½-in. 90° corner molding (2 needed)
H—side panels; 4½-in. x 5⅛-in. x ¼-in. plywood (2 needed)
I—rubber feet (4 needed)
J—panel bushing to fit coupling rod "L" (may be obtained from a discarded potentiometer, as can rod "L")
K—coupling rod tensioner; 2-in. x ½-in. x 1/16-in.-thick sheet aluminum
L—coupling rod; ¼-in. diameter potentiometer shaft (one side flat), at least 3-inches long
M—coil mounting stock; 2-in. x ¼-in. x ½-in. pine stock (L1)
N—coil mounting stock; 5⅓-in. x 1-in. x ¼-in. pine stock (L2)

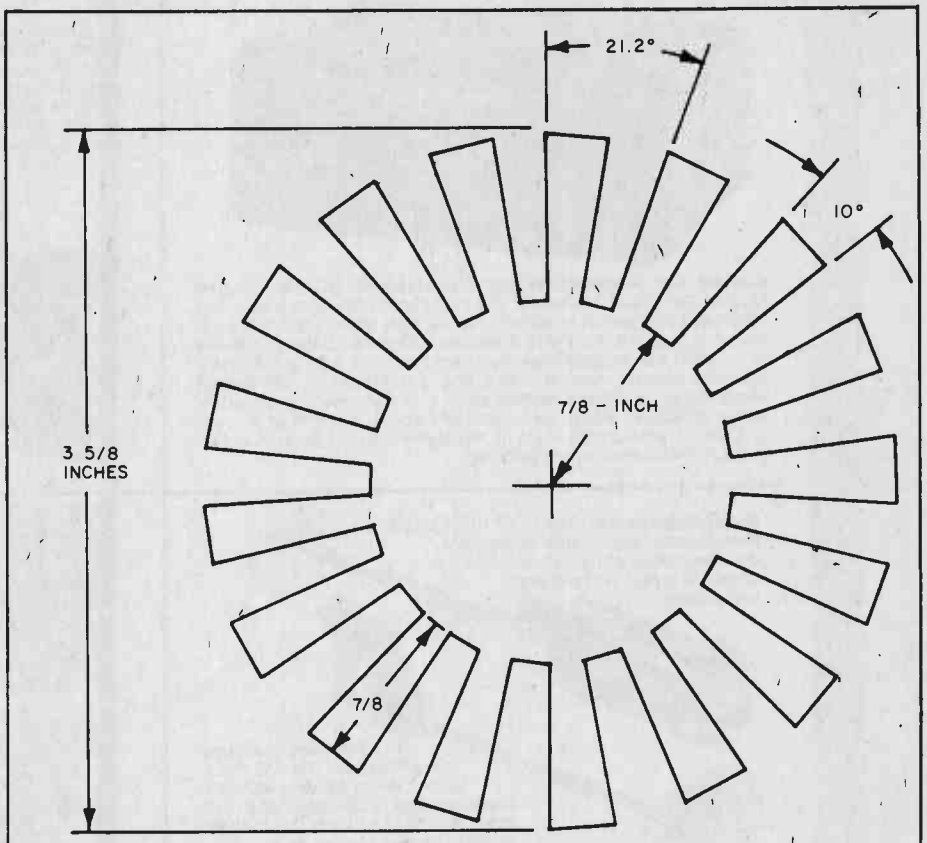
cardboard discs cemented onto the back of small plastic knobs. Fahnestock clips can be used in place of the terminals (J1, J2) on our model, and also in place of J3 for the headphone connections. Install the front panel on the cabinet and make sure that the spiderweb coils do not touch the top lid or bottom of the cabinet.

Operation. A good outside antenna and a good ground connection are required for best results with a crystal set receiver. There is no amplification as in vacuum tube or transistor radios, therefore the stronger the reception of the radio waves, the louder the signals will be. If you are located near a high-powered radio transmitter, an inside antenna will work. For more distant stations, an outside antenna, 25-feet or longer will be necessary. The mail order radio parts houses will be the best source for antenna kits. The ground connection can be made to a cold water pipe, or to a metal rod driven into the ground.

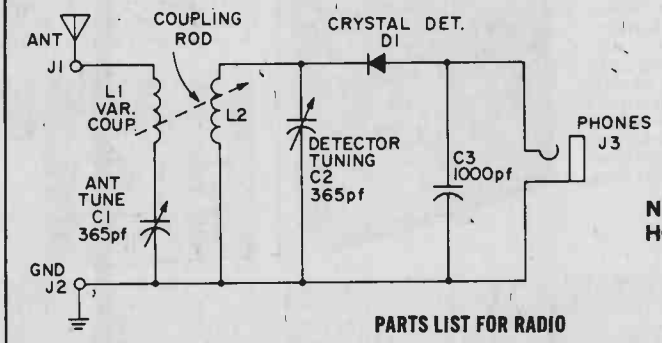
For ease of adjustment in the initial test of the receiver, connect a Germanium diode (1N34A or equiv.) in place of the crystal detector, D1. Plug a set of 2000-ohm earphones into J3 (low impedance stereo-type earphones will *not* work), and connect the antenna to J1 and the ground to J2.

Tune C1 and C3 for a received station, and then adjust the L1 coupling for best selectivity. Retune C1 and C3 for best signal strength, and then readjust the L1 coupling. All of the controls interact, so it will require several tuning adjustments for optimum received signal audio volume. After a station is tuned in, remove the Germanium diode without disturbing the tuning settings and then try your luck in finding a sensitive spot on the crystal with the catwhisker (like the old radio pioneers did). Compare the received volume with that of the germanium diode—you may be surprised at the reception you get. Now, if only we could find an antique radio *station* . . . ■

Here's the same view of the cabinet as in the drawing on the previous page. Be sure that the front panel slides in smoothly.



This is a full-scale template for cutting the coil forms. Cut it off the page carefully, and temporarily fasten it to the plastic coil form stock, and make your cuts. Repeat this process again for the second coil form as well. After both forms are cut, compare them to make sure that there are no differences between the two—they should be made (and wound) as identically as possible to assure you of a proper match and optimum performance. Use number 28 enameled wire for the coil windings, and leave room at the beginning and end of the coils for connections to the solder lugs which you'll use later.



Need parts? Find them in HOBBY MART—page 80

PARTS LIST FOR RADIO

C1, C2—365-pF variable capacitor (Calectro #A1-227 or equiv.)
C3—1,000-pF mica capacitor, 25-VDC or better
D1—crystal detector/catwhisker assembly (available from Modern Radio Labs, Box 1477, Garden Grove, CA 92642)
J1, J2—spring binding posts or Fahnestock clips
J3—2-conductor phone jack
L1, L2—antenna coils (see text)
Misc.—2,000-ohm headphones, 200-feet of #28 enameled magnet wire, 1½-inch aluminum spacers (2), 1/16-in.-thick sheet plastic for coil forms, 1N34A diode for initial testing, knobs, solder, hookup wire, stain, varnish, etc.

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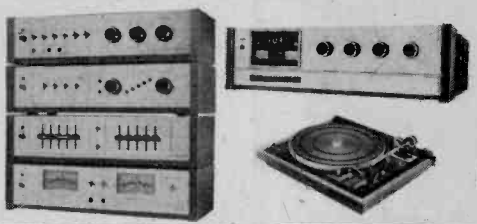

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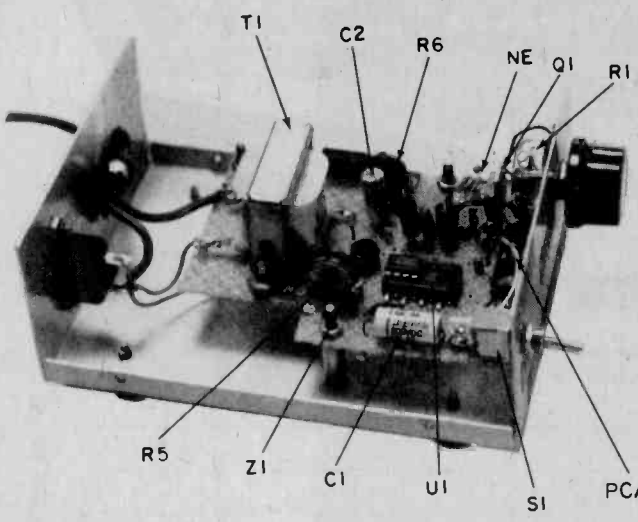
KITCHEN KONTROLLER

Add a new dimension to your culinary artistry—let our electronic chef command your appliances

by Cass Lewart

Here is an inexpensive project—the cost of parts is under $10—which will make many of your kitchen appliances perform better then they were originally designed to. It is a motor speed control combined with an optional automatic on-off-on-off cycling pulser/interruptor. The pulsing feature is particularly important for kitchen blenders, mixers and food processors. The short pause, during which the appliance stops, allows you to see the progress of the food preparation. You can then stop before your food processor grinds and mashes everything to bits. Modern kitchen appliances frequently operate at such high speeds, that a few seconds difference in running time can transform an exquisite meal into meat loaf. Many appliances such as blenders also mix the food better when operating with an on-off cycle, which prevents the food from sticking to one side of the bowl. It should be noted that the duration of both the "on" cycle and the "off" cycle in the Kitchen Helper can be adjusted separately. The continuously variable speed/dimmer control used in conjunction with the pulser adds another desirable feature to many of your appliances. The pulsing/interrupting feature can also be bypassed by flipping a switch, and the Kitchen Helper becomes a regular variable-speed or light dimmer control for your power tools, Christmas lights, Halloween pumpkins, etc. In fact, you may have trouble deciding between the kitchen and the work bench, as to where it should be kept. Don't fret too much, build a pair!



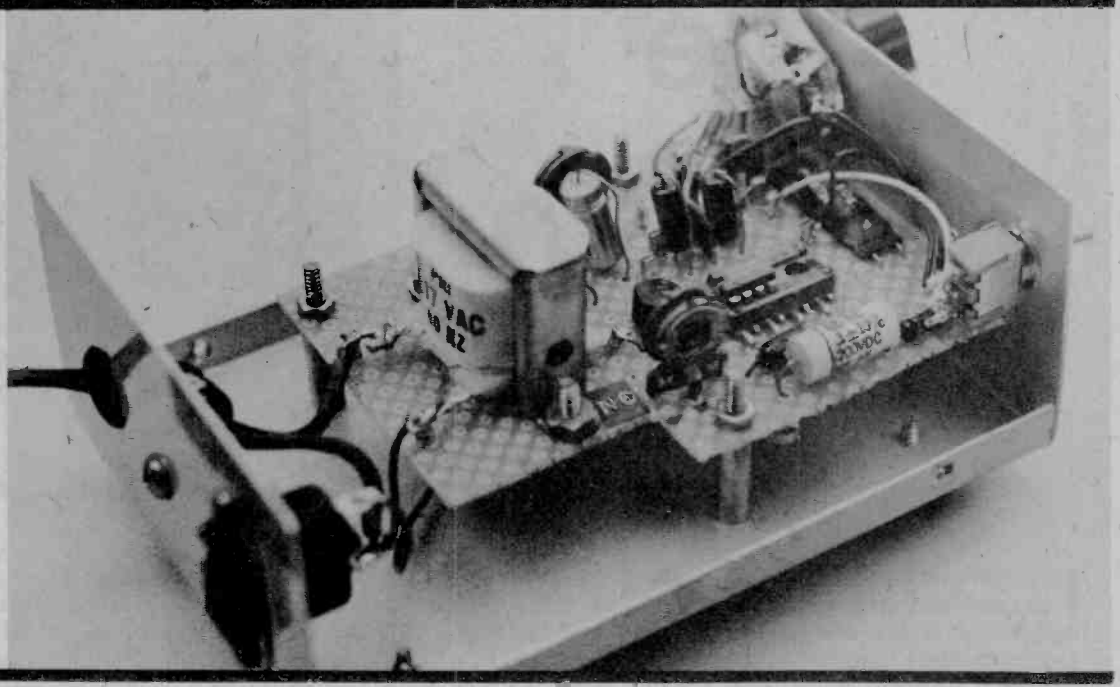
Perfboard construction is the preferred method for building the Kitchen Kontroller, because some components vary in size depending on working voltage and manufacturer style. An IC socket is recommended to prevent damage to the IC from soldering. Be sure to isolate the circuit board from the cabinet.

How It Works. The schematic diagram consists of two distinct sections: The low-voltage on-off pulser with a heart made out of our old friend—the 555 timer (IC1), and the high-voltage section, consisting of a 600-watt/110-volt Triac speed control. A small lamp (L1) and a photocell (PC) tied together, act as a light coupler by separating the high and low voltage sections. When the timing circuit puts a voltage across the lamp (L1), it lights up, the resistance of the photocell decreases, and the Triac conducts. Potentiometers R5 and R6 control independently the "on" and "off" cycles of the timer, with time on—1.1xC4xR5, and time off—1.1xC6xR6. With the values chosen for resistors and capacitors, the "on" and "off" cycles can be set between 0 and 5 seconds. Switch S1, when closed, bypasses the timing section of the circuit. Power for the low-voltage section is provided by transformer T1 with the associated rectifier bridge (Z1) and capacitor C3.

The high-voltage section of the circuit is a standard Triac motor speed/dimmer control for lights and appliances up to 600-watts. Capacitors C1 and C2, resistors R1, R2, R3 and the photocell resistance, set the firing point of the Triac, and vary its duty cycle for conduction. Potentiometer R1 is used as the speed/dimmer control, and neon light NE provides the hysteresis required by the speed control circuit for smooth operation.

Construction. The circuit can be built easily on a 2½ by 3½-inch perf-

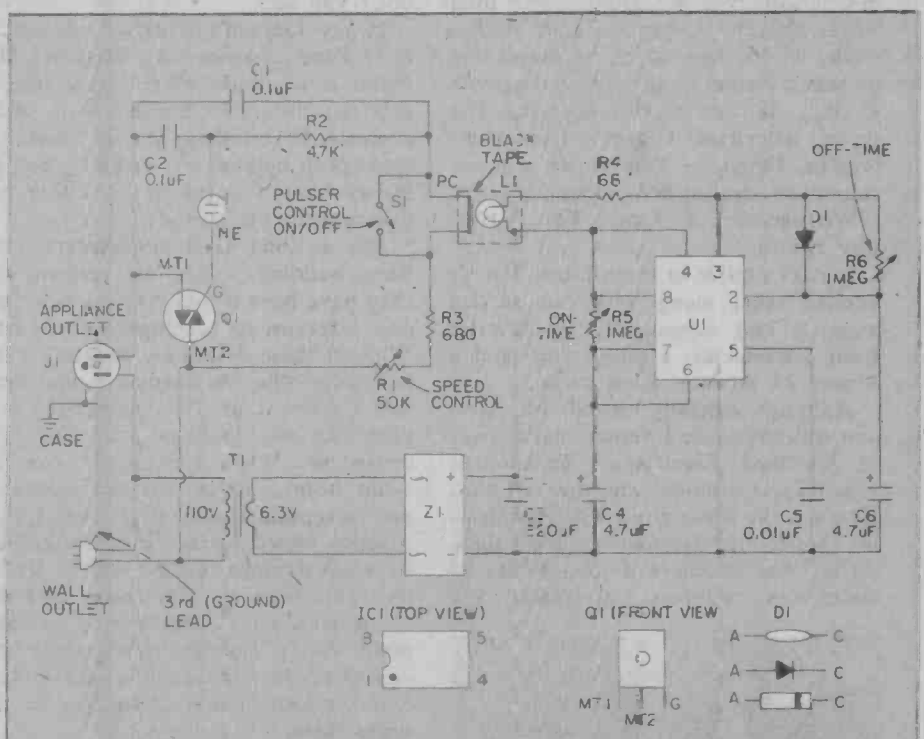
If you decide to put together more than one Kitchen Kontroller, it might be a wise idea to investigate the bulk prices for components offered in the HOBBY MART section at the back of the magazine. The dimmer feature, coupled with the slow pulse timer can be a real bulb-saver with photo-flood lamps, and other high-wattage / high-priced lamps. Be sure not to exceed the load rating of your Triac in use.



board, using point-to-point wiring. No special wiring precautions are necessary, except for the section of the circuit which carries AC voltage. It should be well-insulated, and kept away from the rest of the circuit and the cabinet. We strongly recommend using a 3-prong cable and jack, with the ground wire connected to the cabinet. The light coupler consists of the photocell and the lamp tied together with black electrical tape. Make sure that the active side of the photocell faces the lamp, and that the photocell pins do not touch the lamp wires.

The "on" and "off" controls, R5 and R6, can be mounted externally on the case, or internally on the perfboard. Mounting them inside makes for neater appearance, but changing the timing becomes a chore. We found that 3-seconds "on" and 2-seconds "off" were optimum for most applications.

Operation. Operation of the Kitchen Helper is very simple. Plug it into an AC outlet, and plug your appliance into jack J1 on the case of the Kitchen Helper. You can vary the speed or brightness—if you use it as a dimmer—with R1. If you don't need the pulsing feature flip switch S1. That's all there is to it! Bon apetit! ■



Need parts? Find them in HOBBY MART—page 80

PARTS LIST FOR KITCHEN KONTROLLER

C1, C2—0.1-μF, 200-VDC tubular capacitor
C3—220-μF, 25-VDC electrolytic capacitor
C4, C6—4.7-μF, 35-VDC electrolytic capacitor
C5—0.01-μF, 35-VDC mylar capacitor
D1—1N4000 diode
J1—3-prong AC appliance receptacle
L1—6-volt pilot lamp, low current-type
NE—NE-2 neon lamp
PC—CdS photocell (Radio Shack #276-116 or equiv.)
Q1—Triac rated @ 200-volts @ 6-Amperes (GE-X12 or equiv.)
R1—50,000-ohm, linear taper potentiometer
R2—4,700-ohm, ½-watt resistor
R3—680-ohm, ½-watt resistor
R4—68-ohm, ½-watt resistor
R5, R6—1,000,000-ohm, linear taper potentiometer
S1—SPST switch
T1—transformer with primary rated @ 110-VAC/secondary @ 6.3-VAC @ 300 mA.
U1—555 timer
Z1—full-wave bridge rectifier; 200 PIV @ 4-Amperes
MISC.—cabinet, perfboard, hookup wire, solder, knob, AC plug and line cord combo., etc.

The Golden Library

A treasure trove of technical material
by Michael Hofferber

IT IS MID-MORNING and retired radio and television serviceman Henry Golden, father of five and grandfather to eleven children, opens his mail. The first letter he opens comes from a man in Charlotte, North Carolina. This man writes that he owns a Zenith radio, model 7S-262, for which he would like to obtain a copy of the wiring diagrams so that he can service his set. The second letter Henry opens is from Montevideo, Uruguay. This writer requests copies of declassified schematics for WWII-period U.S. Armed Forces two-way radios.

Letters similar to these litter Henry's kitchen table along with old service manuals and schematics, an Atwater Kent pre-selector, a tube tester, and a Model 33 Atwater Kent radio.

Although officially retired, Mr. Golden still serves the International Society of Certified Electronics Technicians (ISCET) in a unique and unusual way. Henry is the librarian of ISCET's clearing house of electronic service data. ISCET has maintained this library of electronics manuals, diagrams, and magazines through Henry since August of 1973. A sensitive, conscientious man, he repeatedly emphasizes that his goal is "to serve." "I want to make this material available to anyone who needs it, don't you see?"

Henry uses a magnifying loupe to read component markings on older equipment.

Henry Golden's working address is 8015 Paseo, Kansas City, Missouri. His home is a simple white frame house, and the library is housed in a small cinderblock building out in back. It looks both humble and ordinary but, as Henry himself is proof, its true value lies beneath the surface.

For as long as manufacturers have been building radios and televisions, they have been printing up service data and diagrams to accompany their sets. Without these diagrams, neither Henry nor most other servicemen would ever touch a set. It used to be that the service data was included with the purchased set. When a customer took his radio home, he carried the diagrams and schematics with it as well. This practice ended when customers caused so much damage to their sets by trying to repair them on their own, that the servicemen and dealers started to complain. Today, manufacturers supply service materials only to authorized dealers and servicemen who subscribe to receive them.

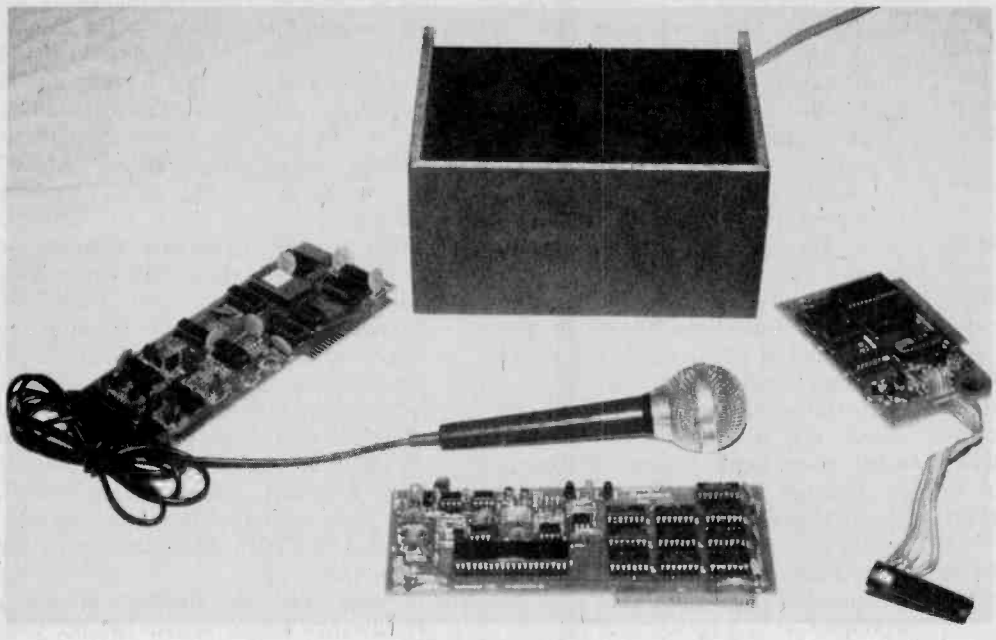
In the past, there existed no central repository for all these materials. Diagrams and schematics which went out of print were rarely replaced. Some materials were lost for all eternity. Others found their way into basements, storage rooms, and into the hands of a few collectors. What the ISCET library in Kansas City was set up to do, was to retain all this service data which people were literally throwing away, and provide copies of diagrams and information to members upon request.

But without Henry Golden, whose mind is as much a storehouse as his library, there would be no clearing house for these materials. It was Henry that ISCET came to when they realized they needed the library, knowing that his background and experience, and his dedication to the electronics field, suited him to the job. A self-apprenticed technician from the early days of radio, 72-year-old Henry Golden knows and understands radios and televisions better than most people know their children. "Why, he's been with 'em since they was babies," a fellow serviceman once said.

In recognition of his talents and contributions to the field of electronics, ISCET and the National Electronics Service Dealers Association have both awarded Henry lifetime honorary membership in their organizations. Mr. Golden is the only man ever to be so honored by the two major electronics trade associations.

The ISCET library cannot meet every need, and doesn't promise to. Materials which are not on hand will hopefully be donated one day by collectors or dealers who have them. The library is funded with $25 memberships, available to anyone, which allow unlimited use of the library's resources for one year. The only additional expenses might be shipping or duplication costs. The services of the library are available to members at no cost, and to non-members for a nominal fee. Anyone stuck for service data on an old TV or radio, or searching for a particular electronic part or instrument, need only write a letter to Henry Golden at this address: ISCET Technical Clearing House c/o Henry V. Golden, ISCET Librarian, 8015 Paseo, Kansas City, MO 64131. If anyone has the material, or knows where to find it, it's probably Henry. ■

HOME COMPUTERS In The Real World



The home computer goes to work and does a real job

by Neil Shapiro

As WE ALL KNOW, the arrival of all the new hobby, personal computers on the market has signalled the advent of the Microcomputer Age. Many hobbyists have been enjoying building them, playing games with them, and perhaps balancing the family checkbook and other such tasks.

Until recently, one very important thing has eluded all but the most advanced personal computerist—the ability to interface a computer with the real world. There has been much written about computers that respond to real world stimuli and can, in turn, affect the real world environment. It has always been assumed that the day such computers would be in the home was far distant. You need wait no longer, because these devices are here now!

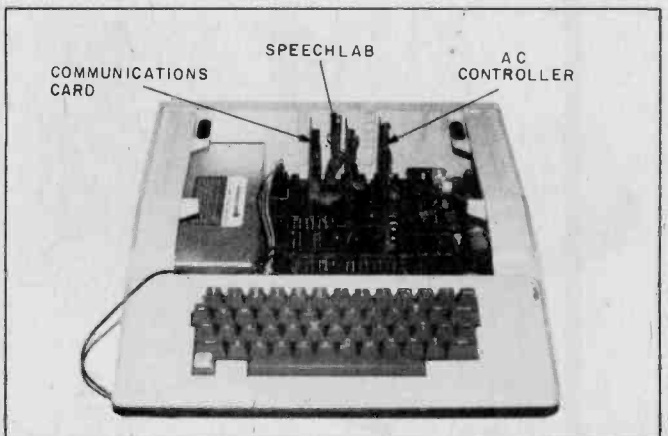
There are now peripherals which allow you to speak out loud to your computer—that will enable your computer to control any appliance in your home—and that will let your computer talk to other computers.

The *Speechlab*, from Heuristics, Inc. (900 N. San Antonio Rd., Los Altos, CA 94022) is available for either the Apple II or any of the S-100 buss computers and will allow you to talk into the microphone directly to your computer.

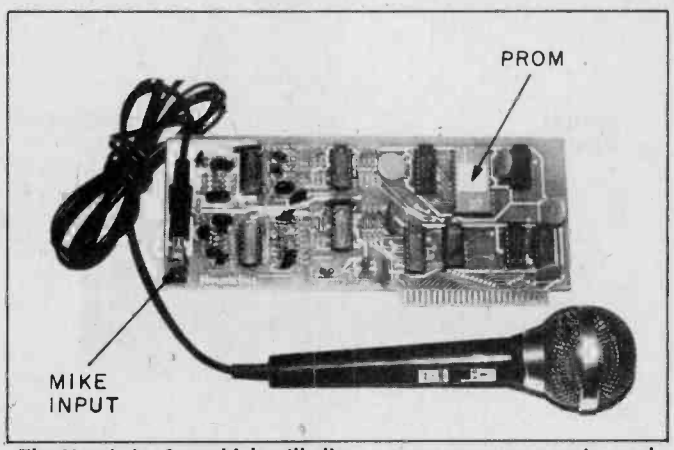
Also for the Apple II or the S-100 computers, Mountain Hardware's equipment will let your computer control your appliances (their address is: P.O. Box 1133, Ben Lomond, CA 95005).

Finally, Apple Computer, Inc. has released a *Communications Card* to fit their own computer which allows interfacing it to other, larger computers via the phone lines (Apple is at 10260 Bandley Dr., Cupertino, CA 95014) for of cost of $180.

Speak To Me, Master! The Heuristics *Speechlab* enables a home computer to accept a spoken word as input, instead of having the hobbyist type the word at the keyboard. Obivously, this can come in handy during a time when both hands are busy. Entering voice input



Both the Heuristics Speechlab vocal encoder, and the AC Controller by Mountain Hardware, are available in configurations suitable for use with the Apple II computer, as well as the many S-100 bus computers available on the home computer market.



The Heuristics Speechlab will allow a computer to recognize and act upon 32 spoken words. If you're tired of using the keyboard, or if you have an application that calls for two free hands, the Speechlab can be a help. Circle 63 on reader service coupon.

also makes for faster-paced game and action programs, and gives the user a real state-of-the-art feeling. Even better, when interfaced to other peripherals, it can give you true environmental control. More on that later.

As mentioned, the *Speechlab* is available on either S-100 or Apple-II boards. Either way, the installation is a plug-in snap.

The *Speechlab* accepts voice input through an analog-digital converter and processes that data via a program contained in an onboard ROM (Read-Only Memory). The program in the ROM identifies which word has been spoken (providing the word has been "taught" to it) and passes the decoded word as a string variable to whatever program running on the host computer has called for the input. Speechlab has a 32-word vocabulary which is user-defined and redefinable.

To begin, the user "trains" the *Speechlab*. The hobbyist speaks into the microphone an example of each of the words the *Speechlab* will be expected to recognize. In actual practice, it is a good idea to allow each word to be spoken twice (meaning a sixteen-word vocabulary) as you seldom say the same word with *exactly* the same intonation. Each intonation, as far as *Speechlab* is concerned, is a different word so you try to give the *Speechlab* a representative sampling of the words it must know.

Speak a word into the mike, and *Speechlab* uses two simultaneous methods to decode it. First, it checks the varying of the amplitude modulation and then the changes in frequency. Suppose you have a word which begins with what is called a voiced sound, such as "chop." This is a loud sound, so the amplitude modulation test can quickly recognize the beginning of the word. If an unvoiced sound begins the word, then the frequency sampling will show the word has started. Either condition must be present for at least 100-milliseconds. This helps eliminate random noise from being interpreted as an unknown word. If either condition is present for less than 100-milliseconds, the program continues waiting for a word.

We found it interesting that once a word has begun, the *Speechlab* determines the end of the word only after all sampling conditions are zero for at least 100 milliseconds. Why, we wondered, did it not instantly end the word when input ceased? It surprised us (though a philologist would have known) that there are many English words that have a short period of silence right in the middle of their pronunciation. The word "six" is a good example.

A sample program that comes with the *Speechlab* graphically demonstrates how the *Speechlab* decodes a word by providing you with a visual display of the "template" process used. Load the "Voice Plot" program and talk into the *Speechlab's* microphone. Your voice is plotted on the CRT (or TV) just as *Speechlab* "hears" it. The energy of the word (its amplitude or change in volume) is plotted as a waveform running along the top of the screen. Two other waveforms—low frequencies and high—are plotted along the middle and bottom of the screen. After a few minutes of experimentation, you can easily see that every word you speak has an unique three-waveform pattern.

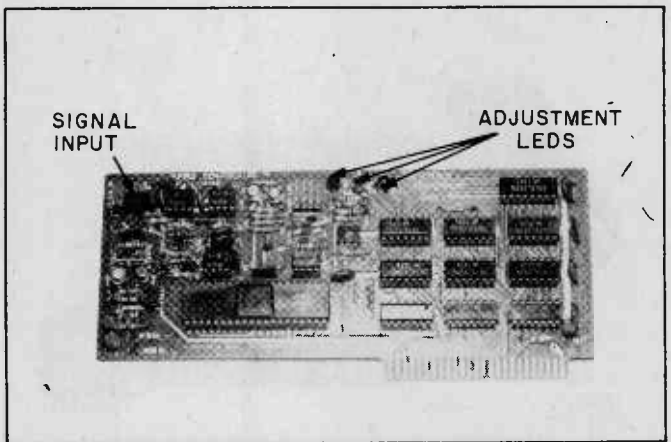
The program also shows how short words can seem similar and lead to some confusion. We first tried programming *Speechlab* to recognize the letters of the alphabet, and ran into a bit of trouble. Then we realized (and demonstrated to ourself via the "Voice Plot" program) just how close in sound letters such as *C*, *E*, and *B* really are. It wasn't the *Speechlab* that was fouling up, it was our own sloppy pronunciation. When we started saying "Alpha" for A; "Beta" for B; etc., everything went well.

We used the Apple II version of the *Speechlab* and found programming very simple. When you want the *Speechlab* to accept voice communication, you simply tell the Apple II to ignore its keyboard and accept input from whatever slot Speechlab is in. The command (on the Apple) PR#3 would do, if *Speechlab* is connected in the third I/O slot. Once data is loaded, you can return control to the keyboard (PR#10) or continue with the *Speechlab*.

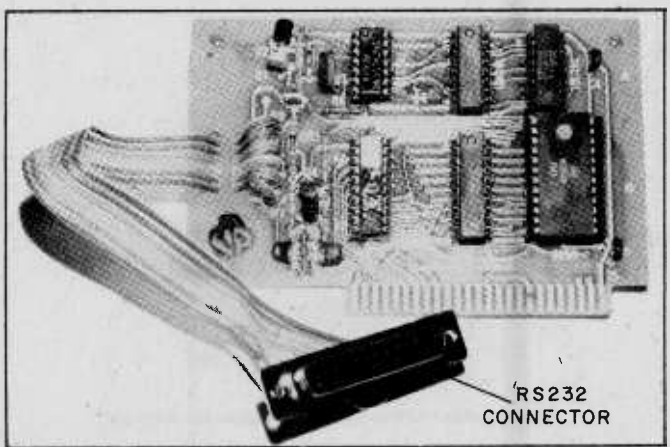
Power To The People! Mountain Hardware's unique system can put your computer to work all around the house. Pun intended, the AC Controller is a real turn-on!

The AC Controller card is available to plug directly into the Apple II or any of the S-100 computers. Each remote can control one or two appliances. All control signals are passed back and forth from the computer controller to the remotes, and back again, right over the AC wiring of the house. This makes the system completely portable from room to room.

The AC Controller and remote(s) are available from Mountain Hardware in either assembled or kit form. We like building kits and found these to be very straightforward. The instructions are not as complete as the Heath-



Mountain Hardware's AC Controller has an easy to assemble PC board. Once built, all it takes is a quick adjustment using onboard LEDs, an attachment to the AC line, and you are ready to control your appliances. Circle 37 on reader service coupon.



The Communications Card from Apple will, through use of a modem, allow an Apple computer to be utilized as an intelligent terminal. The "Com Card" gives the Apple an industry-standard RS232 output port. Circle 64 on reader coupon for information.

kit variety, but if you have ever built one of our projects, or done any PC board work, you need not be afraid of this.

The AC Controller Card is first plugged into a computer and then interfaced (by a supplied plug-in interface) to the AC wiring of the house. The controller and the remotes communicate by sending out 7-bit signals as modulation of the AC current in the wiring. If the signal is, say, a command to a remote to turn an appliance off or on (by activating one of the remote's two relays) then bit 7 is a 1. Bits 0-through-5 determine which of 64 relays (up to 32 two-channel remotes may be in a system) is to be address 1. The AC Controller can "talk" to a remote as far distant as a half-mile, so long as both are on the same AC line and the line is relatively free of transients and the like.

Communication between the controller and the remotes is completely two-way. You can "toggle" a remote (turn it either *on* or *off*) or you can "poll" it (look to see if it is *on* or *off*). When you write a program to turn your appliances off or on, you can also test to see if appliances you cannot see have done what you have told them! The remote, by the way, is no less complicated than the controller. Both depend on a UART chip (Universal Asynchronous Receiver Transmitter) and associated circuitry in order to originate and answer signals.

The controller is a bit complicated to program, but Mountain Hardware has provided some of the best supporting software we have seen to help everyone get the maximum from it. S-100 computer users get a program which lists names of appliances (or asks for names) and will then control them according to the hobbyist's whims. The Apple II version of the program draws a house on the screen, along with colorful indications of how the program is running.

Here's the best part. Mountain Hardware recognized that the hardest part of programming is getting all your subroutines to work. All the needed subroutines to toggle or poll are on the demo program. Just delete the rest of the program, and you are left with the subroutines to fit into your own programs!

Let's say you want to turn off a radio which is plugged into remote channel #0 (which is the first channel, with #1 being the second, and so on). You first set a variable in one of the program lines equal to 0. Then enter the command GOSUB TOGGLE. TOGGLE is a variable equal to the line number of the subroutine you need. Instantly, the radio responds to your command! Easy, fun, and no hassle to program!

Applications are limited only by your own imagination. We set up a few timing loops so that, right on the dot, the TV came on during a favorite show. Then we manually turned on a lamp so that the computer would know (via a poll) that we were indeed watching the TV. With this input, the controller shut off the air conditioner in the room we had just left, in order to conserve electricity.

Playing With The Big Boys. There are really two types of computer home-hobbyists: Those who own their own microcomputer, and those who use a time-share terminal.

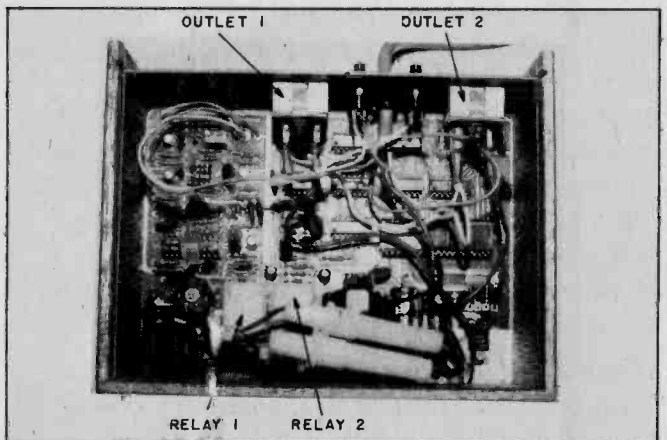
A time-share terminal hobbyist connects his keyboard/display via the phone lines with usually a very large computer located almost anywhere. Many schools and colleges use the time-share approach to give many students access to a computer.

Time-share had, and still has a lot going for it. You are not, for instance, tied down to using one language such as BASIC. Most time-share computers will give the user access to COBOL, FORTRAN and even more esoteric languages such as PILOT, as well as real powerhouess like APL, or even PASCAL. Besides that advantage, a time-sharer has available a library of previously prepared programs. Also, terminals have the ability, through the master computer, to talk to each other on a "network." Even the lucky person who owns his own microcomputer with a lot of RAM memory, BASIC in ROM, and good Input/Output peripherals, can be missing an exciting aspect of the hobby.

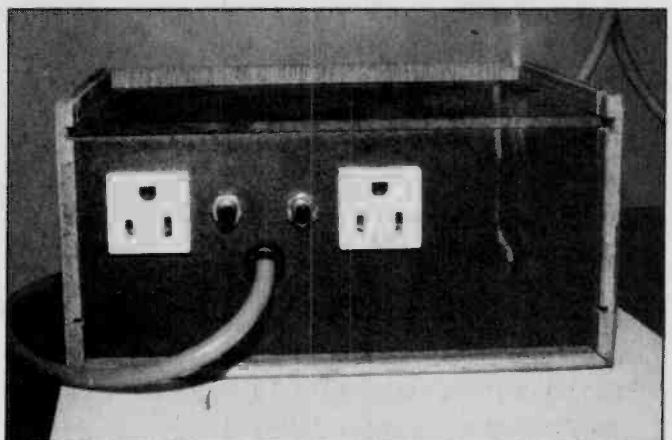
Apple Computer has released its *Communications Card* for the Apple II. The "Com Card" plugs into one of an Apple's I/O slots and turns the Apple into a terminal to communicate with a time-share computer via a modem. A modem converts the computer's digital output into tones that can pass along the phone lines, and converts incoming tones into digital input signals to the computer.

Apple has provided some great programs that let the user get right into the world of time-share. First is the Dow Jones Stock Quote Reporter. For a small fee, the hobbyist can tie his Apple II into a mammoth stock exchange computer to receive up-to-the-minute prices on every stock in his portfolio. Remember that the Apple II is more than just a terminal—it is still an intelligent computer, and once the info is obtained, an onboard program can process it in any manner the user programs and thus save the expense of further time-share charges.

(Continued on page 83)



Mountain Hardware's Remote unit is another easy to assemble project, owing to the scrupulously detailed instructions. Each remote will control one or two appliances of up to 500-watts each through two relay-switched AC outlets located on the back side.



The back of the Remote unit shows the two relay-switched AC outlets. They are also controllable by means of two pushbutton switches, so the operator can manually override the computer without entering new commands or returning to the terminal.

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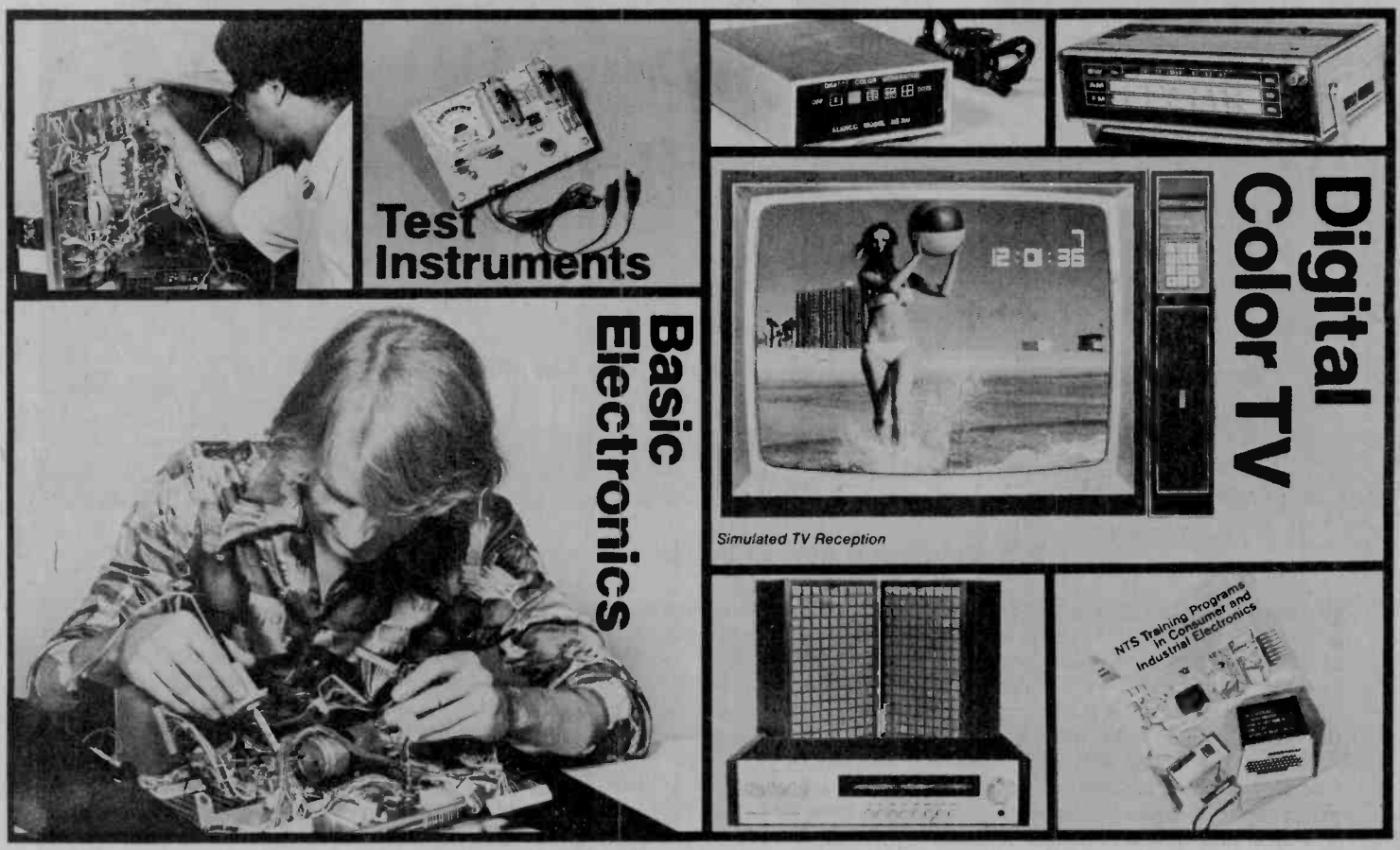

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DXing Foreign Intrigue

e/e shows you how to be the first spy on your block **by Don Jensen**

IN THE DAYS OF YESTERYEAR, radio news was king of the hill. Nightly, millions of American listeners tuned in to hear Lowell Thomas, H. V. Kaltenborn, Robert Trout, Edward R. Murrow and the other familiar radio news voices.

In the 1940s and 50s, before—let's face it—television replaced radio as the prime news medium of immediacy, it was not uncommon to hear a radio newscaster refer to a late-breaking story as having just been "picked up by our shortwave listening post."

The past quarter century has seen many changes in broadcast journalism. Portable mini-cameras, video taping, live satellite relays from half a world away, these developments of the TV age make the idea of networks and news services monitoring foreign shortwave stations seem quaintly old fashioned.

Why bother with shortwave newscasts? It's mostly propaganda—or so many people think.

There is propaganda, of course, politically and ideologically slanted news and commentary. However, there are also some remarkably fair and even-handed news broadcasts on shortwave. But biased or unbiased, the best way to get your news—news in the purest sense—is by listening to a number of different versions, from a number of different SW broadcasters, and then, make up your own mind!

If you're under 25, you probably don't remember hearing radio network news references to its shortwave listening post monitorings.

NBC and CBS DX Posts. Both the National Broadcasting Co. and the Columbia Broadcasting System got into the shortwave news monitoring business shortly before the start of World War II.

CBS had its DX post, an honest-to-goodness wooden shack, located at the edge of a field that contained its elaborate antenna "farm." As any savvy shortwave listener would do today, if he had the opportunity, CBS chose a location well away from traffic and electrical interference near Roosevelt, Long Island. Four radio technicians worked around the clock, in shifts, monitoring three sophisticated shortwave receivers.

One receiver was used to monitor broadcasts from the major capitals, Berlin, Paris, Rome, London. A second was tuned to other regularly scheduled European newscasts. The third radio was used to randomly patrol the airwaves for anything new or unusual.

The shortwave signals were fed by phone line from the Long Island site to downtown Manhattan, to the translators and newsmen in the CBS building on Madison Avenue. Monitors jotted down the main points of the news while the entire broadcasts were recorded on wax Ediphone cylinders. If the first listening indicated real newsworthiness, the recording was transcribed – translated when necessary—by high-speed typists.

Fast-breaking news was fed out over the CBS network immediately. Otherwise, shortwave news editors used up to 15,000 words of verbatim copy from the monitored broadcasts in the various CBS radio news reports each day.

NBC's listening facilities were even more elaborate. Its east coast setup, which utilized eight shortwave receivers, was located in a quiet section of Bellmore, Long Island. In late 1941, NBC opened a second post in North Hollywood, California, to monitor news broadcasts from Tokyo, Australia, the Philippines and the Free Chinese station, XGOY in Chungking.

Foreign Reports. With so many parts of the world shut off from Allied newsmen, due to the war, monitoring shortwave radio was a key factor in international news gathering. And SW news monitoring remained important for about a decade after the war ended.

Even in more recent times, however,

news services have sometimes found tuning in to foreign broadcasts essential to their journalistic efforts.

Sometimes it involved tuning the various secret and clandestine broadcasts of revolutionary groups or organizations whose views often were difficult to obtain otherwise.

During the years that Cuba was effectively closed to American newsmen, the Associated Press established a simple, but effective monitoring post in Miami to pick up Fidel Castro's lengthy speeches and other domestic broadcasts from that island just 90 miles off our shore.

In an updated version of news broadcast monitoring, NBC set up a "viewing post" in the hills outside Hong Kong to pick up the TV programs from Canton, behind the Bamboo Curtain of Mainland China.

Cuba and China, of course, no longer present such major problems in gathering news. But in other areas of the world, where Western newsmen are not regularly stationed, in parts of Asia, Africa and the Middle East, it is still important to keep an ear on the broadcasts coming out of these regions.

News, compiled and distilled from foreign shortwave broadcasts, even today, finds its way into our homes via the broadcast and print media. Most of the monitoring now is done by governmental agencies, rather than network or news services. Monitoring agencies such as the Foreign Broadcast Information Service and the United Kingdom's British Broadcasting Corporation Monitoring Service do the listening and provide daily summaries of news items monitored to the press, as well as their own governments.

Direct to You! But why not cut out the middleman in this information channel? You really don't need anyone to sift, winnow and edit the news for you when you can operate your own shortwave news listening post!

Students will find monitoring SW news a social studies project that is, believe it or not, fun as well as educational. And teachers may even bring a shortwave receiver right into their classrooms for the "realtime" news listening from stations in various parts of the world.

Or you can impress your friends with your grasp of the world's current events when you can recount what South Africa really thinks about the latest developments in Namibia, or Australia's position on the Vietnam refugee issue.

There are a number of ways you can go about operating your news listening post. All you need is a shortwave receiver and, perhaps, a tape recorder or cassette unit.

You may simply pick out certain representative stations in the major nations of the world and monitor those broadcasters' English language newscasts. Or you may focus on a certain area of the world that especially interests you; the emerging nations of Africa, the Middle East, Southeast Asia.

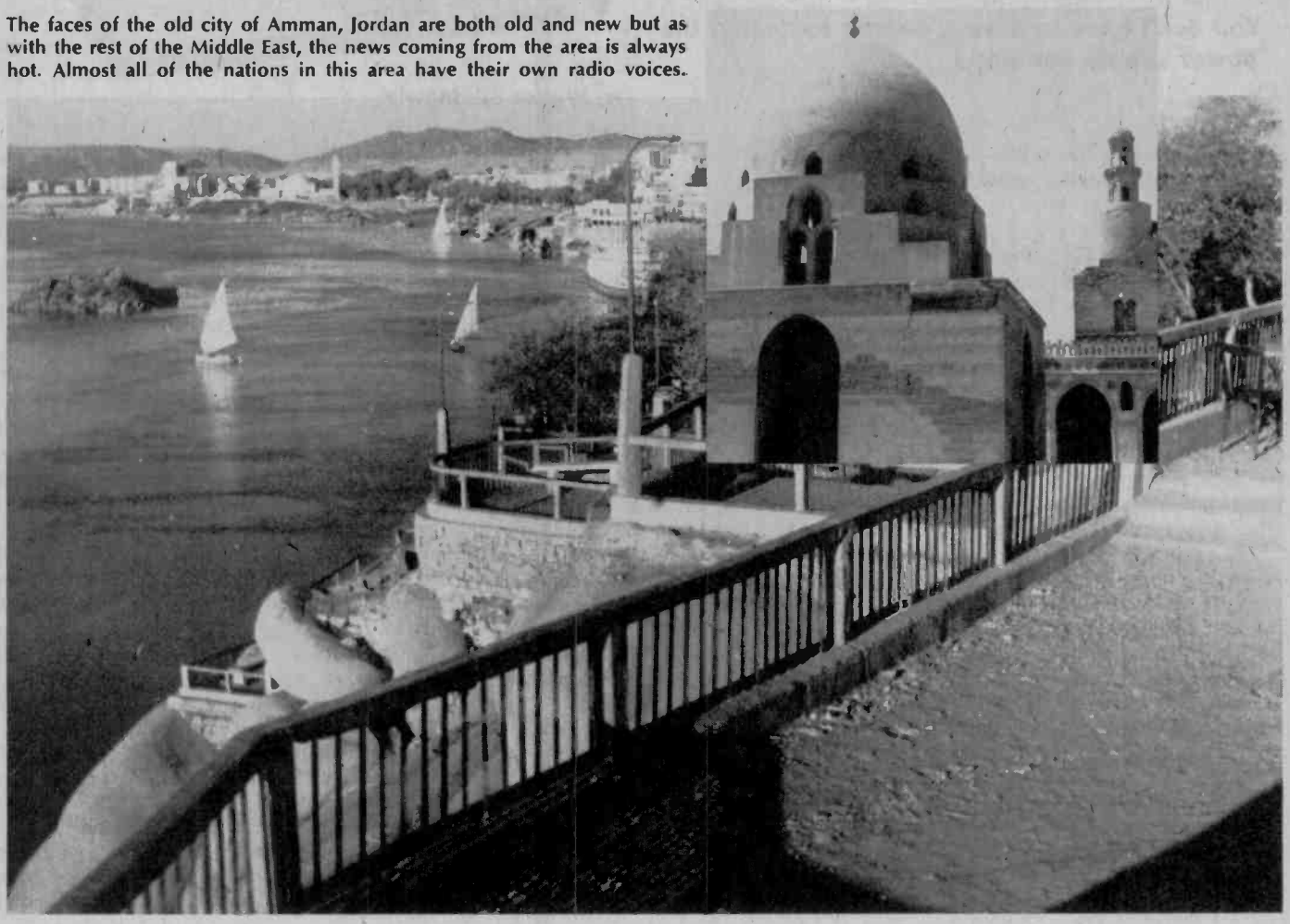
Another possibility is focusing on a certain issue or several issues, such as Cuban military operations in Africa or the Strategic Arms Limitation Talks, and carefully watch for appropriate news items from many different shortwave broadcasters.

You can, if you wish, record on tape or cassette these newscasts for your own news file or for school use.

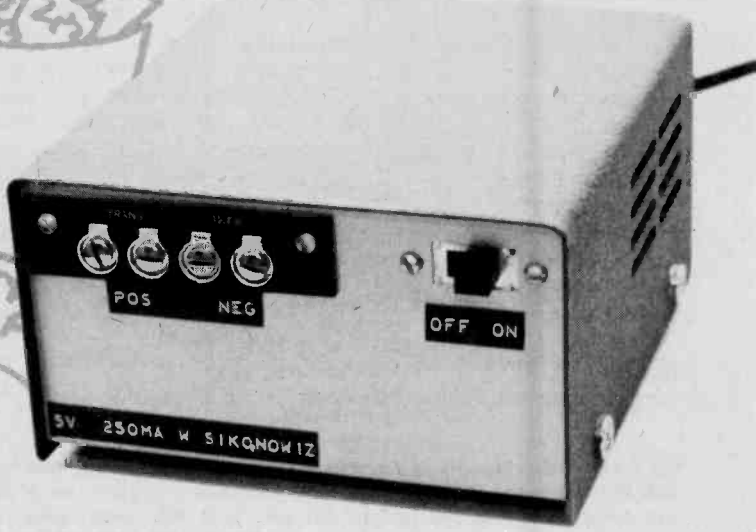
A particularly interesting approach is

(Continued on page 83)

The faces of the old city of Amman, Jordan are both old and new but as with the rest of the Middle East, the news coming from the area is always hot. Almost all of the nations in this area have their own radio voices.



DESIGNING REGULATED POWER SUPPLIES



You don't have to have a degree to design the power supply you need

by Walter Sikonowiz

UP UNTIL A FEW YEARS AGO, the task of designing a regulated power supply was both complicated and time-consuming. As a result, the average experimenter either made do without regulation or copied someone else's circuit. Things have changed a lot since then. Now, even a beginner can design his own regulated supply using one of the integrated-circuit voltage regulators. No fancy oscilloscope is necessary; in fact, you don't even need a calculator. Simply by consulting the tables and graphs in this article, you can custom-design your own regulated supply in a matter of minutes.

The supplies to be covered here range in output from 5 to 18-volts at currents up to one-ampere. Both posive and negative outputs are possible. Let's start by examining the basic positive-regulator circuit shown in Figure 1. Voltage from transformer T1 is full-wave rectified by diodes D1 and D2, and smoothed by filter capacitor C1. Voltage regulator VR+ converts the unregulated DC across C1 into a regulated potential of the desired size at its output, pin 2. Capacitor C2 bypasses this output and thereby stabilizes the circuit and improves transient response. On the primary side of T1, fuse F1 protects the circuit should a malfunction cause excessive current to be drawn from the AC line.

Similar, But Not Equal. The similarity between the positive-supply circuit and the negative-supply circuit (Figure 2) is apparent. Note, however, that D1, D2, C1 and C2 are reversed in the negative circuit. Furthermore, the pin designations of negative regulator VR– are different from those of positive regulator VR+. For the positive regulator, pin 1 is the input, while pin 2 is the output, and pin 3 is ground. On the negative regulator, however, pin 1 is the ground connection. Pin 3 is now the input, and pin 2 remains as the output of the voltage regulator.

Both the positive and negative regulators are available in two case styles, a "T" package and a 'K' package; see the base pin diagram.

Regardless whether a regulator is positive or negative, the same pin-numbering scheme applies. Remember, however, that the numbers have different meanings for positive and negative regulators. For example, on the "T" package, pin 3 is always the middle pin. If the regulator is positive, the middle pin is ground. But if the regulator is negative, then the middle pin is its input.

In the design procedure to follow, the same tables and rules will be used to specify F1, T1, D1, D2, C1 and C2, whether a positive or negative supply is being built. This is certainly reasonable since the two circuits are so similar. However, the positive and negative supplies must use different types of regulator ICs, and these may not be interchanged. With all the preliminaries out of the way, let's get down to the basics of this easy seven-step method for designing the supplies.

Determine the Required Voltage. You have your choice of seven positive voltages and seven negative voltages, as shown in the middle column of Figure 6. Note that +10V has no negative counterpart. Be sure that you know the *maximum* current that your load can draw; it must be no more than one ampere. If you are powering a construction project or a kit, you should find a supply-current specification somewhere in the literature. If you have no idea as to how much current your intended load will draw, you can measure it directly. Connect the device you intend to power to a variable bench

supply set to the desired voltage. Measure the current drain with an ammeter in series with one of the power leads.

Select a Transformer. Refer to Figure 6, and locate the desired output voltage in the middle column. For a positive supply, you will find the necessary transformer listed in the hight-hand column, and in the same row as your selected voltage. The proper transformer for a negative supply will be found in this same row, but in the column furthest to the left. The transformers are specified according to the RMS voltage from one end of the secondary to the other. Note that all secondaries must be center-tapped (CT). The transformers listed are standard, although they may not seem so if you are accustomed to the usual 6, 12, and 24-volt transformers that flood the hobby market. Finding a source is not hard; check the catalogs of any of the large electronics retailers. At least one transformer company, Signal, will sell you these transformers by direct mail-order. Before ordering, request a catalog and price list (Signal Transformer Co., 500 Bayview Ave., Inwood, N.Y. 11696).

You do have a little bit of leeway in the selection of a transformer, particularly at the higher voltages. If a 34-VCT transformer is called for, and you have on hand one that measures 32-VCT, go ahead and use it. Also, you could hook up the secondaries of two 12-volt transformers in series (and in the proper phase) to obtain the equivalent of a 24-VCT transformer.

In addition to the voltage, you must also specify your transformer's current rating. A convenient rule-of-thumb is to pick a transformer whose secondary-current rating is about 1.2 times the maximum current that is to be drawn from the supply. If you use a transformer whose current rating is too small, it will overheat. On the other hand, if you choose a transformer that can supply much more current than is necessary, it will be bulkier and more expensive than a transformer of the proper size.

Pick a Regulator. Here again, you should use Figure 6. Positive regulators can be found in the column just to the right of the "Output Voltage" column, and negative regulators are just to the left. As you can see, a positive regulator may be chosen from either of wo IC families: The 7800 series, or the 340 series. Furthermore, each family comes in either the "T". package or the "K" package. Thus, when selecting a 6-volt positive regulator, you can pick from any of the following: 7806K, 7806T, 340K-6 or 340T-6. If you were looking for a negative 6-volt regulator, the 7900 and 320 families would offer the following candidates: 7906K, 7906T, 320K-6 or 320T-6. Actually, there is no significant distinction between the 7800 and 340 families, nor between the 7900 and 320 families. The "K" package, however, can facilitate high power more readily, so it might be preferred at the higher supply-current levels. On the other hand, the "T" package is probably preferrable if you intend to build your supply on a PC board.

At all but the smallest load currents, these voltage regulators will have to be heat-sinked. This will be covered in more detail later. When you buy a regulator, try to get a specification sheet, too. It will provide you with more complete information on your particular IC.

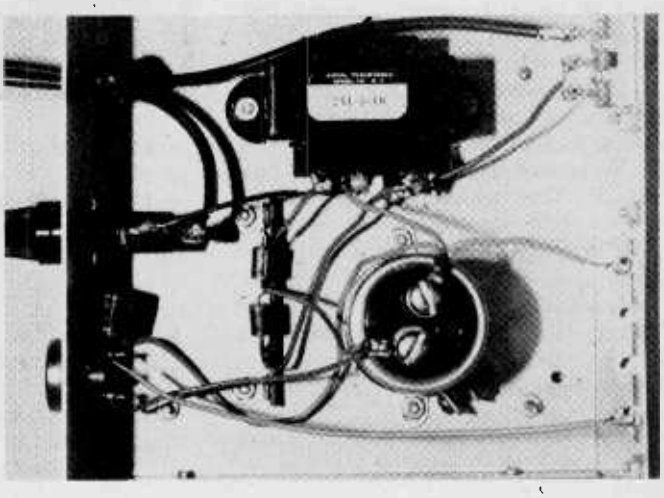
Choose Your Rectifier Diodes. The factors to be considered here are the diodes' voltage rating, average-current rating, and surge-current rating. Since the supply's load current is restricted to a maximum of one ampere, each diode must see an average current of less than half an ampere. Therefore, a rectifier diode with an average-current rating of one-ampere should suffice. A voltage rating of 100-PIV would be adequate, but it is even safer to use diodes with a 200-PIV rating. These will survive most power-line transients. The surge-current rating becomes an important consideration at the instant when the supply is turned on. At that moment, filter capacitor C1 is uncharged. Transformer T1 charges the capacitor with a current through one of the rectifier diodes. Since this current is limited primarily by the small resistance of the transformer's secondary, it is very large. When all of the above factors are taken into account, the 1N4003 emerges as a good rectifier with transformers of 28-VCT or less. Its higher-voltage cousins, the 1N4004 and 1N4005, also will work well. For transformers of 34-VCT to 48-VCT, use a 1N5402 rectifier or a higher-voltage relative (1N5403), etc.). The 1N5402 is a 3-ampere diode that will handle higher surges than the 1N4003. Both rectifier types are readily available from many suppliers, including Radio Shack.

Specifying Capacitor C2. This is easy, since anything greater than 25-μF will be fine. The capacitor's voltage rating should be from 1.5 to 2-times the output voltage of the supply you are building. If a capacitor with too small a working voltage is used, it will not last long. Conversely, using a capacitor with a working voltage greater than twice the supply voltage is wasteful of space and money.

Selecting Filter Capacitor C1. First, determine this component's working-voltage rating from the chart. A range of satisfactory working voltages will be found opposite the transformer voltage that you selected in step 2. Use a filter capacitor with a voltage rating as high as possible within the recommended range of working voltages.

The minimum capacitance of C1, in microfarads, can be found from the graph. Locate your supply's maximum current drain (see step 1) on the x-axis of the graph. Project a line upward to strike the one line (out of the three in the graph) that is appropriate to the transformer voltage being used. The y-value at the point of intersection is the minimum capacitance necessary. Use a standard electrolytic capacitor that is greater than or equal to the value determined from the graph.

In most cases, you can afford to be generous with capacitance. A larger capacitor will have less ripple voltage across it. As a result, it will heat less and last longer. So, when a low-current supply demands only 200-μF, you can



Here's the interior of our "typical" 5-volt power supply. Unless you're the type who likes to dress up all of your projects, these types of power supplies can be assembled in any handy chassis. There's almost never any cause to worry about ventilation, as many of the regulator chips can handle their full-rated loads without even heatsinking!

use 500-μF if you like. But when the capacitor must have a high working voltage (50 to 75-volts), extra microfarads come in a bigger package and at a higher price. Therefore, you may not wish to be so generous.

In order to locate a suitable electrolytic capacitor, consult the catalog of a large mail-order supplier, such as Allied or Burstein-Applebee. You will find some electrolytics listed as "computer-grade." These cost a little more, but they last longer in heavy-duty service. Whether or not the extra cost is warranted is a decision that is up to you.

Finding the Right Fuse. The fuse rating table will be of assistance here. Locate the row corresponding to the transformer being used, and the column appropriate to the maximum expected load current. Check the zone in which the row/column intersection lies for the proper fuse rating. Be certain to buy a slow-blow (3AG) fuse, since this type is less prone to blow on the current surge at turn-on.

Now, let's consider a practical design example. Suppose that a 15-volt, 350-milliamp, positive supply is required. The table indicates that a 40-VCT transformer will be needed. Estimate the transformer's current rating: 350 x 1.2 = 420. A look through a transformer catalog reveals the nearest commercially available unit to be 40-VCT @ 500 milliamps.

Referring once more to the table, let's choose a 7815K regulator IC.

Since a 40-VCT transformer is being used, 1N5402 rectifier-diodes are a good choice.

For capacitor C2, let's use a 100-μF unit with a standard working voltage of 35-volts. Because the voltage rating is about twice the supply's output voltage, this is a safe selection.

Figure 4 reveals that filter capacitor C1's working voltage should lie between 40 and 60-volts. Turning to Figure 5, and using line "B," we find the minimum capacitance to be about 750-μF. The nearest commercial unit turns out to be 1000-μF @ 50 volts. You can use more capacitance if desired.

Finally, Figure 3 indicates that a ¼-amp, slow-blow fuse is appropriate for this particular combination of transformer voltage and maximum load current.

Now that you know how to design your supply, let's talk about how to build it. Most manufacturers recommend that a voltage regulator be mounted fairly close to C1. This means 3-inches or less of interconnecting wire. Likewise, C2 should be mounted close by—right on the pins of the regulator, if possible.

Rectifiers D1 and D2 are cooled by heat conduction through the two mounting leads. To assist conduction, mount these rectifiers with short leads. If the rectifier is mounted on a terminal strip, then the lugs of the strip will act to sink some heat. Printed-circuit mounting requires the use of large pads and thick connecting traces to draw heat away from the rectifier's leads.

Be sure that there is adequate air flow around the components of the supply in order to prevent overheating. This applies particularly to the higher-current supplies.

Short, heavy wires should be used for interconnecting components. Again, this is most important for high-current

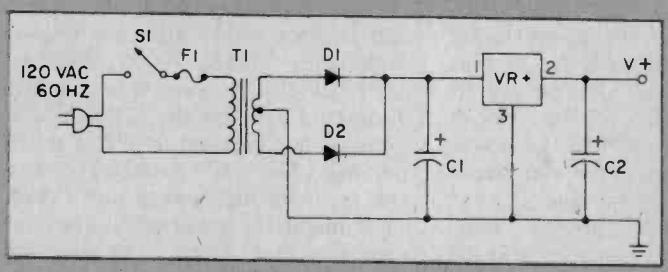


Fig. 1. Here is the schematic for the typical positive - regulated supply. Note the pin connections on the voltage regulator chip.

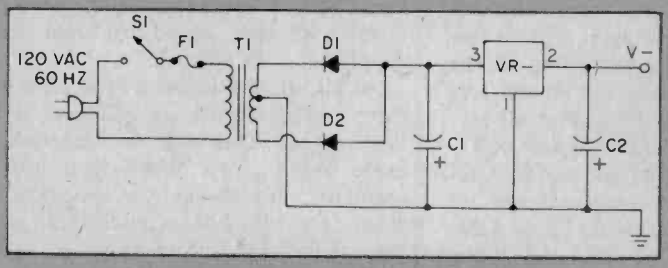
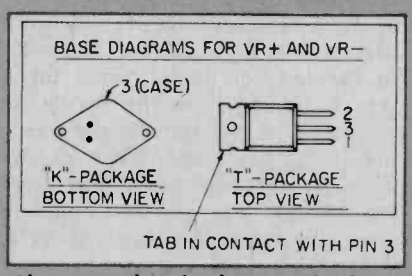


Fig. 2. The negative supply is almost identical to positive, with the exception of the reversals of the diodes and the pinouts of the regulator.

LOAD CURRENT (AMPS) / XFMR RATING (VOLTS RMS)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
16	1/8-AMP			1/4-AMP				3/8-AMP		1/2-AMP
20										
24										
28										
34										
40										
44										
48										

Fig. 3. To calculate what size fuse is needed for your supply, find your transformer's output rating in the vertical column, and your regulator's rating at top. Draw a line out to the center of the chart from each box. Where they meet is the fuse rating in amps.



Above are the pin diagrams for both the "T" and "K" package regulators. Note difference between pos. and neg.

TRANSFORMER RATING (RMS VOLTS)	WORKING VOLTAGE OF C1 (VOLTS DC)
16	16-25
20	25-35
24	25-35
28	30-40
34	35-50
40	40-60
44	50-75
48	50-75

Fig. 4. Simply look across from left to right in order to determine what the working voltage of C1 will need to be.

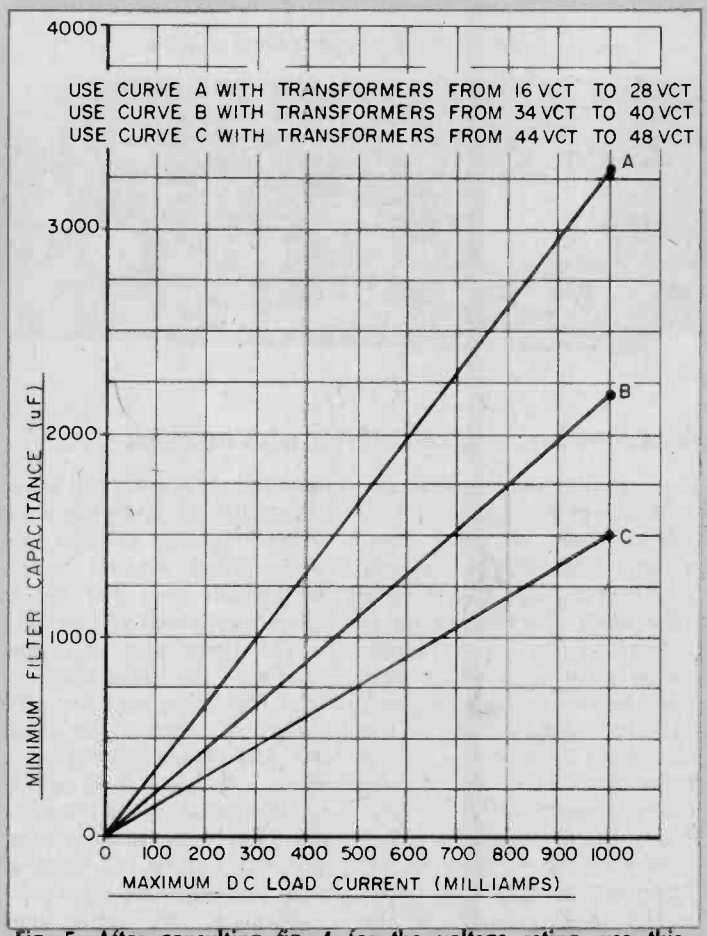


Fig. 5. After consulting fig. 4 for the voltage rating, use this graph to determine the correct capacitance for capacitor C1.

NEGATIVE SUPPLIES			POSITIVE SUPPLIES	
TRANSFORMER (RMS VOLTS)	REGULATOR	OUTPUT VOLTAGE	REGULATOR	TRANSFORMER (RMS VOLTS)
16 ct	7905/320-5	5	7805/340-5	20 ct
20 ct	7906/320-6	6	7806/340-6	20 ct
24 ct	7908/320-8	8	7808/340-8	24 ct
24 ct	7909/320-9	9	NOT AVAILABLE	
NOT AVAILABLE		10	7810/340-10	28 ct
34 ct	7912/320-12	12	7812/340-12	34 ct
40 ct	7915/320-15	15	7815/340-15	40 ct
44 ct	7918/320-18	18	7818/340-18	48 ct

Fig. 6. Here's a listing of the most commonly used transformer and regulator combinations for both positive and negative.

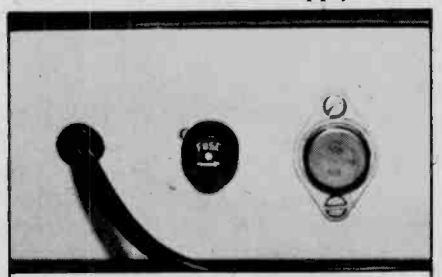
supplies, which should be wired with #16 or #18 stranded wire. Those wires connecting the load to the supply should be as short as possible for the best regulation.

In most instances, voltage-regulator ICs will need to be heat-sinked. There just fine. However, there is an even better, cheaper way to heat-sink a regulator IC: Assuming that the supply will be mounted in an aluminum case, simply attach the regulator to the case. Remove all paint from the area where the IC is to be mounted, and then bolt the regulator to the chassis. Silicone grease between the chassis and the regulator will improve the heat transfer.

If, as is generally the case, the chassis is to be at ground potential, then positive regulators may be mounted directly to the chassis with no difficulty. Negative regulators, however, pose a problem because the mounting flange on both the "T" and "K" packages is connected to the input, not ground. The solution here is to use mica insulating wafers, coated with silicone grease, between the IC and the chassis. Heat will still be effectively transferred, but the mounting flange will be electrically insulated from the chassis.

Once your supply is finished, check it out before permanently wiring it to a load. You will need a dummy resistor to test the supply. Its resistance should be equal to the supply's output voltage divided by the maximum expected output current, in amperes. For the supply that was designed in this article, that amounts to 15/35, or about 43-ohms. The resistance should have a power rating of about two times the product of output voltage and maximum current. Again, for the supply that was designed here, this comes to 2 x 15 x .35, or about ten-watts. Usually, you can build up such a dummy resistance from series and parallel combinations of lower-wattage resistors.

Connect the dummy resistance across the supply's output terminals, and then connect a voltmeter across the dummy resistance. Turn on the supply. Your meter should indicate the desired output voltage. After a few minutes, *carefully* feel the regulator IC's flange. It should be no hotter than hot tap water. If touching the regulator case is painful, use a larger heat-sink to cool it down.



This is a prototype power supply with a "K" package regulator mounted on rear of chassis for heatsinking. Make sure case connection agrees with ground!

If, at the end of ten minutes, your supply is still putting out full voltage, and the regulator is not uncomfortably warm, you can turn the supply off. Disconnect the dummy resistance and voltmeter, wire the supply up to its load, and start pumping out those happy amps. ■

e/e checks out the...

SST T-4 Ultra Tuner

CIRCLE 75 ON READER SERVICE COUPON

This mini matchmaker weds antenna and transmitter with no tears

MANY AMATEURS LIVE in constricted areas and have limited space for antennas. In such a setting, antenna designs are usually a compromise at best, and an antenna tuner is a useful accessory for the shack.

Unless an antenna is designed for a nominal 50-ohm impedance across all intended frequencies, an antenna tuner is needed to "fool" the transmitter into seeing a "perfect" load.

SST Electronics, of Lawndale, California, markets a line of compact antenna tuners. Their top-of-the-line is the T-4 Ultra Tuner.

Installation. The tuner should be placed in the antenna line between the low-pass filter (or transmitter) and the antenna(s). Use RG-8 or RG-58 cable. The tuner should be grounded before attempting to use it.

Specifications. The T-4 is compactly-sized at 9-inches, by 2½-inches by 5-inches. It will accept either three coax-fed antennas, or two coax-fed and one random wire. They are selected by a three-position switch located on the rear apron. In addition, the first antenna switch position bypasses the tuner, but keeps a built-in SWR (standing wave ratio) meter in the antenna circuit for comparison testing.

The antenna tuner circuit is very straightforward. Two, 208-pf variable capacitors bracket a 12-position tapped inductor. The SWR metering circuit is in series with the transmitter input.

The tuner is rated at 300-watts output power and had no problem handling almost 250-watts output as long as the circuit was near resonance. Out of resonance, the tuner would arc on 160 and 80 meters, when higher power was mistakenly applied. It should be noted that this characteristic is seen on all brands of compact tuners. The simple reason for this is that spacing of the variable capacitors' plates is small. That's why the high power tuners have their physical size measured in feet, not inches. They need the space.

Operation. The T-4 Ultra Tuner did a fine job handling an end-fed, 135-foot random wire on all bands, 160 through 10 meters. The antenna tuner was connected to an outside ground rod, and a six-band counterpoise was attached.

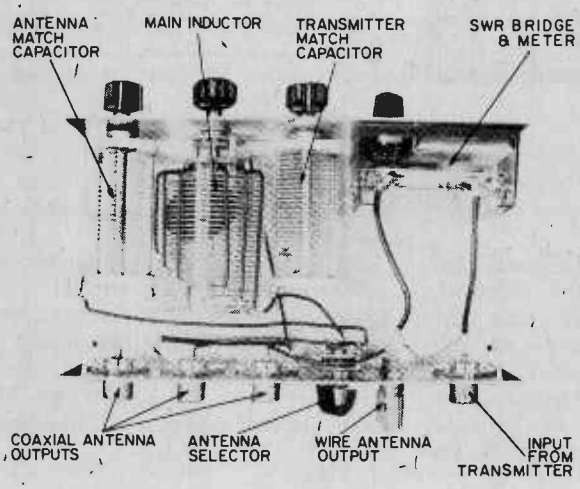
There was sufficient inductance to load the transmitter on 160 meters, provided the random wire was at least one-quarter wavelength long. That, incidentally, is a fundamental rule of using long wire antenna tuners: Make the end-fed wire at least a quarter wavelength long for the lowest frequency on which you intend to operate.

The tuner also performed well in "fooling" the transmitter when using coax-fed antennas. As with compact tuners of other major manufacturers, the SST T-4 cannot tune a coax-fed dipole designed for one band onto another band. What it can do is flatten the SWR when using a dipole cut for the high end of the band, on the low end, and also vice-versa.

Similarly, the tuner can help the transmitter on a compact, 3-band beam fed with coax. The beam in question is dipped for the low end of the CW bands on 10, 15, and 20 meters. The SWR rises above 3:1 halfway through the Advanced class phone bands. With the SST, the transmitter can be loaded up in the General portions of the bands wherein the DX phone nets reside.

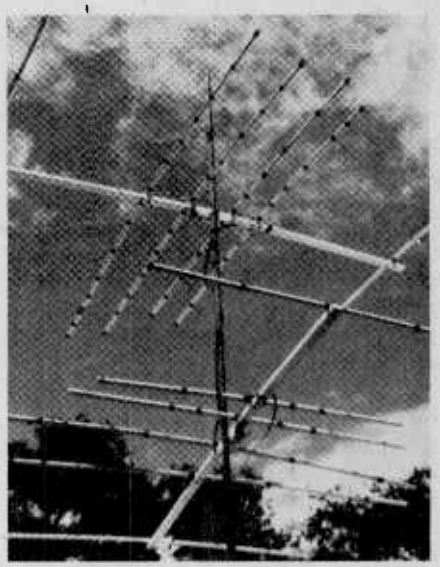
Unfortunately, a 4:1 balun was not included in the package. The tuner could not be checked on an 80 meter "inverted-vee" antenna fed with 300-ohm twinlead. The baluns are now on hand and are being shipped as part of the package. Judging from the characteristics seen on the other tests, there should be no difficulty in tuning a dipole or "inverted vee" fed with balanced 300 or 450-ohm line.

Conclusion. The SST T-4 Ultra Tuner is a neat, compact package eminently suitable for the average shack. With a competitive price of $64.95, they will probably not languish for too long on your local dealer's shelves. For more information on the T-4, circle number 75 on the reader service coupon, or contact: SST Electronics, P.O. Box 1, Lawndale, CA 90260. ■



The tight spacing of the interior components is the reason for the low power rating. When more than 250-watts output is used, some arcing may occur. This is characteristic of all miniaturized antenna tuners. 4-antenna capacity of the SST allows you to put up plenty of experimental antennas for comparison tests. Circle number 75 on reader service coupon.

BARGAIN BASEMENT BEAMS



Build a high-power TV antenna for next to nothing

by Charles Fullinwider

MANY FAMILIES HAVE TWO or more television sets in their homes and do not wish to mount additional antennas on the roof, or to install a complicated system so that a single antenna can be used with several TV sets. So, why not build a TV antenna, one that will bring in fringe-area stations, using wire instead of aluminum tubing?

Wire beams have been around for a long time, and have been used successfully by radio amateurs. The more popular beams are made of aluminum tubing because the tubing is self-supporting from a single mast, and may be rotated. But wire beams, fixed in one direction, make good antennas, and are simple to construct, as well as inexpensive.

Open Space. The antenna described here can be built in a back yard or even mounted in an attic. Its effectiveness indoors depends upon several factors, including the type of building structure and how far the antenna can be kept from vent pipes and other metal objects. It is usually better to mount the antenna in the open, above trees and buildings, but sometimes good reception can be achieved even when the antenna is not in an ideal spot.

The basic antenna may take several forms. The simplest one consists of two folded dipoles (one for channels 2 through 6, and one for channels 7 through 13), and a reflector. If these terms mean little to you, that is not important, for their construction will be described. It may be that only this basic antenna will be needed to receive the stations in your area, but if a more sensitive antenna is needed, directors should be added.

Here is how the basic antenna is made. A piece of 300-ohm twin-lead is cut so that it has a length of 89 inches. At the center of this piece of twin-lead, *one* of the two wires is clipped, and an inch of the wire on each side of the clip is cleared of insulation. An inch of insulation is taken off each end of the twin-lead, the two wires are twisted together and soldered. This is the folded dipole for channels 2 through 6, and it should be approximately 88 inches long from one soldered connection to the other.

Cut another piece of 300-ohm twin-lead so that its length is 30½ inches. Follow the same procedure to make a folded dipole with a length of approximately 28½ inches.

Antenna Hang-Up. The folded dipoles and other elements of the antenna may be supported by two lengths of plastic clothesline, preferably the kind that contains no wire. If wires are used to fasten the elements to the support lines, insulators may be made from small pieces of plastic (such as caps from ball-point pens) through which holes have been drilled. The plastic support lines may be attached to cross pieces made of heavy wood doweling or ¾-inch PVC plastic pipe, so that the entire antenna can be hung from two points.

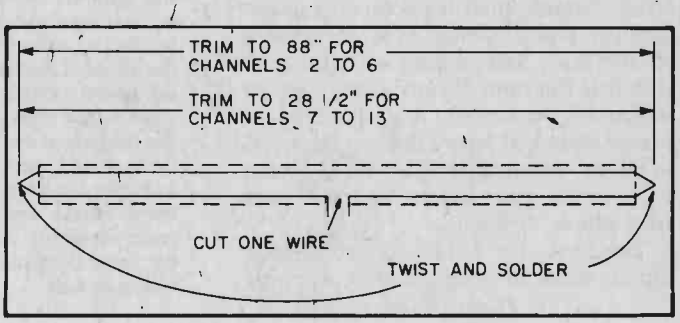
The reflector is the element at the back of the antenna, and is made from a 92-inch length of wire. Any small wire may be used, from number 24 enameled wire to bell wire. Neither reflectors or directors have an electrical connection to the folded dipoles, but do their work by electro-magnetic coupling. They are called "parasitic" elements.

After the reflector is attached to the plastic support lines, the longest of the folded dipoles is placed 26½ inches in front of the reflector, and the second folded dipole is mounted about 12 inches in front of the longer dipole. The two center wires on the longer element are attached to the center wires of the shorter element, giving the twin-lead that connects the two a twist so that the folded dipoles are out of phase with each other. Use 300-ohm

Chart I—DIRECTORS

Channel	Length	Spacing
2	92"	19.4"
3	83.6"	17.6"
4	76"	16"
5	66.5"	14"
6	61.75"	13"
7	29.4"	6.2"
8	28.5"	6"
9	27.5"	5.8"
10	27"	5.7"
11	26"	5.5"
12	25.6"	5.4"
13	24.7"	5.2"

You can enhance the sensitivity of any beam antenna by adding tuned directors for the frequencies that you have trouble receiving.



To make a folded dipole cut a section of 300-ohm, television lead-in wire to the lengths shown here. Solder the ends together. Cut one conductor at the center of the antenna and solder each end to the end of a 300-ohm twin lead.

BARGAIN BEAMS

twin-lead, or a transformer and co-ax, to connect the TV set to the front folded dipole.

Directors. That completes the basic antenna, and it may be all the antenna you need. However, if additional sensitivity is needed in order to receive a good picture from some stations, add some directors.

Chart I gives the lengths of the directors for the different channels, and also the spacing from the front folded dipole and from each other. You may add as many directors as you have space for.

If you have difficulty receiving two or more channels in the range of channel 2 through 6, the directors should but cut for the higher channel. The same applies for the range of channels 7 through 13. You may wish to experiment with the spacing of the reflector and the directors. They may be spaced a little wider than the chart shows; the chart reflects the common practice of spacing the reflector .15 wavelength behind the main element, and the director .1 wavelength in front of the short antenna.

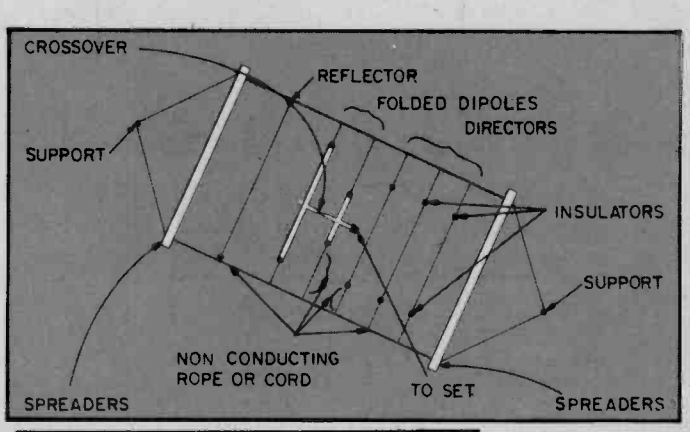
A Better Wire Antenna. A better TV antenna may be built, but because of the number of wire elements in it, the elements ought to be taped to some kind of non-conductive support rods or pipes. Fiberglass rods may be used. A less expensive method is to use ½-inch PVC plastic water pipe. The pipe is easily cut with a hack saw, is light in weight, and seems to stand up under varying weather conditions. The big disadvantage is that the ½-inch diameter of the pipe makes the antenna look like a small ham antenna. The construction described below makes use of the plastic pipe.

The center beam of the antenna is made from a length of 1-inch by ½-inch lumber. The exact length is determined by the number of directors used.

The four support pipes, cut from the PVC pipe, are 93 inches, 88 inches, 84 inches, and 79 inches in length respectively. Attach small wires to each of the support pipes, taping each lengthwise to the pipe, and cutting each wire so that it is the same length as the pipe to which it is attached. A few wraps of plastic electrical tape will keep the wires in place temporarily. Clip each of the wires at the exact center, and you have four dipole elements.

The next step is to add two shorter dipole wires to each element, clipping

(Continued on page 84)



A wire beam can be built for next to nothing. String it between two support posts or trees. While the direction is fixed, it is easy to set up in terms of maximum sensitivity. Use the same folded dipoles that are described on the preceeding page. Make sure that all of the support lines are made of non-conducting rope. Strong nylon fishing line is good.

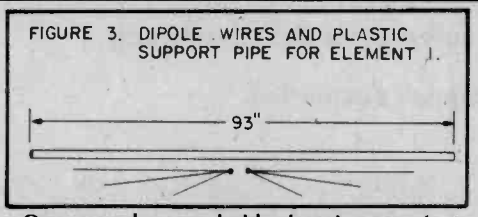


FIGURE 3. DIPOLE WIRES AND PLASTIC SUPPORT PIPE FOR ELEMENT 1.

One cross bar can hold wire elements for three frequencies if you cut three wires.

The diagram to the right shows how four, three element sections are wired together.

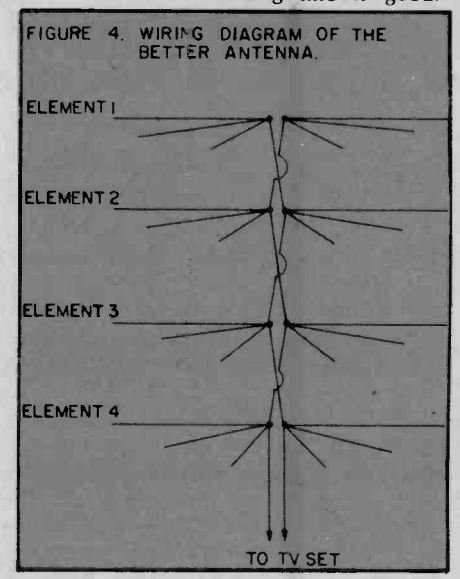
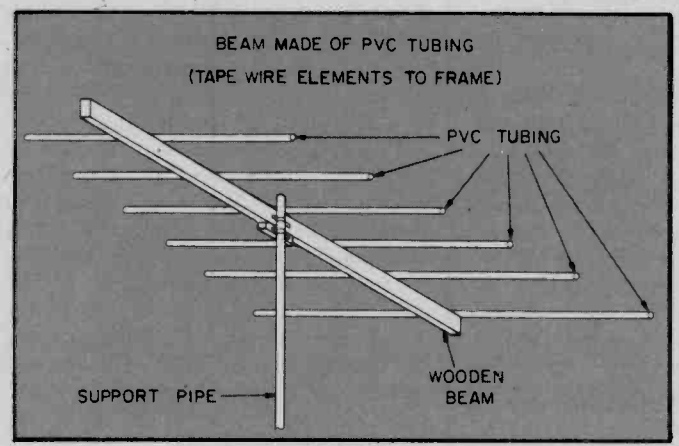


FIGURE 4. WIRING DIAGRAM OF THE BETTER ANTENNA.

Chart II—DIPOLE WIRE LENGTHS FOR SECOND ANTENNA

Element 1	93"	74"	35"
Element 2	88"	69"	31"
Element 3	84"	65"	29"
Element 4	79"	61"	26"

Cut the elements of the antenna according to the chart above. Tape to the PVC tubing.

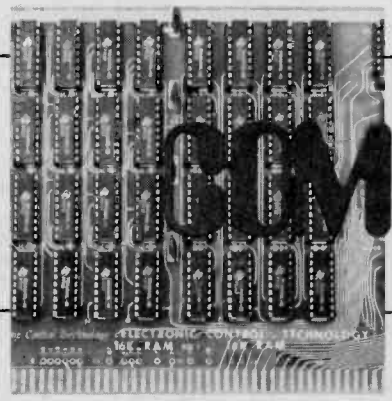


The frame for the wire beam is simple and cheap to build. The shaft can be sturdy wood or metal. Use U-bolts to secure a two-by-four to the mast and clamp the PVC, antenna element supports to the two-by-four. If the support pipe is too high above its base then you should add guy lines to keep the antenna vertical and rigid.

If you wish to make the antenna more selective then cut a director and reflector for the channel that needs the most help. The chart to the right gives the lengths of both reflectors and directors, and the spacing between these and the main elements. Don't cut these parasitic elements in half.

Chart III—DIRECTOR AND REFLECTOR DATA

Channel	Director Length	Reflector Length	Spacing
2	92"	97.8"	32.7"
3	83.6"	92"	29"
4	76"	84.8"	26.7"
5	66.5"	74"	23.3"
6	61.75"	69"	21.7"
7	29.4"	33"	10.3"
8	28.5"	31.8"	10"
9	27.5"	30.75"	9.7"
10	27"	29.6"	9.3"
11	26"	28.6"	9"
12	25.6"	27.5"	8.7"
13	24.7"	26.5"	8.3"



COMPUTER READOUT

by Tom Williams

Operating Systems—they make your computer more compatible with disks and other peripherals

EVENTUALLY, EVERY ENTERPRISING computerist, if he has been using cassette storage for any length of time, will look at the system he started out with and begin dreaming of upgrading it to do even more wondrous things. Visions of printers, X-Y plotters, color graphics, and controlling external devices will dance in the heads of those who have become relatively competent at programming and operating their basic systems.

Disk Drives. One of the first and most popular upgrades to a personal computer is, of course, the addition of a floppy disk drive. It is also one of the most dramatic. A disk system really makes a computer come alive and seem more "magical" after those interminable waits for a program to load from cassette. It also makes the system a serious contender for use as a business tool.

The big advantage of a disk system is the increased storage obtained and the speed with which stored programs and data can be read and utilized. We hear much about single and double density, access time, formats, etc, that is, the physical capacity of the disk itself. But one major consideration is often neglected. It takes a very sophisticated computer program, that is, software, to even begin to use the capabilities of a floppy disk system.

Operating Systems. Such a program, called an *operating system*, is far beyond the abilities of most home computer users to write and is therefore usually supplied by the manufacturer or by an independent software house. Anyone who is contemplating upgrading his system to include floppy disks should look well to the type of operating sysem that will be available to him. Also, by examining what an operating system is and what it does, we will get a better idea of some of the true potentials of today's microcomputers.

Essentially, the operating system is a program which supervises and coordinates the operation of all the various programs and peripheral devices (printers, disk drives, terminals, etc.) operating on the computer sysem. It keeps track of the order in which things are done, the names of different programs in memory, their locations, and it allows the user to tailor the system's operation to opimally suit his needs.

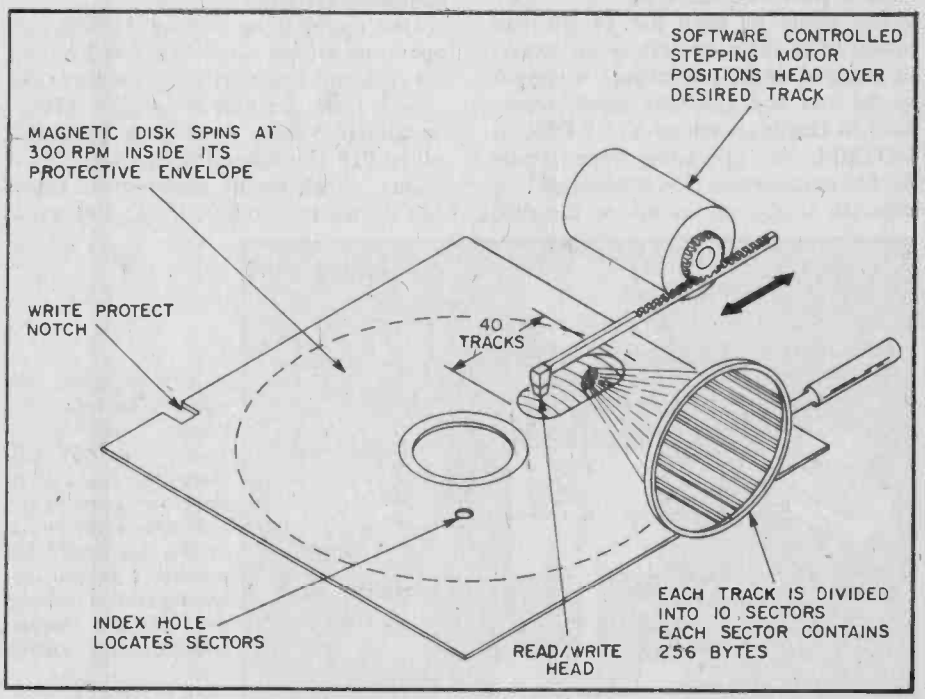
To understand how the operating system does this, we will need to use the concepts of "devices" and "files." A device can be any peripheral device connected to the computer: a CRT terminal, a printer, a disk drive, and X-Y plotter, etc. The operating system communicates with and uses these devices by means of special sub-programs known as *device drivers*.

Different peripherals require different software routines to drive them and an operating system may not have drivers for all possible devices. Nonetheless, a set of such routines is essential if the computer is to communicate with external contraptions, be they teletypewriters or robot arms. The ambitious programmer who wishes to run some exotic gizmo with his computer usually has to deal himself with writing the software to run it as well as building the hardware. A good operating system, though, will provide an easy method for the user to add device drivers of his own making.

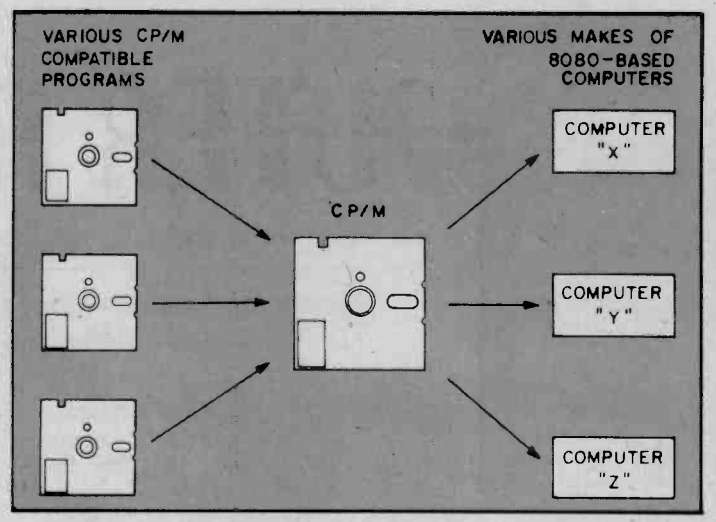
Files. The concept of a "file" is a little more complicated. To explain it, we will use the example of the floppy disk. The floppy disk is both a "device" which requires its own device driver, and a gigantic "file" itself. It is the place where all the other blocks of data and programs, or "files" are kept.

In fact, you can think of the disk drive, the device, as the filing cabinet, the physical storage unit. All the pieces of paper and records in the filing cabinet, then, correspond to the data blocks or files, recorded on the disk. The way the data is stored on the disk is illustrated in the accompanying diagram.

The floppy disk is a circular piece of material much like magnetic recording



There are many different sizes and types of floppy disks but they all look much like the one in this diagram. The disk tracks are not visible lines but rather sectors of a single magnetic coating. The read/write head is positioned by a stepping motor. Some systems have read/write heads for both sides of the disk. Index hole marks the first sector.



The CP/M operating system can be modified slightly to run on any 8080-based microcomputer. Applications programs can then be written to conform to CP/M's requirements rather than those of the computer. Thus, any computer running CP/M can use any of the thousands of independently produced programs written to run under that operating system.

tape. It rotates inside a protective envelope under the read/write head of the disk drive. The disk is divided into a number of concentric tracks, and each track into a number of sectors. A sector is the smallest unit of information the disk can access at one time. In a typical home computer diskette, each sector contains 256 bytes and each track contains ten sectors. On a diskette with 40 tracks, that adds up to over 102,000 bytes of storage!

With the disk rotating continuously under it, the read/write head moves quickly in and out until it has found the track requested by the computer. It then waits over that track until the proper sector comes around. At that point the head "taps" the disk and either reads data from it into the computer or writes data onto the disk.

File Finder. The job of the operating system in all of this is to keep track of where all the things are on the disk so they can be found when requested by a program. The operating system acts much the same as a poor, harassed file clerk who is constantly asked to fetch and file records. To ease its task, it generally uses part of the disk to establish a *directory* for itself. The directory is a little reference file the operating system uses to tell itself where everything is stored on the disk.

The name of each file (a file can consist of as many sectors as necessary, all grouped under one name) is chosen by the user and generally means something in English, such as STARTRK or BIOTHM. The operating system reads the file name when it is entered on the terminal, then looks it up on the disk directory. From the directory it finds out what track and sector it must go to to find the beginning of the file. We might also liken this process to finding a book in the library. First we go to the card catalog (the disk directory) and find out what aisle and shelf (track and sector) the book is on, then we go get the book.

So far, we have seen the actions of the operating system with the main means of mass storage, the disk drive. Let us now explore some of the things that are made possible by a typical microcomputer operating system. Not all the methods described here work for all operating systems because the approach of different authors varies. The general concepts, however, apply to all operating systems.

One major thing we can do with an operating system is take a file and transfer it from one device to another, or copy it from one disk to another. Many operating systems contain a program called PIP (Peripheral Interchange Program), which simply copies a file from one device to another. Using this program, a businessman can record the status of his inventory or reciepts on a disk kept outside his shop and update that backup disk, say, every week. Thus, if anything should happen to his daily working disk, he only has to go back one week in his paper records to get things straightened out. A better idea is to update the backup disk daily—with PIP it only takes a few seconds.

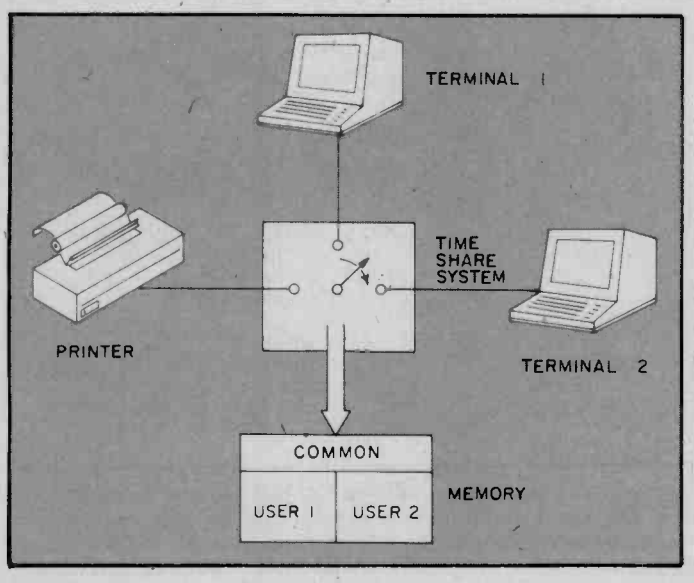
An operating system increases in versatility if it is able to treat certain peripheral *devices* as if they were *files*. In that way it can use them as sources of data to be copied to a corresponding file on the disk and later used by a program. For instance, if a program is monitoring a temperature at some peripheral, that information can be read as a file by the operating system and stored as a file on the disk. It can later be read as a file from the disk and copied as a file to a printer or used as a data file by another program.

With various peripheral devices connected to the computer (CRT, printer, disk, etc.) the operating system must always be aware of which one is really running the show, that is, which terminal is allowed to give commands to the operating system, tell it to shut up, power down, or fetch a file. This terminal is known as the *console terminal.*

In most cases, the console terminal is the CRT terminal since many printers don't even have keyboards. It is, however possible to have more than one console terminal and more than one user program working on the same computer system at the same time. This is done by means of a method called *time sharing*, and it is one of the most powerful features available on today's computers.

Thumb Twiddling. Peripheral devices, especially those with mechanical parts, are terribly slow when compared to the speed of a microprocessor CPU. While

(Continued on page 83)



In a time sharing system various terminals, printers and other "slow" peripherals share the use of a single computer to enable more efficient use of the machine. This requires a special operating system to keep the different inputs and programs sorted.

e/e checks out the...

REALISTIC DX-300 COMMUNICATIONS RECEIVER

CIRCLE 32 ON READER SERVICE COUPON

Digital readout ends the problems of guesswork tuning

FROM WORLD-WIDE NEWS, to ethnic radio programming, to communications with Air Force One (our President's airplane); to ships at sea, and communications between insurgent armies and terrorists around the globe, the short-wave frequencies to 30 MHz are jumping with entertainment and action. The only problem is, it's often hard to find precisely where the action is. Except for Radio Moscow, whose megawatt multi-frequency propaganda transmitters pound in from one end of the dial to the other—literally drowning out almost all of the 40-meter band—it's not the easiest task to dig out the real interesting signals even when you know their frequency. "Bandspread" dials just put you inside the ballpark—it takes much *rocking* of the tuning knob, or an external frequency calibrator, to place your receiver's tuning "on the money" on the first few tries.

But all that's a thing of the past. With the new Realistic DX-300, you simply *dial up* the desired frequency, and your tuning is accurate to within 1 kHz. Even if you've got the DX-300 baking in the hot sun, or down in a cold, damp basement, your tuning will be right on the station at the first try, and will stay there hour after hour.

Features. The DX-300 covers 10 kHz to 30 MHz in six bands. Actually, the "bands" refer to tuning of the RF preselector; the frequency selection is *direct dial* without bandswitching, but we'll get to that later.

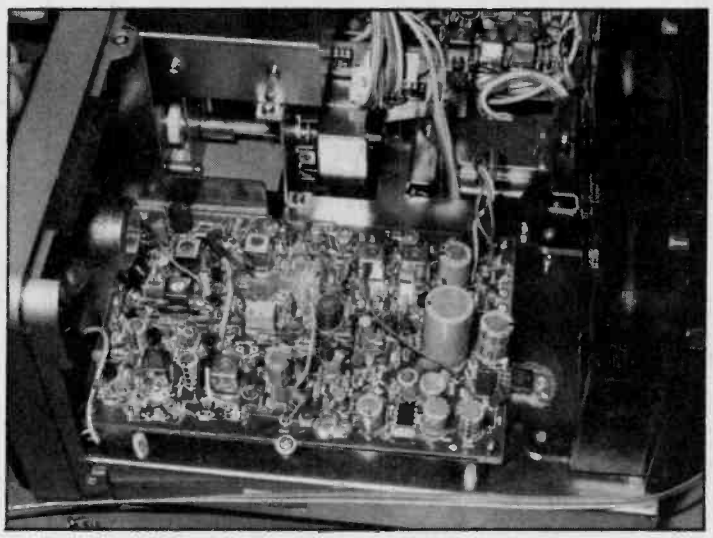
The normal power supply is 120 VAC. The unit may be powered, however, by six self-contained flashlight batteries stored within the cabinet, or by the 13.8-volt power of a motor vehicle (through the cigar lighter).

Controls include the usual volume and RF gain, the preselector bandswitch, preselector tuning, the operating selector (CW/LSB, CW/USB, STANDBY, AM, and AM with ANL—Automatic Noise Limiter), a MHz selector concentric with a kHz selector, and a *fine tune* that varies the tuning approximately ±1 kHz (serving as a *clarifier* for SSB and pitch control for CW).

There are switches for *battery test/lights* (when operating from the battery pack), *audio bandwidth* (wide, normal, narrow), and 0/20/40 dB antenna input attenuation. The receiver is supplied with a screw-on telescopic antenna. In addition to a built-in speaker, there is a front panel headphone jack, a tape output (phono-type) jack, and a jack for a telegraph key for the built-in code practice oscillator.

There are antenna input terminals for balanced and unbalanced (long-wire) antennas, and 50-ohm coax. The supplied telescopic antenna connects to the UHF-type coax jack. The usual S-meter rounds out the package.

Readout. The tuned frequency is indicated by a five-place digital readout with a decimal separating MHz and kHz. Two digits are reserved for MHz, three for kHz, providing a readout down to 1 kHz—close enough to put you right on top of any signal. The MHz dial steps directly in 1 MHz increments; as the dial is rotated, the readout will change from 0.000 to 1.000, to 2.000, all the way to 30 MHz. The kHz tuning dial steps in 1 kHz increments from 0.000, to 0.001, and finally, to 0.999. Actually, the kHz tuning starts slightly below 0.000 (it shifts the MHz indicator down 1 MHz) so you can "tune-thru" any precise multiple of 1 MHz without returning the MHz dial. For example, if you are searching out a station around 9.998 MHz, you could set the MHz tuning



All of the DX-300's circuitry is contained on discrete PC boards. This makes the rig easy to troubleshoot and service, and also helps reduce the possibility of spurious signals sneaking in and causing reception problems that can make you pull your hair out. This shot is of the audio filtering and amplifying section. Circle number 32 on the reader service coupon for more information.

to 10.000 mHz and then bring the kHz tuning down below MHz, say to 9.995 MHz. This would permit you to tune through 9.998 MHz to 11 MHz.

It all sounds a lot more complicated than it is. In actual practice, you simply set the MHz tuning so the readout indicates the desired MHz, then tune the kHz reading directly to the desired frequency. The "below" tuning is simply a convenience when you have to tune through the ends of each 1 MHz segment, which will be rare.

Quartz Reference. Unlike some other digital-readout receivers which use conventional tuning with an offset frequency readout of the local oscillator to indicate the received frequency—a system still subject to "drift"—the DX-300's tuning is directly controlled by a quartz-referenced digital frequency synthesizer. When you adjust the tuning dial, you are directly generating the local oscillator frequency(s); the only way the readout can change is if the local oscillator frequency changes, something it can't do because the local oscillator is referenced to a crystal controlled oscillator (the *quartz* reference). The only possible drift would be that of the crystal itself, which is infinitesimal, having almost no effect on reception from initial turn-on.

Triple Conversion. The type of digital synthesis used in the DX-300 requires triple-conversion, which has no direct effect on selectivity. (Don't confuse it with the triple conversion needed some 30-years ago in order to insure high IF selectivity.) The first conversion beats the received signal up to the 55 MHz range, where it is again beat against the local oscillator to produce an IF output of approximately 2-3 MHz. The local oscillator for the 2-3 MHz IF is variable for the *fine tune* adjustment, eventually producing a 455 kHz third-IF output.

Since the heterodyne oscillator that "kicks" the received signal up to the 50 MHz range, and the first local oscillator are both digitally derived from the quartz reference, any "crystal drift" is effectively cancelled. The tuned local oscillator that produces the 455 kHz output is so low in frequency that cold and heat have virtually no effect on its stability. This is how the DX-300 ends up essentially drift-free.

Audio Bandwidth. The *audio bandwidth* switch narrows the frequency response of the audio amplifier to reduce interference (particularly from adjacent CW stations). Keeping in mind that a communications receiver is not a high-fidelity device, in the *wide* mode, the output frequency response to the speaker measured ±5 dB from 150 to 2500 Hz. In the *normal* mode, the response measured ±5 dB from 200 to 2000 Hz. In the *narrow* mode, the response measured ±5 dB from 200 to 1700 Hz. The tape recorder output frequency response measured ±5dB from 100 to 2700 Hz. Naturally, in all instances there was output beyond the limits indicated.

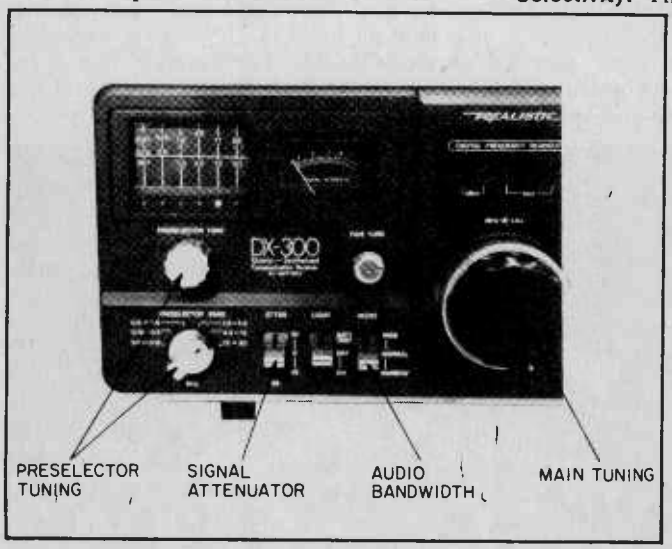
Sensitivity. Sensitivity from 2.5 to 30 MHz was almost a consistent 0.3 μV for a 10 dB S+N/N ratio.

Selectivity. The measured selectivity depends on what method is used for making the measurement. On a straight carrier-for-carrier basis, it is slightly less than 70 dB at ±10 kHz. When tested against a signal removed from the desired frequency by 10 kHz, which is modulated 30% by a 1000 Hz tone, the selectivity measured 50 dB. (This is the usual test procedure.) When tested under the same conditions, but where the interfering signal is modulated to 100% (the standard test for selectivity in CB transceivers), the selectivity measured 45 dB.

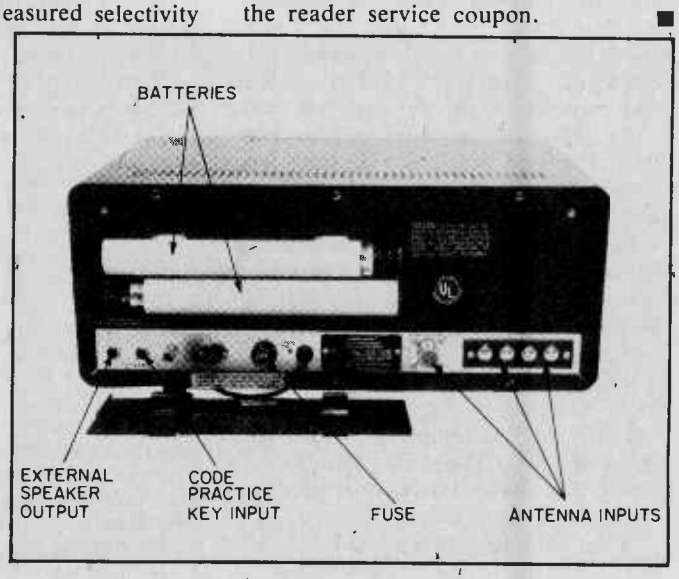
The AGC action, which is the variation in audio output for an antenna input signal range of 1-10 k μV (80 dB) was a very tight 6 dB. In plain terms, this means that your ears won't get blasted if you suddenly tune from a very weak to a very strong station. About the only minor complaint we have with the DX-300 is its relatively low overload threshold, which is why there's an antenna attenuator on the front panel. If the signal gets distorted due to overload, you simply flip the attentuator from 0 dB to 20 dB or 40 dB attenuation.

Summing Up. If you're into shortwave listening, and are either tired of tuning a "relatively calibrated" dial, calibrating the receiver against a crystal calibrator, or fussing with an uncalibrated bandspread, and you'd like to eliminate the "unknowns" and tune right to a known station's frequency the first time, then a digtial receiver, such as the DX-300, is what you're looking for.

The DX-300 is priced at $379 at local Radio Shack stores. For additional information, circle number 32 on the reader service coupon. ■



After a little practice, you can zero the DX-300 in on any band in a second or two. The preselector is really sharp, and helps to attenuate unwanted off-frequency signals. The audio bandwidth control can really sort out a signal when two or more are bunched.



The rear apron has appropriate antenna connectors for just about any type of antenna you might possibly wish to utilize. If you are contemplating portable operation, just slip a few batteries into the convenient holder, roll up your antenna, and hit the road!

BUILD THE LI'L WAILER

by Russ Head

Slip this small package into your pocket, walk down the street with one of your friends, and push the button; he or she will go crazy trying to figure out where the sound is coming from. You can "raid" your local poker group, or let it sound off at a party. We don't recommend using it within earshot of your local gendarme (unless you *want* to attract his attention) however.

Our 'Lil Wailer sounds like a police siren, and can be adjusted from a barely discernible cry to a scream that will attract attention for at least 100-feet around. It is rugged and small, and can be built in an evening or two with readily available parts.

How it Works. A combination of old and new technology is used in the design of the wailer. The heart of the circuit is the venerable unijunction (UJT) transistor. With power switch S1 on, and with trigger S2 depressed, capacitor C2 charges through Q1 until the level at the emitter of the UJT (Q2) causes it to fire. It discharges through R5 to create the basic siren tone. The voltage applied to the UJT charging circuit is varied to produce the ascending and descending pitch required. As S2 is held, capacitor C1 charges through R1, with the emitter voltage at Q1 "following." Thus, the UJT fires at a faster and faster rate, peaking when C1 is essentially fully charged. When S2 is released, C1 discharges through Q1, causing the voltage to the UJT charging circuit (R2, R3 and C2) to decrease, with the firing rate dropping slowly to zero. R3 provides an adjustment to select the most "authentic" tone.

The sawtooth-like waveform at the emitter of Q2 is then coupled through R6 and R7 to IC1, the LM386 audio amplifier. IC1, a 10-transistor linear amplifier, amplifies the waveform to a level sufficient to drive the tiny 8-ohm speaker through C3. The level at Q2's emitter is fairly high, so R6 and R7 divide it to prevent overdriving the amplifier, with R7 serving additionally as the volume control. The high value of R6 prevents loading down the UJT emitter circuit, ensuring proper operation of the device.

R4 and R5 are values typically associated with the unijunction transistor's characteristics. R4, in particular, was chosen to provide the best temperature stability of the circuit, a dubious requirement in this application. If a 2N2646 were to be used, R4 would be 2K. Due to another characteristic of the UJT, its *Intrinsic Stand-off Ratio*, use of the 2N2646 may increase the frequency of the tone, as compared to the 2N1671. It may be necessary to increase the value of R2 to 2.7K, or higher, in order to compensate.

The 2N2102 and the 2N1671B, were used in the author's wailer simply because of their availability from the "junk" box. A 2N2646 may be used, with the value of R4 adjusted as described above. Similarly, a 2N3646 or almost any inexpensive NPN silicon transistor will work, although if the device's gain is too high, the descending wail will be prolonged. The builder may wish to try neighboring values around C2, if the peak pitch, within the adjustment range of R3, is not completely suitable to his ears. In like manner, variations in C1 will cause a variation in the tone's rate of ascent and descent; a larger value for C1 slowing both processes.

Construction. Lay-out is not critical, except for the space allotted by the specified box. Perf-board was used because of the circuit's simplicity. The material used in the unit shown required additional holes drilled to mount the IC. Board material with 0.100-inch spacing would avoid that inconvenience. An IC socket may be helpful in protecting the amplifier during soldering, but since one wasn't handy, the chip was pushed flat against the board, bending over the unused leads to hold it in place.

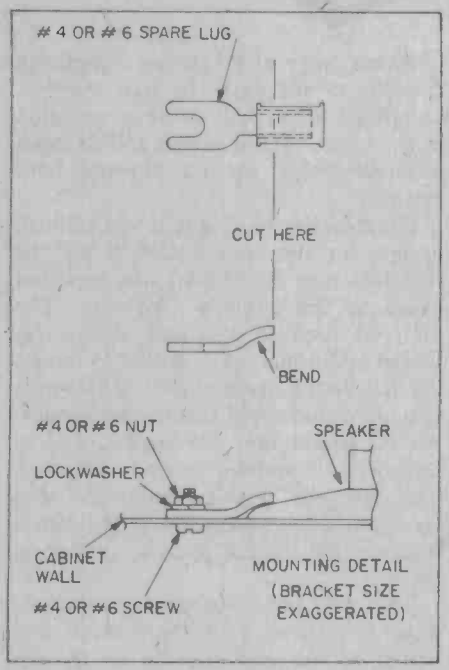
The perf-board mounting brackets were bent from thin sheet stock and bolted to the enclosure so as to seat the board firmly against the speaker magnet. This keeps the heaviest part, the battery, from bending the board. Foam tape, strategically placed at the end of the battery and also on the cover, secures it nicely, making a rattle-free unit. Care should be taken to ensure that no contact is made between the switch terminals and circuitry on

the bottom of the board when the board is in place.

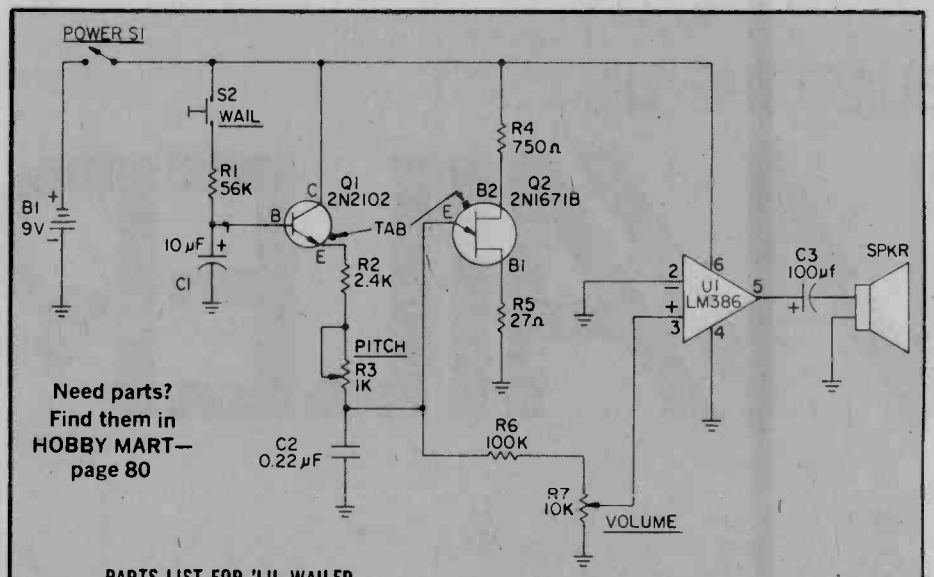
Although glue would likely be adequate to secure the speaker, four mounting brackets (see detail) were made from spade-tongue terminals. A piece of grill cloth was cemented inside the box to cover the five, ¼-inch holes drilled to pass the sound.

Checkout. Before connecting the battery, carefully check all wiring, especially to the LM386. Then, connect the battery and flip S1 to "on." A soft click should be heard from the speaker as IC1 gets power. Set the pitch and volume controls at mid-point and hold S2 down. After a short delay, the siren should wail up, and volume can then be set at the desired level. Adjust the pitch control next for the desired "high-point" of the wail. Release S2 and the unit should wail down and stop—just like a police siren. Check for suitable wail-up and wail-down times by depressing and releasing S2.

After satisfactory operation is obtained, place the cover on the box, adjusting the foam tape as necessary to ensure a solid, rattle-free unit. Then, have fun with it, and just *try* to keep the kids' hands off of it! ■



Here's a novel way to mount subminiature speakers that don't have tabs for mounting screws. A few spade lugs bent to the proper angle will solve the problem. You might use this same method (on a larger scale, of course) to flush-mount speakers in your car, where space doesn't allow for running screws through the mounting tabs in the speaker frame, as on door mounts.



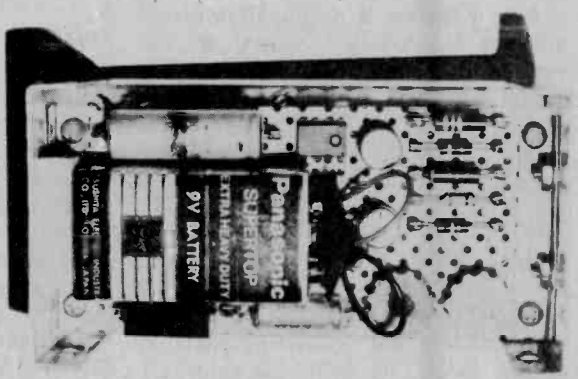
Need parts? Find them in HOBBY MART—page 80

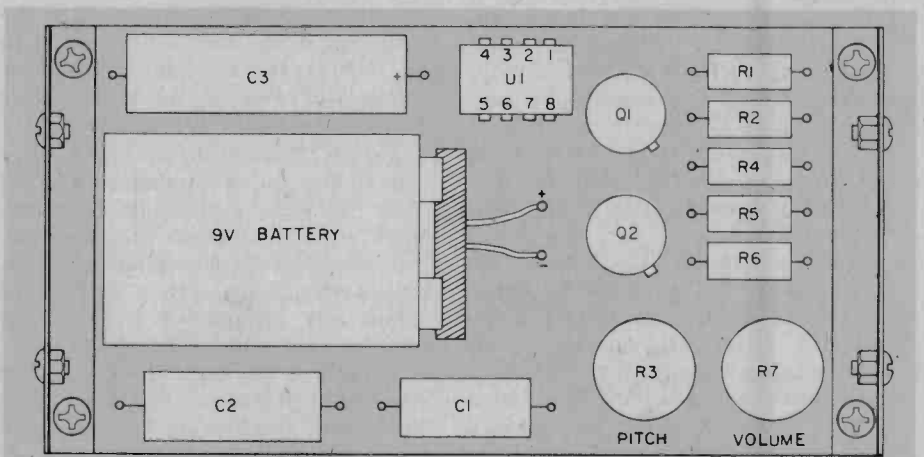
PARTS LIST FOR 'LIL WAILER

B1—9-volt transistor radio battery
C1—10-µF, 25-VDC electrolytic capacitor
C2—0.22-µF, 15-VDC mylar capacitor
C3—100-µF, 25-VDC electrolytic capacitor
Q1—2N2102 NPN transistor (or equivalent, see text)
Q2—2N1671 (or 2N1671A, or 2N1671B) unijunction transistor
R1—56,000-ohm, ¼-watt resistor
R2—2,400-ohm, ¼-watt resistor
R3—1,000-ohm, PC-type trimmer potentiometer
R4—750-ohm, ¼-watt resistor
R5—27-ohm, ¼-watt resistor
R6—100,000-ohm, ¼-watt resistor
R7—10,000-ohm, PC-type trimmer potentiometer
S1—SPST miniature toggle switch
S2—SPST miniature pushbutton switch normally open
SPKR—8-ohm, 2-inch miniature speaker
U1—LM386 audio amplifier

MISC.—cabinet: 4-inches long, 2⅛-inches wide, 1⅜-inches deep (Bud # CU2102A), battery clip, perfboard, hardware, hookup wire, spade lugs (4), grille cloth, 8-pin DIP socket (optional), etc.

At right is a photo, and below is a placement diagram, showing how the project goes together on perfboard. Both the photo and the diagram are just about to scale, so you can get an idea of how compact the Wailer will be when completed. With a little ingenuity it can possibly be made even smaller for pocket use.





Kathi's CB Carousel

by Kathi Martin, KGK 3916

A computerized sideband smoke signaller

THE CB WORLD has been so bombarded by new innovations brought about by modern technology that only a select few of the twenty or so CB brands on the market a few years ago are still around today. One of the companies to keep up with the fast pace of CB's advancing technology is Radio Shack, which has recently introduced their new computerized CB transceiver, the TRC-459.

Radio Shack just didn't use a microprocessor to scan all, or a select few, CB channels. Rather, they provided a way for the user to pre-program the operating mode—AM, LSB, or SSB—in the computer memories. But I'm getting ahead of myself. Before I confuse you and me both, let me go back and give you the lowdown on Radio Shack's new powerhouse transceiver.

Performance Facts. The computerized TRC-459 is an AM/SSB 40-channel transceiver primarily intended for base operation, but also having a chassis connector for 13.8 VDC so it can be used mobile or portable. It is housed in a low-slung data-processing equipment type cabinet measuring 3.8"H x 15.3"W x 11.8"D. A "break" in the front of the cabinet provides a flat surface for all operating and computer controls, and a sloping surface for an LED digital clock, LED channel indicator, two 9-step LED "meters" (for S/RF-output/modulation, and SWR), and two rows of small LED indicators that show the selected functions, mode of operation, and computer program.

The horizontal surface has pushbutton switches for setting the digital clock and its alarm; a separate group of pushbuttons select the assorted functions such as 12 or 24 hour clock, AUTO clock timer for turning on the transceiver at a preset time, the transceiver power, ANL with Noise Blanker, CB, PA, MON (CB signals monitored through the PA speaker), LED display dimmer, and SWR calibrate; slider controls for the CLARIFIER, TONE CONTROL, RF GAIN, SQUELCH, and VOLUME; finally, an 0-9 keypad for channel selection and memory selection (up to 5), and computer function switches such as *memory write, auto scan*, up and down (channel stepping), also mode (AM, LSB, USB).

The rear apron has jacks for remote and PA speakers, the 13.8 VDC power source, the antenna connector, and the SWR calibrate control. The front edge of the cabinet has jacks for the microphone and headphones. The speaker is mounted in the top of the cabinet.

At the touch of a button the transceiver will scan all 40 channels stopping on busy or clear channels (as you select), or you can scan the five computer memories which can be programmed not only for channel, but for mode. For example, you can program memory M1 for channel 19 AM, then program memory M2 for channel 16 LSB, memory M3 for channel 37 USB, etc. The memories will program for whatever mode is set before the MEMO WRITE button is pressed. Here's an example of how it's done. Suppose you're working on channel 16 LSB and decide you want to put channel 19 in M1 with AM (of course). You would simply press the mode switch until the LED mode indicator glowed next to AM. Then you would press the O/STOP key (zero and *stop*) to set up the computer. Pressing 1 and 9 would display channel 19. Simply pressing the MEMO WRITE button would store channel 19 with AM mode in memory M1. Other memories are programmed the same way.

The instruction book doesn't mention it, but the memories are nonvolitile, meaning they don't lose programming when you turn off the rig. As long as the power cord is connected, either 120 VAC or 13.8 VDC, the memories are kept alive, ready for instant use when the power switch is depressed, or the rig is turned on by the digital clock.

Easy Operation. If you have seen some of the new computerized rigs you might think I left something out because it all sounds so easy. Well, that's part of what's great about the Realistic

(Continued on page 88)

The Navaho, otherwise less colorfully known as model number TRC-459, is a completely computerized base, with all legal modes of operation, and enough automation to keep a home computer hobbyist satisfied. No. 32 on the reader service coupon.

e/e checks out the...

Antenna Specialists HM-179 2 Meter Whip

A short story with a happy ending for the ham

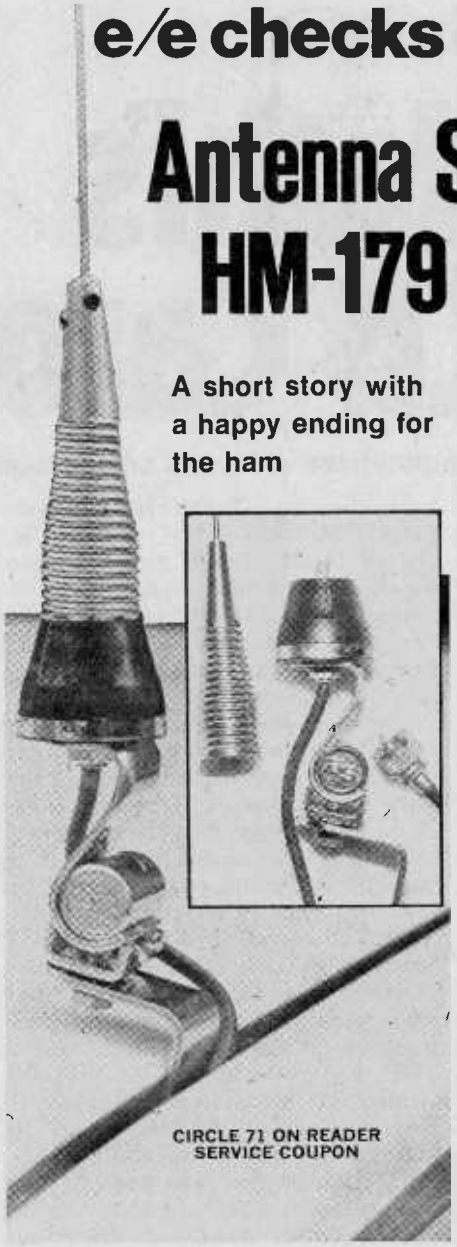
THIS IS A TALE of doing things right the first time. As in all good yarns, there must be a hero, a villain, and an innocent victim. In this case, the hero(es) is the Antenna Specialists Corp., the villain is SWR, and the innocent victim is the ham. If we had nickels for every time a mobile VHF antenna didn't work the way the manufacturer claimed it would, the entire editorial staff would be riding around in Rolls Royces.

As in any mobile installation, transmitter power is dictated by the amount of electrical power available from the vehicle's electrical system. Since that power is limited, the antenna assumes a very critical role in overall performance. It must not only have excellent receiving characteristics, in order to compensate for the motion of the vehicle, it must have equally good transmission characteristics as well, in order to make the most effective use of the available transmitter power.

The model HM-179 2 Meter mobile antenna by the A/S people fills the bill in admirable fashion. Available in magnetic, trunk-lid, and hatchback base mounts, it is truly a universal antenna. Our test choice, in this case, was the hatchback-mounted model, since, by nature of its position on the car, this is the toughest test for any mobile.

Installation. The entire installation on our VW Rabbit took all of 15-minutes to accomplish. First, using the dimension chart supplied with the antenna, the whip was cut for 146 mHz, or dead-center of the 2 Meter band. Next, the base of the antenna was attached to the inner lip of the hatch molding with two small sheetmetal screws. The installation kit comes with two, adhesive-backed rubber pads, which can be attached to the hatch itself, immediately across from the mount, to protect the paint on the hatch from chipping if the base sways from movement generated by the motion of the car. Silicon grease is also provided to make a weathertight, and rust-deterring seal between the screw heads and the car's body. We should mention, for those of you who recoil at the thought of drilling holes in your iron beauty, that if for any reason the antenna mount is removed (for resale of the car, as one example), the holes are invisible from the exterior and if care is used in the initial installation, will be covered by the hatch's weatherstripping when the hatch is closed, thereby preventing the possibility of water leaks ruining the headliner on the inside.

With the mount in place, the coax (supplied) was led down to the floor and run up to the front under the carpet trim molding. In the VW, this molding is a snap-on piece(s) of plastic, which came off in a second with gentle leverage from a screwdriver. In GM cars, for example, this is equivalent to the chromed strips running under the door sills, which are held down by a few screws, and are just as easily removed to accomodate the coax. If you're not sure how to do this on your car, have the dealer do it for you. Chances are he won't even charge for it, as it only takes a second or two.



CIRCLE 71 ON READER SERVICE COUPON

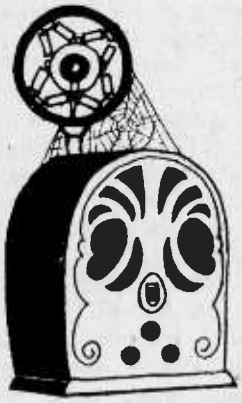
The solderless coax connector (also supplied) fit onto the trimmed end of the coax at the dash with only a few grunts and groans. The whip was screwed onto the base, and our Pace Communicator II transceiver was then screwed onto the coax.

Performance. Can something that attaches to your car with so little effort, perform electronically in the same manner? With the SWR meter in line, it was an easy matter to check the broadbandedness of the antenna by dialing up frequencies on the synthesizer at each extreme of the band. At 146 mHz, the frequency to which we had cut the whip, the SWR was not enough above 1:1 to budge the needle on the meter. In fact, at both 144.000 and again at 147.995, the SWR never exceeded 1.4:1. That, friends, is called "flat."

Having scaled down the power output of the Pace to two-watts, we proceeded to work a string of repeaters from the comfort of our own driveway. The closest repeater was ten miles away, and the farthest was some 45-miles distant. All this from a valley with two-watts. On high power, with about 23-watts, we were able to access repeaters in two neighboring states from a distance of about 55 to 65 miles out.

On the road, the HM-179 seemed to really grab the repeaters, and we could detect very little fade or flutter from the same repeaters we had worked through while stationary. The antenna was highly repellent to ignition and accessory motor noise, a common problem in today's cars which have less and less metal to shield electrical interference from the engine compartment.

Conclusion. All told, the HM-179 is one antenna that lives up to its specs, and, as far as SWR is concerned, even surpasses them by a bit (although we suspect that the A/S people were just a wee bit conservative in their ratings). On a larger car, the ground plane advantage might reduce the SWR even further. Of course, if you live in an area in which security is of more than passing concern, you might opt for the trunk-lid mount, or the magnetic mount, which is less conspicuous. Either way, the HM-179 is a good stick, and at $31.95, we recommend it highly. For complete information, contact: The Antenna Specialists Company, 12435 Euclid Avenue, Cleveland, Ohio 44106, or circle number 71 on the reader service card. P.S. We all lived happily ever after. ■



ANTIQUE RADIO CORNER

by James A. Fred

A brief history of the Carborundum detector

IN THE SEPTEMBER-OCTOBER 1978 issue of ELEMENTARY ELECTRONICS, there was a construction project showing how to build a radio using a Carborundum detector. Since the history and technical explanation of Carborundum was only lightly touched on, I decided to devote most of this column to this type of detector. Most radio-electronic experimenters have either never heard of Carborundum detectors or know very little about them. However, I have a particular interest in the subject and have been collecting information and data for over two years, some of which I will present here. Some of the information was taken fom a very rare book entitled *Carborundum In Radio*, which was published in 1926 by the Carborundum Company. It contains 31 pages which are filled with many circuits using Carborundum detectors and grid leaks.

Historical Origin. The story of Carborundum began in 1891 when Dr. Edward Goodrich Acheson was completing a series of electrical experiments with Thomas A. Edison. During the course of these experiments, Dr. Acheson began to think about making an abrasive that would be superior to any found in nature.

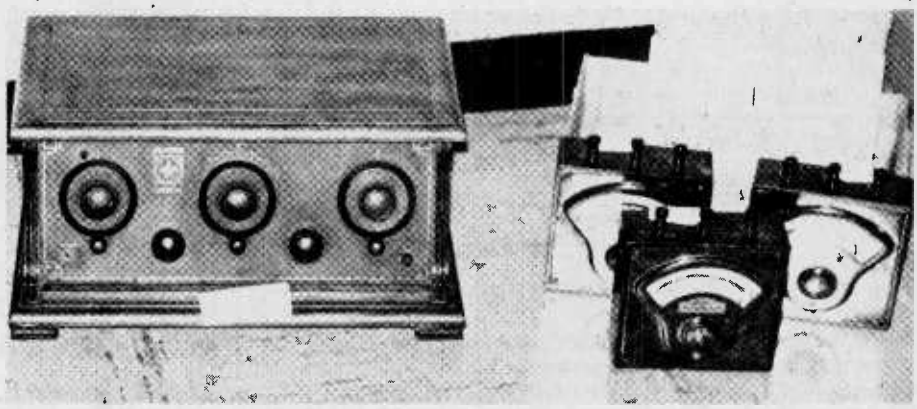
He filled a cast iron bowl with a mixture of clay and coke, and connected wires from an electrical generator to the iron bowl and to a carbon rod. He plunged the rod into the center of the mixture and turned on the generator. After a sufficient length of time had elapsed, he turned off the generator and let the molten mass cool. He then broke open the fused mass in the bowl and discovered a few bluish, diamond-like crystals. These crystals were so hard and so sharp that they would cut and scratch glass. He had these crystals crushed into powder and used them to polish diamonds, rubies, sapphires and other gem stones. As time went on, he learned how to mass-produce this abrasive material which he named Carborundum™. By 1926, the Carborundum plant at Niagara Falls, NY was producing 1,500,000 pounds per month. Most of it was used in grinding wheels and other abrasive products.

Detector Value. In 1906, General Dunwoody, a member of the United States Army, discovered that the rectifying properties of Carborundum permitted its use as a detector in radio and wireless receiving sets. Realizing that Carborundum would be valuable as a detector on shipboard receivers, the Carborundum research laboratories began an intensive investigation to determine how best it could be used. They determined that five pounds of pressure on the Carborundum made a much more reliable detector than a mineral such as Galena, with only catwhisker pressure. The detectors they developed were a decided improvement over those in use in the Marconi receivers.

The Carborundum detector is not as sensitive to radio frequencies as Galena, but Galena has one big disadvantage—the catwhisker contact is light and easily jarred out of adjustment. On shipboard, this could happen at a critical moment, such as when a wireless operator was receiving an SOS call for help. For this reason, Carborundum was used in most shipboard installations. Although not as efficient as Galena, it was more dependable in operation.

It was soon found that Carborundum worked best as a detector when a bias voltage was applied. There were several theories as to why this happened. The Carborundum research laboratory thought that applying a bias voltage would match the impedance of the detector to that of the tuning circuit. If you can match the impedances of two connected circuits, you get optimum transfer of energy and maximum sensitivity.

The other theory is illustrated by plotting a graph showing the change in current in a Carborundum detector with a change in voltage. The resulting curve will have a "knee" similar to the curve drawn for a vacuum tube. This is point "X" on the graph shown. At this point, we have the greatest change in current for the least change in voltage, and a continued increase in voltage creates an additional current flow. Another way to look at it is that the resistance at the contact point of the Car-



This Aladdin radio, and several antique electrical meters were on sale at a recent meeting of the Indiana Historical Radio Society. Try a local antique club for similar gems.

borundum has been suddenly reduced, and it is this physical property that makes Carborundum useful as a radio detector.

Put To The Test. To put these theories to use, a practical radio circuit was devised similar to the radio set shown. There is the usual tuning coil, tap switch, and variable capacitor. The alternating radio frequency current, modulated by an audio frequency, will induce current from the antenna through the tuning coil. If it were not for the Carborundum detector, no sound would be heard in the headphones. The slider on the potentiometer applies the proper bias voltage to cause the detector to conduct more efficiently in one direction than in the other, thus producing pulsating DC at an audio frequency rate, which the headphones convert to sound waves which our ears can hear. The RF carrier wave is no longer needed, and it passes around the headphones to ground through the bypass capacitor. The value of the capacitor is chosen so that it presents a low impedance to RF and a high impedance to audio frequencies.

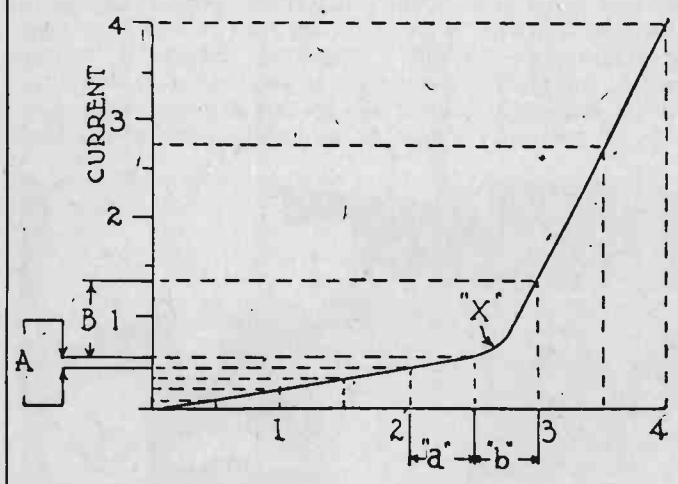
When you connect a high resistance across a battery, the potentiometer acts as a voltage divider. In other words, if you have a potentiometer with 6000-ohms resistance and 300-degrees of rotation across a 6-volt battery, you will find that for every degree you turn the wiper arm, you will change the voltage out by 0.02-volts. Thus, we can accurately control the amount of bias voltage applied to the piece of Carborundum.

Stabilization Unit. The Carborundum Company produced a unit called the *Carborundum Stabilizing Detector Unit.* The unit consisted of a bakelite molding on which was mounted the potentiometer, bypass capacitor, battery clips, and clips to hold the special Carborundum cartridge detector. The circuit shown is that of an "Improved 200 mile Crystal Set." Builders of the original set have received stations over 1100 miles away using a suitable antenna and ground. The tuning coil "L" consists of 40 turns of annunciator or bell wire. (no. 18 or 20 plastic-covered single conductor can be used) wound on a cardboard or bakelite form, 4-inches in diameter, and 5-inches long. The coil is tapped at the 10th, 20th, and 30th turns. You may want to duplicate a set of this type using the Carborundum Detector unit shown in the September-October 1978 issue of ELEMENTARY ELECTRONICS mentioned at the start of this column. Carborundum can be purchased by its common name of Silicon Carbide. It is used in grinding wheels and can be found in jewelry stores in the form of small sticks which can be broken up and used as a detector. If you want to explore the Carborundum story, I would recommend that you buy the book *Carborundum in Radio,* available from the Antique Radio Press, Box 42, Rossville, IN 46065, for $4.00 postpaid.

If you are a member of the Antique Wireless Association, you saw the write-up by Floyd Lyons on how he built a radio using an old Carborundum detector cartridge. It was printed in the June 1978 issue of the *Old Timers Bulletin.* If you are not a member, I urge you to join and ask to buy this back issue. The AWA National Conference will be held on September 29, 30, and October 1 in Canandaigua, NY. This is a beautiful site for the conference with ample room for the flea market, auction sales, and seminars. You may write to Richard Ransley, Secretary of the Antique Wireless Association, 9 Belden Ave., Sodus, NY 14551 for a membership form. You will still have time to register for the conference too. Be sure and send an SASE for a prompt reply.

With the energy crisis becoming more serious every day, radio collectors may find it difficult if not impossible to travel later this year. Attendance at radio collector club meetings will no doubt suffer, as well as attendance at flea markets, auction sales etc.

I would advise every collector to travel as much as possible in 1979 because this may be the last year that it will be easy to get around to all the collector club meetings and conferences. I had planned on four or five trips this year, but I may find that I'll have to cancel some. Travel by air may be much easier than driving, but the collector is restricted by how many radios he can carry on his return flight. No doubt it will be an interesting year, but hardly as enjoyable as the past seven or eight. I'll be looking for readers of this column at Auburn, Indiana, Elgin, Illinois, Dallas, Texas, and Canandaigua, New York. ■



This is the sample bias curve for a Carborundum detector, as seen in the 1927 publication "Carborundum in Radio," published by the Carborundum Company of Niagara Falls, NY. This book was one of the first "applications" books seen in the radio industry. See the text for information on obtaining a reprint of this collector's item.

This is an advertisement which appeared in radio journals of the late 1920's, extolling the virtues of the Carborundum detector in producing superior audio output. The cartridge-type detector found widespread use in radios which were subject to being jarred during use. It replaced "catwhisker" units which were rather fragile.

Amateur Radio Contests

Catch contest fever!

by Thomas R. Sundstrom, W2XQ

CONTEST OPERATING can be a contagious disease. If you catch it, you're likely to spend more time in your shack than you do in your bedroom. In fact, your shack may become your bedroom, or vice versa. You will spend sleepless nights trying for that one more contact in some distant corner of the planet, or some rural county where they count the farm animals in the population.

Types of Contests. The aim of most contests is to contact other stations, usually as many as possible, within a given period of time. Usually, these contests are scheduled during a weekend, so they won't interfere with the working week. They can be grouped into four major categories: international, special interests, certain frequency bands (to promote band usage), and state and district QSO parties.

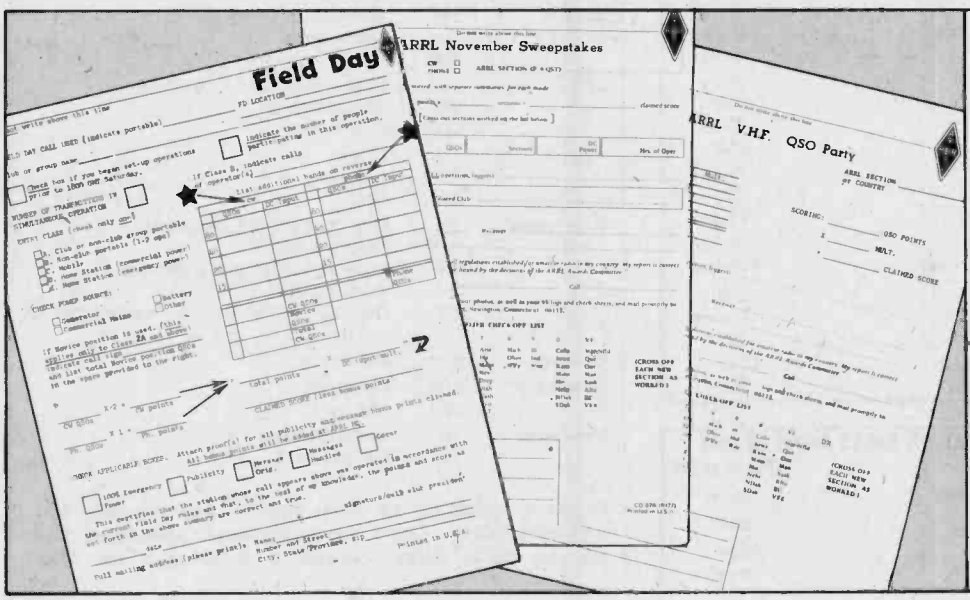
Scoring for most contests is done by counting the number of contacts made, and then multiplying them by the number of different areas or districts worked. Some contests permit contacting the same station on both CW and phone on the same band, while others allow only one contact with any given station per band, regardless of the mode.

International Contests. The "biggies" are the ARRL DX competitions held in March, and the CQ Worldwide contests in October and November. Both are split into two weekends, one for phone, and one for CW. During these contest periods, many hams form DXpeditions, assembling their gear, and then setting out for some area, such as an island, that is not normally heard on the bands, and putting it "on the air" for the contest's duration.

As a result, many Amateurs have the opportunity to pick up a very rare contact in pursuit of, for instance, a DXCC (worked and confirmed 100 countries) award. By the way, the best sources of information on upcoming DXpeditions are the DX bulletins, such as the *West Coast DX Bulletin*, or the *Long Island DX Association Bulletin*.

By the way, you don't have to be entered in the contest to contact these expedition stations, but don't expect the QSO to consist of much more than a brief signal report exchange. Don't tie up the station with QSL information requests. You can pick that up from one of the bulletins, another operator, or possibly even from QST magazine.

Special Interests. The VHF contests



Almost all of the contests that you will enter require that you submit your records of contacts on an approved log form, such as the ones seen here. It makes the job of tabulating the final results much easier, and decreases the possibility of error in computing contest points. With the calendar of events seen elsewhere in this article, you can plan ahead and order your log and entry forms well in advance. It's a good idea to make a photocopy of each log sheet that you submit, in case of loss. Most contest administrators will accept a photocopy as long as it bears your signature in ink on each sheet of the log.

HAM CONTESTS

are examples of this type. The top winners of these contests usually work all the VHF bands up to 1296 MHz. Although sometimes winners are listed for each different band, don't expect to win unless you're really loaded for bear.

There are also contests for SSTV (slow-scan television), RTTY (radio teletype), and moonbounce operators. In these contests, a relatively small number of operators take part. Check the contest notes in QST for more detailed information.

Certain Frequency Bands. The ARRL sponsors two very popular single band contests in December. The 160 meter contest is limited to CW only, due to the small size of the band, but the 10 meter contest is for both modes of operation. With 10 meters coming to life during the current sunspot peak, the 1978 contest was a busy one. Several operators in my neighborhood worked over 100 countries in this single weekend, and none of them consider themselves "contest" operators.

State and District QSO Parties. Over thirty states have their own QSO parties each year. Whereas the international contests tend to wander all over the bands, the QSO parties are usually found on a cluster of pre-announced frequencies.

The county hunters, those operators looking to work all of the 3,071 counties in the United States, find these parties very helpful.

Sometimes it's nice to be the hunted and not the hunter. If you live in an area that is not too heavily populated, you may become one of the most sought-after stations on the band during one of these contests.

Other Contests. The ARRL's Novice contest is spread through more than a week, but total operating time cannot exceed 30 hours. Novices and Technicians contact themselves on the novice bands, identifying their license class by adding "/N" for Novice at the end of their call sign, or "/T" for Technicians. Higher class licensees may participate, but can only contact the Novices and Technicians, to help them with their point totals.

The last weekend of June brings with it the ARRL's Field Day activities. Mobile and portable operations take to the outdoors in a test of the ability to "get up and go" in case of emergencies. This test of emergency preparedness has evolved into a contest of how many stations can be contacted on the HF and VHF bands. The participants these days tend to be clubs.

This is a compendium of good operating procedures, one of many from the ARRL.

The Contest QSO. The content of the contest QSO tends to brief, with just

(Continued on page 88)

ANNUAL MAJOR CONTESTS ON THE AMATEUR BANDS BELOW 30 MHZ

Month	Weekend	Contest	Phone or CW
January	4th	French Contest	CW
February	*	ARRL Novice Contest	CW
	4th	French Contest	Phone
March	1st	ARRL DX Competition	Phone
	3rd	ARRL DX Competition	CW
	4th	CQ Worldwide WPX (worked prefixes) Contest	Phone
April	3rd	Bermuda Contest	Both
May	4th	CQ Worldwide WPX Contest	CW
June	3rd	All Asian DX Contest	Phone
July	2nd	IARU Radiosport Contest	Both
	3rd	HK Contest	Both
August	1st	YO DX Contest	Both
	2nd	European Contest	CW
	3rd	Can-Am Contest	Both
	4th	All Asian DX Contest	CW
September	2nd	European Contest	Phone
	3rd	Scandinavian Contest	CW
	4th	Scandinavian Contest	Phone
October	2nd	VK-ZL-Oceania Contest	Phone
	4th	CQ Worldwide DX Contest	Phone
November	1st	ARRL Sweepstakes	CW
	3rd	ARRL Sweepstakes	Phone
	4th	CQ Worldwide DX Contest	CW
December	1st	ARRL 160 Meter Contest	CW
	2nd	ARRL 10 Meter Contest	Both

ANNUAL MAJOR CONTESTS ON THE AMATEUR BANDS ABOVE 50 MHZ

Month	Weekend	Contest	Phone or CW
January	3rd	ARRL VHF Sweepstakes	Both
June	2nd	ARRL VHF QSO Party	Both
August	1st	ARRL UHF Contest	Both
September	2nd	ARRL VHF QSO Party	Both

STATE/DISTRICT QSO PARTIES

Month	Weekend	Contest
February	3rd	New Hampshire
April	1st	Tennessee
	1st	Florida
	3rd	Zero-land (W-K 0 call area)
May	1st	Georgia
	1st	New York
	1st	Vermont
	2nd	Massachusetts
	3rd	Kansas
	3rd	Michigan
June	1st	Minnesota
	2nd	Canal Zone
	3rd	West Virginia
July	1st	Seven-land (W-K 7 call area)
	4th	Rhode Island
	4th	New Jersey
August	1st	Illinois
	4th	Kentucky
	4th	Ohio
September	1st	Four-land (W-K 4 call area)
	2nd	Pennsylvania
	3rd	Maryland-District of Columbia
	3rd	Washington
	4th	Delta (an ARRL Division, states of MS/AR/AL/LA)
October	2nd	California
November	2nd	Delaware
	2nd	Missouri
December	1st	North Carolina
	1st	Connecticut

Here's a listing of the most popular and regularly run annual contests. There are many more sponsored and run by local clubs. Contact a local club for info.

e/e checks out the...

CIRCLE 70
ON READER SERVICE
COUPON

BSR X-10 Remote Controller

A wireless remote controller that saves steps and money

HERE'S AN ELECTRONICS-AGE gadget that is a real turn on! Just by poking buttons on a master control unit, or on a cordless accessory control, you can turn lights and appliances on or off anywhere in your home. It's all done without need of stringing connecting wires all over the house, and without transmitting radio signals that could mess up your TV picture. Essentially, all you have to do is plug the various modules into wall sockets and enjoy!

The BSR X-10 Control System utilizes regular home power wiring as a ready-made network to send control signals to as many as 16 remote modules, wherever they may be located. You might keep the control unit next to your TV watching chair most of the time. At other times it can be moved quickly and easily to other locations for temporary use—to a basement playroom or a bedroom, for example. The system is a virtual necessity for physically disabled folk who live alone, and a great convenience for those who are even temporarily bedridden.

Simple Installation. To set up a table lamp for remote control, unplug the lamp from its wall receptacle and insert the plug into a compact lamp module. On the module are two small dials, respectively numbered from 1 to 16 and from A through P. Set the "unit code" dial to 1 to indicate that this is "number one" lamp, and the "House Code" dial to any letter (more about this later). Now plug the module into the wall receptacle.

Easy Use. On the master control, dial the same "House Code" letter, and plug the unit's power cord into a wall receptacle. It's now ready to operate. Press button 1 to tell the control you want to either turn lamp 1 on or off. Press the "on" key and the lamp will light. Is the light too bright? Just press the "dim" key to make the light intensity fade smoothly to any reduced level that you find pleasing. A "bright" key returns illumination to the maximum level.

The system comes with two lamp modules designed for plugging into wall receptacles. Each can handle a load up to 300 watts. By purchasing additional remote modules, you can selectively control as many as 16 lamps, anywhere in the home, by giving each a different unit number.

At the end of the day, there is no need to individually turn off all the controlled lamps. Tapping the "all off" key extinguishes all of your lights at the same time.

Want to turn all lights on in a hurry, as when you hear suspicious noises in the middle of the night? Hit the "all lights on" key to instantly flood every part of the home with light.

Versatility Plus. Permanent light fixtures can also be controlled, by installing a wall switching module in place of any regular wall switch. The changeover is fast and easy. Just turn off the power, remove the original switch, and connect the black wire on the new module to the liberated black wire in the box; the blue wire on the module connects to the remaining wire in the box, which may be either red or white.

After installing the switch in the box, use a small screwdriver to set the "unit code" and "House Code" controls just beneath the toggle switch. For example, if the first two wall lamps are for table lamp 1 and floor lamp 2, you might make this permanent light fixture unit 3. Now replace the switch box cover and turn on the power. The master control will now operate the permanent fixture just as it does the other lamps. This wall-type module can handle up to 500 watts, but must be used only for incandescent—not fluorescent—illumination applications.

If the original switch replaced by the module operated outside flood lighting, you now have control of the illumination from any location in the home, depending on where you happen to plug in the master control. A toggle switch on the wall module permits normal operation of the same lighting.

You also get an appliance module that plugs into any wall receptacle. It has a resistive load of 15 amperes, a motor load of ⅓ HP, and can handle incandescent lamps up to 500-watts (200-watts more than a regular lamp module).

Do you have trouble greeting the day before that first cup of coffee? This control can make life a lot brighter under such trying times. Set up the electric coffee maker the night before by plugging into an appliance module. Next morning, punch the coded key from the master control (now in your bedroom), and the coffee will be ready by the time you finish shaving—or fixing your face, as the case may be. Many other small appliances can be remotely controlled if you purchase extra appliance modules.

Still More Features. It all sounds pretty convenient, doesn't it? But wait! We aren't through. Remember, there's still that cordless remote unit to talk about yet.

This accessory remote control has a

duplicate set of 22 keys that operate in exactly the same manner as those on the master control. By pointing the cordless unit at the master, from anywhere in the room within a range of about 30 feet, you can operate lights and appliances all over the house. A red light glows on the front of the master control to indicate that communication with the cordless unit has been completed. This feature is handy if you are turning lights or appliances off in other parts of the home, and you cannot actually see if the desired results are being achieved.

The remote control works by means of ultrasonic signals, in much the same way that you perhaps control your TV set with a remote, cordless unit. I find that the light control does not interfere with TV operation unless the master control is placed close to the TV set so that the cordless remote unit must be pointed toward the TV. In that case, the attempt to control a light may now and then flip the TV to a different channel. Under normal use conditions, the master will be located well away from a TV set, and the remote control can be operated from virtually any other part of the room without problems.

The remote control is powered by a small, 9-volt transistor type battery that should last a very long time. There are no unit code or house code dials to set on the remote unit.

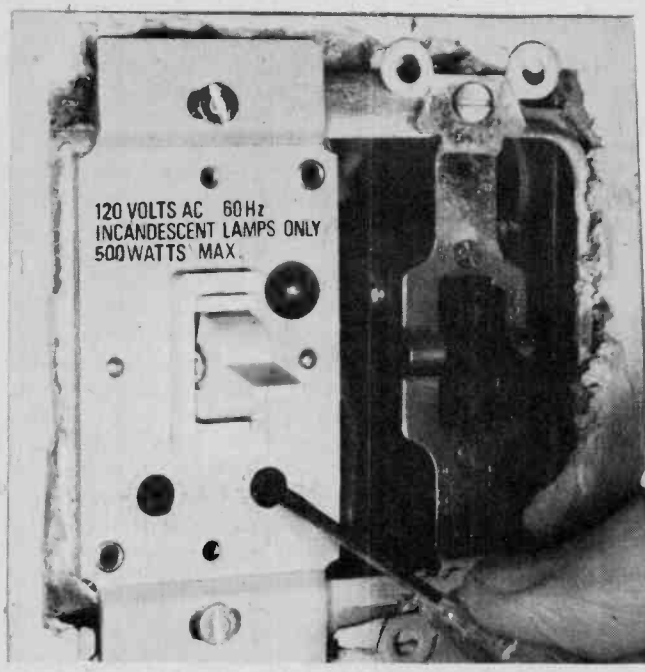
Good Neighbor Policy. By this time, you may be wondering what could happen if a neighbor has the same type of control unit. After all, his power lines are connected to the same mains as yours, and it's conceivable that when you turn on your lights, you might inadvertently turn on his coffee pot, or vice versa. That is why the system has those "House Code" dials on the master control and on the individual lamp and appliance modules. You set your dials on, say, letter "A." Your neighbor sets his system on letter "B." Thereafter, no possible interference by one system on the other—unless the guy next door is a practical joker and dials "A" to start your coffee pot at two in the morning.

It's not likely that a whole flock of residents on the same block will buy these control units, but once you show off yours, more than one neighbor might be tempted. The problem would be especially acute in an apartment house where the electrical wiring is more closely integrated. But there's still little chance of trouble because the House Codes, from "A" through "P" allow 16 different family settings.

Where homes are further apart, and especially if outside power transformers intervene, the interaction problem is even more remote. I tested my unit by taking some lamp modules to a neighbor's home that is a good 200-feet away from mine. The modules could not be activated from that distance.

What might basically be considered a problem, can in fact be turned into an asset under the right conditions. Assume that your control could affect modules in a nearby home or adjacent apartment, if the House Code is set to the proper letter. When your neighbor goes off on a vacation, you can turn his various controlled lights on and off at random times without ever getting up from your easy chair. After operating his lights, just dial your own House Code to resume normal operation of your lights.

The suggested retail prices for the individual components are as follows: Standard Command Console, $39.99; Ultrasonic Command Console, $44.99; Cordless Controller, $19.99; Lamp, Appliance, and Wall Switch Modules, $15.99. The System X-10 is sold by BSR (USA) Limited, Route 303, Blauvelt, NY 10913. For more information, circle number 70 on Coupon. ■



There's even a replacement module for wall-switched lights. You can still operate your lights independently of the X-10 with this switch. Circle 70 on the reader service coupon for more info.

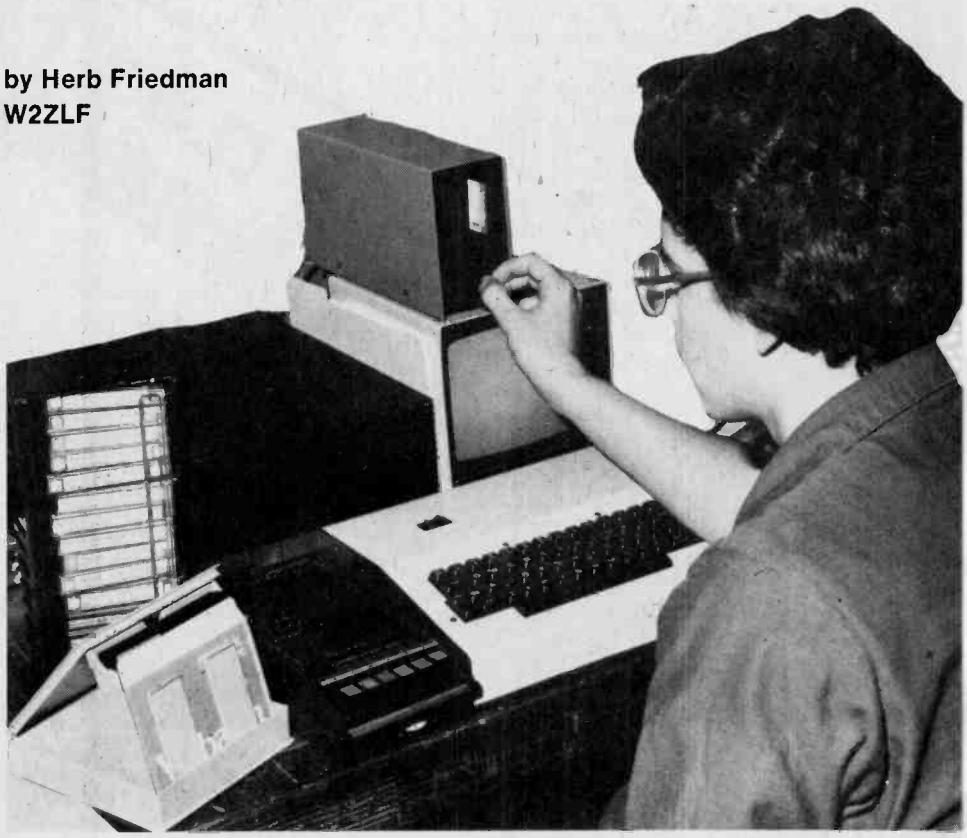
These are the modules that receive the controller's signals and actually accomplish the switching of the lights or appliances.

Different modules are required for controlling appliances that present a reactive load (ie. motors, etc.) in the AC line.

DON'T DROP THAT BIT

Buying the right kind of tape, and knowing how to store it can save hours of wasted work

by Herb Friedman
W2ZLF



WHEN YOU FIRST START out in personal/hobby computing, it's all fun, fun, fun. Even if a program you've taken three hours to type blows up, you go right back and do it over. But after the initial thrill of seeing your program come to life on your terminal wears off, it's frustrating to find hours of effort wasted because a bit—one single bit—of information got lost somewhere in the recording process.

Also, consider what happens as you develop a program. You might have version after version, each with an improvement or modification. For speed, you might utilize several cassettes or diskettes to reduce time on dumps and loads. Suddenly, there's a table full of recordings in front of you, and you don't know which one has "version 3 out of 7," which has subroutines; or if you have, in fact, made a final dump.

Common Sense. Just about all cassette and diskette data handling problems can be avoided by simply selecting the correct "tapes" and a little common sense. As far as the storage medium—diskette and cassette—is concerned, there's not much that can go wrong. All diskettes will be satisfactory in a personal/hobby computer system. (So far, there are no "seconds" or six-for-a-dollar diskettes on the market. All we have seen have been top quality.)

Cassettes are another story. While just about any good quality audio cassette can be used for non-digital recording, that is, a Byte/Manchester, or Kansas City-type cassette system, which utilizes two audio tones to represent data, six-for-a-dollar cassettes are notorious for dropping bits of information. As long as you use quality cassettes such as TDK-AD, Maxell-UD, Fuji-FX, etc., you're perfectly safe up to speeds of at least 1200 baud.

On the flip side of the coin, there's no good reason for investing in rather expensive "Data cassettes" if your cassette system is limited to 1200 baud using audio tones. Data cassettes are specially constructed and have *certified tape:* they are great for digital cassette recorders up to 9800 baud, but few hobbyists have or need that type of cassette equipment. Some hobbyists, however, do utilize the National Multiplex digital cassette recorder, which can easily record up to 4800 baud (you could load a 10K BASIC in less than 10-seconds at this rate). As a general rule, any quality audio tape, such as previously mentioned, will easily handle up to 2400 baud. And while most will handle 4800 baud, you'll never know for certain until its too late; so at 4800 baud we suggest certified "Data cassettes."

Proper Storage. Okay, you have your data recorded. Now what? Well, it takes only one single dropped bit, caused by a speck of dust or a fingerprint, to blow or crash a program. Also, get confused by which version is which, and you might never sort out your programs or data. This is where ordinary tape handling accessories can save hours of work and aggravation.

Though diskettes are supplied in paper "protective" sleeves, the sleeve doesn't really protect the disk from dust, or from being accidentally crushed. We recommend the use of a *diskette file.* Made of relatively hard plastic, the file closes into a protective "book." Opened, the file stands erect, so the user can slide the disks out easily without possible damage to other disks. Leave the disks in their paper sleeves even when stored in the file. Among other things, the sleeves can serve as an index file for the disk.

For storing cassettes, there's just about no equal, for a computer hobbyist, to TDK's cassette storage cabinet. Holding up to fifteen cassettes with or without their plastic boxes, the TDK cabinet can be used vertically or horizontally, and the "locking" clear plastic door allows instant identification or examination of the stored cassettes. The cabinet is about as small as can be made for storage, and won't clutter the computer work area. It's a lot better than the padded monster-sized automotive-type cases with covers you can't

even see through, much less keep in a handy position on the bench.

Labeling. Finally, identification of what's what. There's not much room to write on a cassette. After you've changed programs a few times, or you have several versions of the same program, or several different programs or data on a single cassette, the small label's markings will start to resemble chicken tracks in the dust. You can keep order and legibility with a few special casette labels sold as accessories in high fidelity stores and showrooms.

For example, you can purchase packs of the strip labels that fit across the top of the cassette. Each time you DUMP, you simply write a new label and place it on the cassette. When you make your final DUMP, just go back and strip off the labels from your "work" cassettes. However it's done, by using strip labels, you can easily keep track of all changes, modifications, and dumps until the final recording is made.

For inventorying several programs on a single cassette, or if you just want to keep track of what program went where, you can purchase *audio accessory* index cards, which fit inside the cassette's plastic storage box. These allow an orderly running record of what was, or is, on the cassette. When the card is used up, you simply insert a new card. The cards fold twice in the middle like a book cover, to provide a surface so you can utilize an edge identification for the cassette.

Many of the better quality casettes come supplied with an index card; generally, its the decorative "logo" card which is turned inside out. If your cassette comes supplied with an index card, by all means use it. But when it's filled, simply throw it away and substitute an accessory card.

Summing Up. Your programs probably took you much time and effort to develop, yet just a single speck of dirt or dust on the magnetic storage medium is all it takes to crash a program. Much heartache is avoided simply by storing cassettes and diskettes in a secure cabinet. The few extra seconds it takes to apply an appropriate label, or make a filecard entry, will insure that you can find any version of any program without wading through a stack of essentially unmarked boxes. The pleasure in personal/hobby computing should come from using the computer, not searching for data recordings that might turn out to be unusable. ■

IT'S SIMPLY BASIC

Your computerized radio log is here! **by Larry Friedman, WB2AHN**

MANY OF YOU HAVE WRITTEN requesting a logbook program—a computerized logbook to keep SWL records—which at the same time is easily adaptable for logging other forms of communication such as Amateur Radio. OK, here's your answer—"SWL LOGBOOK," a program that can store and retrieve as much data as your disk system or other storage device can hold.

"SWL LOGBOOK" has been kept as short as possible, to allow users of smaller-memory systems to run the program. The program operates much the same way as a standard logbook; information such as DATE, STATION, FREQUENCY, TIME, and LOCATION are recorded, and the data can be retrieved by the commands: STATION, FREQUENCY, TIME, or LOCATION. For example, if you wanted a listing of all the contacts with England, you would simply enter LOCATION, and then type ENGLAND. At this point, the computer will feed back to you all the stations from England in your logbook, or notify you that you have no listings of English stations in your logbook. For Amateurs, this can be used as a tool in contests so that you know what countries you have contacted, and what countries you must seek. The commands: STATION, FREQUENCY, and TIME, work the same way LOCATION does; enter the command and the data that you wish to retrieve.

The FILE COPY command has been installed so you can copy the logbook data into another sector of the disk. This permits you to have a SAFETY, or a copy of the logbook data, in case the first copy gets destroyed or damaged. It also allows you to have different logbooks for different types of communication, and to be able to move data back and forth on the disk.

Because of the need for a program that will run on lower-memory systems, we have ommited functions such as error correction and MAPPING (putting the data through two selective tests such as LOCATION and FREQUENCY to get a very selective set of output material). However, if you are interested in having error correction, here is a simple error correction loop that you can put into the program between lines 1120 and 1130.

```
1122 INPUT "SURE",Z$
1125 IF Z$="YES" THEN 1130
1128 GOTO 1120
```

The program, as mentioned earlier, has four retrieval commands: STA-

(Continued on page 84)

```
0100 REM            "SWL LOGBOOK"
0110 REM          BY LARRY FRIEDMAN
0120 REM   FOR ELEMENTARY ELECTRONICS
0130 REM USES SWTP 6800 BASIC VERSION 2.0 WITH PERCOM
0140 REM LFD-400 DISK SYSTEM.
0145 REM
0150 INPUT "WHAT SECTOR DO YOU WISH TO START AT",X
0160 INPUT "DO YOU NEED INSTRUCTIONS",Y$
0170 IF LEFT$(Y$,1)="N" THEN 330
0180 PRINT
0190 PRINT "SWL LOGBOOK: A COMPUTERIZED LOGBOOK"
0200 PRINT "FOR SHORT WAVE LISTENERS. IT CAN STORE"
0210 PRINT "AN UNLIMITED AMOUNT OF DATA (WITHIN THE"
0215 PRINT "SPACE LIMITATIONS OF YOUR DISK), AND"
0220 PRINT "IS EASILY ACCESSIBLE OR RETRIEVABLE."
0230 PRINT "THE COMMANDS ARE:"
0240 PRINT "START              TO ENTER DATA ONTO DISK"
0250 PRINT "UPDATE             TO ADD DATA TO EXISTING DATA FILE"
0260 PRINT "TIME               TO REFERENCE AN ENTRY BY TIME"
0270 PRINT "STATION            TO REFERENCE A PARTICULAR STATION"
0280 PRINT "FREQUENCY          TO REFERENCE ENTRIES BY FREQUENCY"
0290 PRINT "LOCATION           TO REFERENCE ENTRIES BY LOCATION"
0300 PRINT "FILE COPY          TO COPY DATA FILE TO A NEW SECTOR"
0310 PRINT "LIST               TO LIST ENTIRE DATA FILE"
0320 PRINT "EXIT               TO LEAVE PROGRAM"
0330 PRINT
0340 DATA START,UPDATE,TIME,STATION,FREQUENCY,LOCATION
0350 DATA FILE COPY,LIST,EXIT
0360 FOR N=1 TO 9
0370 READ X$(N)
0380 NEXT N
0390 INPUT "COMMAND",C$
0400 FOR N=1 TO 9
0410 IF X$(N)=C$ THEN 450
0420 NEXT N
0430 PRINT "ILLEGAL COMMAND."
0440 GOTO 390
0450 ON N GOTO 1000,2000,3000,3000,3000,3000,4000,5000,6000
1000 INPUT "NEED INSTRUCTIONS ON DATA ENTERING PROCEDURE",Y$
1010 IF LEFT$(Y$,1)="N" THEN 1100
1020 PRINT "ENTER DATA IN THE FOLLOWING ORDER:"
1030 PRINT "(1) DATE (IN FORM XX/YY/ZZ)"
1040 PRINT "(2) STATION      (3) FREQUENCY"
1050 PRINT "(4) TIME (IN GMT)     (5) LOCATION-(COUNTRY, ETC)"
1060 PRINT "SEPARATE DATA ENTRIES WITH COMMAS"
1070 PRINT
1080 PRINT "TYPE  Q,,,,  TO EXIT START MODE"
1100 IF U=1 THEN U=0:GOTO 1110
1105 OPEN #10,X
1110 INPUT D$,S$,F$,T$,L$
1120 IF D$="Q" THEN 1500
1130 PRINT #10,D$,S$,F$,T$,L$
1140 GOTO 1110
1500 CLOSE #10
1510 GOTO 390
2000  U=1
2010 OPEN #10,X
2020 READ #10,D$,S$,F$,T$,L$\2040.
2030 GOTO 2020
2040 GOTO 1000
3000 IF C$="TIME" THEN Z=1:INPUT "TIME",T$(1)
3010 IF C$="STATION" THEN Z=2:INPUT "STATION",S$(1)
3020 IF C$="FREQUENCY" THEN Z=3:INPUT "FREQUENCY",F$(1)
3030 IF C$="LOCATION" THEN Z=4:INPUT "LOCATION",L$(1)
3035  V=0:C=0
3040 IF LEN(S$(1))<>15 THEN S$(1)=S$(1)+" ":GOTO 3040
3050 IF LEN(T$(1))<>15 THEN T$(1)=T$(1)+" ":GOTO 3050
3060 IF LEN(F$(1))<>15 THEN F$(1)=F$(1)+" ":GOTO 3060
3080 OPEN #10,X
3090 READ #10,D$,S$,F$,T$,L$\3750
3100 IF Z=1 THEN IF T$(1)=T$ THEN 3500
3110 IF Z=2 THEN IF S$(1)=S$ THEN 3500
3120 IF Z=3 THEN IF F$(1)=F$ THEN 3500
3130 IF Z=4 THEN IF L$(1)=L$ THEN 3500
3140 GOTO 3090
3500  C=1
3510 IF V=1 THEN 3600
3520 PRINT "DATE";TAB(11);"STATION";TAB(21);"FREQUENCY";TAB(31);
3530 PRINT "TIME";TAB(41);"LOCATION"
3540  V=1
3600  D$=LEFT$(D$,10):S$=LEFT$(S$,10)
3610  F$=LEFT$(F$,10):T$=LEFT$(T$,10)
3620  L$=LEFT$(L$,10)
3630 PRINT D$;S$;F$;T$;L$
3640 GOTO 3090
3750 IF C=0 PRINT "NO STATIONS IN LIST."
3760 CLOSE #10
3770 GOTO 390
4000 PRINT
4010 INPUT "  (ENTER SECTOR TO COPY FILE INTO)",K
4020 OPEN #11,K
4030 OPEN #10,X
4040 READ #10,D$,S$,F$,T$,L$\4070
4050 PRINT #11,D$,S$,F$,T$,L$
4090 PRINT "FILE HAS BEEN COPIED"
4095 CLOSE #10:CLOSE #11
4100 GOTO 390
5000 OPEN #10,X
5010 PRINT "DATE";TAB(11);"STATION";TAB(21);"FREQUENCY";TAB(31);
5020 PRINT "TIME";TAB(41);"LOCATION"
5040 READ #10,D$,S$,F$,T$,L$\5100
5050  D$=LEFT$(D$,10):S$=LEFT$(S$,10)
5060  F$=LEFT$(F$,10):T$=LEFT$(T$,10)
5070  L$=LEFT$(L$,10)
5080 PRINT D$;S$;F$;T$;L$
5090 GOTO 5040
5100 CLOSE #10
5110 PRINT :GOTO 390
6000 END
```

★ PULSTAR

Here's the universal digital clocking source you always needed but couldn't afford

by John Rasmussen

IF YOU HAVE BEEN INVOLVED in designing and building digital circuits, you have undoubtedly found a constant need for a handy clock signal source of some kind. There are several ways of satisfying this need. One way is to build a simple R/C oscillator whenever you need one. Another way is to build a fixed-frequency crystal oscillator, and divide the output frequency down to whatever frequency you want. Any of these methods will do the job in most cases, but it invariably involves building something special for each particular case, and tearing it down again when it is no longer needed. Of course, you could also buy one of the commercially available pulse generators if your budget can stand the price tag of $150.00 and up.

We have another solution for you—a simple pulse generator based on two CMOS ICs. It covers a frequency range of 1 Hz to 1 MHz, and has a pulsewidth variable between 0.5-seconds and 0.5-microseconds. It features three modes of operation: Free running, Gated oscillator, and Single Shot, with either external or internal triggering.

The unique thing about this design is that it is powered from the same power supply as the circuit it is driving. This means that you can use the pulse generator to drive both CMOS and TTL circuits, as the drive level will always match the circuit you are testing. It also saves you the cost of a separate power supply for the pulse generator.

The Circuit. Referring to the schematic diagram, it can be seen that the basic pulse generator consists of U2 and U3, which are both 4047s, a low-power CMOS Astable/Monostable multivibrator.

U2 and associated circuitry form an oscillator circuit with a 50% duty-cycle in the free running mode. In the monostable mode, it is a one-shot oscillator which may be triggered either from an external source or from the internal pushbutton.

S4 controls the mode of operation. In the free running mode, it grounds pin 8 and pin 9 of U1, thereby keeping pin 6 of U2 high, and pin 8 of U2 low. This enables the astable mode of U2. Neither the trigger input or the pushbutton have an effect on the circuit operation in this mode, because pin 5 of U1 is held high.

When S4 is in the free running position, pin 5 of U2 may be pulled low by a low input on GATE IN. This allows U2 to operate as a gated oscillator. When GATE IN is pulled low, the operation of U2 is inhibited.

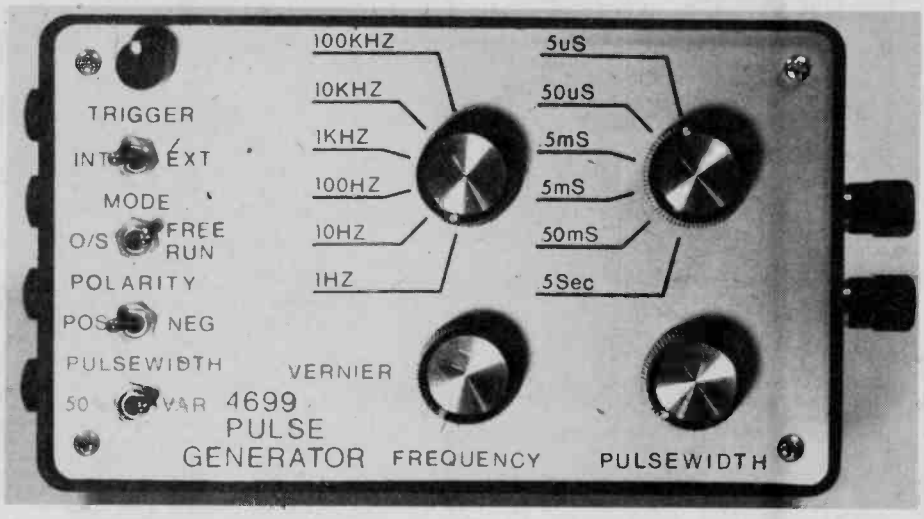
With S4 in the one-shot position, U2 operates as a one-shot oscillator. In this mode, U2 is triggered by a low-going signal at pin 6 of U1. This low-going signal may originate from an external source (if S3 is in the EXT TRIG mode) or from the de-bounced pushbutton switch, if S3 is in the INT TRIG mode. Two sections of U1 are used to de-bounce the push button switch.

The components which determine the operating frequency of U2 are capacitors C1 through C6, and resistors R6 and R8. S1 allows frequency adjustment in decade steps while R8 is a vernier control allowing adjustment of the output to the exact frequency required.

U3 operates continuously in the astable mode. It is used to generate an output signal with a variable pulsewidth, and is triggered on the rising edge of the waveform output of U2. The components which determine U3's pulsewidth are C7 through C12, and R7 and R9.

S5 allows a choice of either a positive or negative-going output pulse. S6 allows a choice between an output signal with a 50% duty-cycle, or one with a variable pulsewidth (adjusted by R9).

The output signal is buffered by U4. Only one section of the six buffers contained in the chip is shown on the schematic, although all the buffer sections can be driven in parallel to provide as many as 12 (each buffer can drive 2 TTL or DTL circuits) outputs. Check the wiring diagram provided

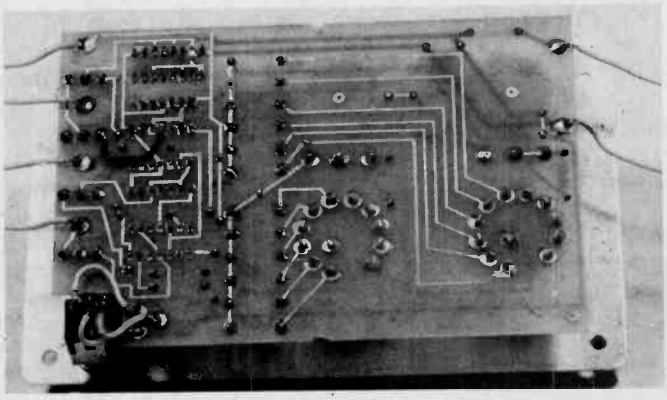


This professional-looking finished product was completed with the aid of a dry lettering transfer kit, which is available in most art supply stores for a usually very low price.

with the chip for the pin numbers of the additional buffers.

Construction. Assuming that you will utilize a PC board for assembly of the pulse generator's circuitry (and we suggest that you do), take note of the fact that the PC board that must be used for this project is a double-sided one, with copper foil on both sides of the board. We have provided two templates for this purpose. Template "A" is to be used to create the foil pattern on the underside of the board (the side opposite the component side). Template "B" is to be used to create the foil pattern on the component side of the board. Depending upon what etching method you use, you may have to etch one side, and then repeat the process for the other side, or you may be able to etch both sides in one single process. Check the directions with your etching kit before proceeding with the etching process.

Once the board is completed (and after you have visually inspected it for accuracy and compliance with the original template) solder all of the components (except the ICs) to the "B" side, following the component layout diagram we have provided. We strongly suggest that you utilize IC sockets, especially for CMOS chips, since they are susceptible to damage from static charges emanating from your body, as well as stray AC from a soldering iron.



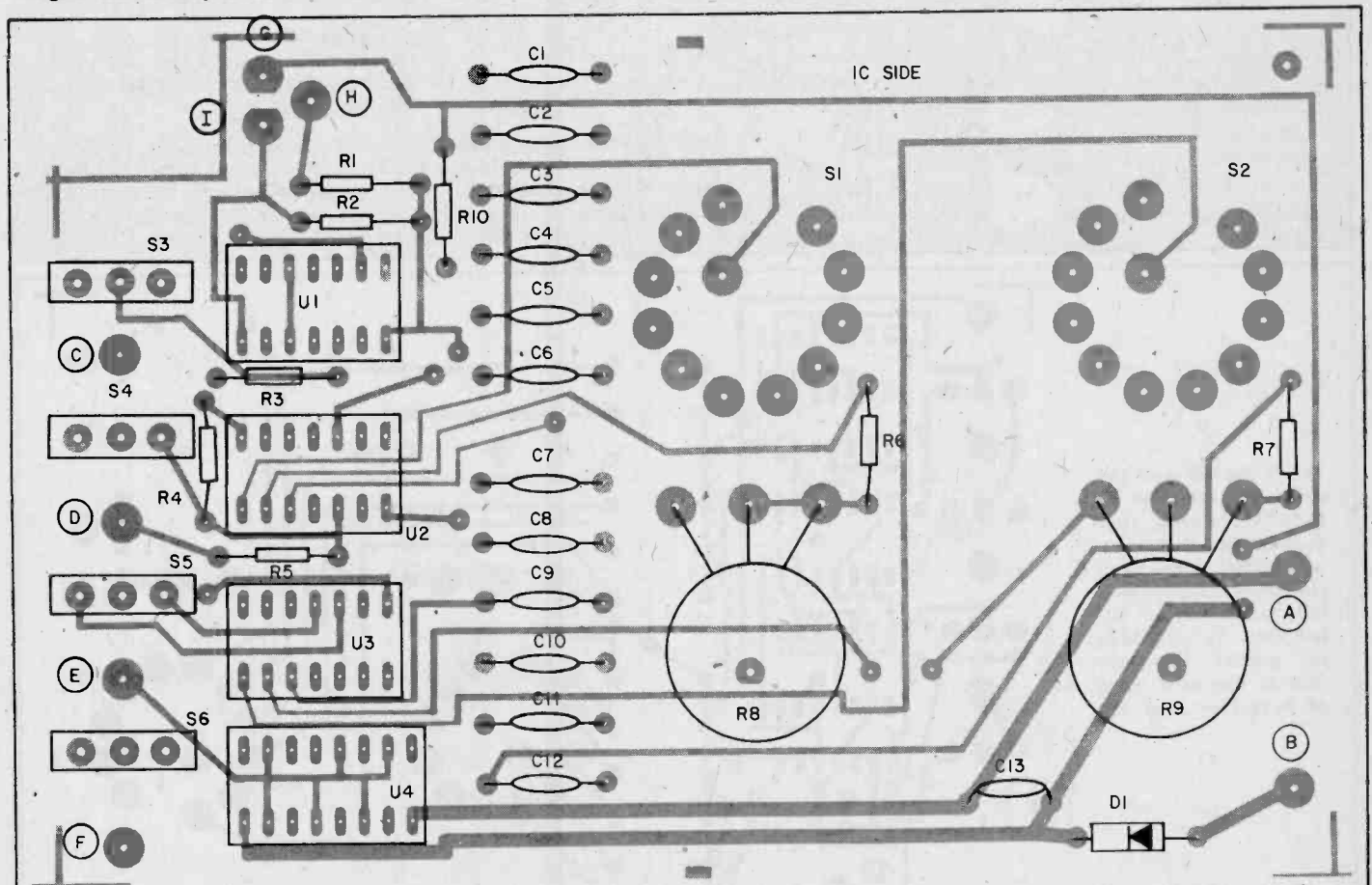
This photograph shows the foil pattern of the PC board. Use the template on the next page to obtain similar results in building your own PULSTAR.

The only component which is not mounted on the board is switch S7. As you can see in the photograph, S7 is connected to the board by three jumper wires to points G, H and I.

In order to mount switches S1 and S2 on the PC board, the wiper and the topmost terminal of the unused second sections must be cut away. In addition, the wiper of the section that *is* to be used must be bent down slightly to accommodate the holes drilled in the PC board.

Applications. This pulse generator may be used to check out all kinds of digital circuits. Its wide frequency range and operating voltage make it very adaptable. The variable pulse-width feature enables you to check a circuit for sensitivity to variation in clock pulse width.

Let's say a circuit using CMOS ICs with long counting chains, and both positive and negative edge-triggered flip-flops was to be tested. Such a circuit, due to the relatively high propagation delays in the CMOS ICs, may



This is the component placement guide for the printed circuit board. Be certain that you observe correct pin orientation when installing the integrated circuit sockets. Switches S1 and S2 can be mounted directly on the PC board. Refer to the text for mounting instructions.

PULSTAR

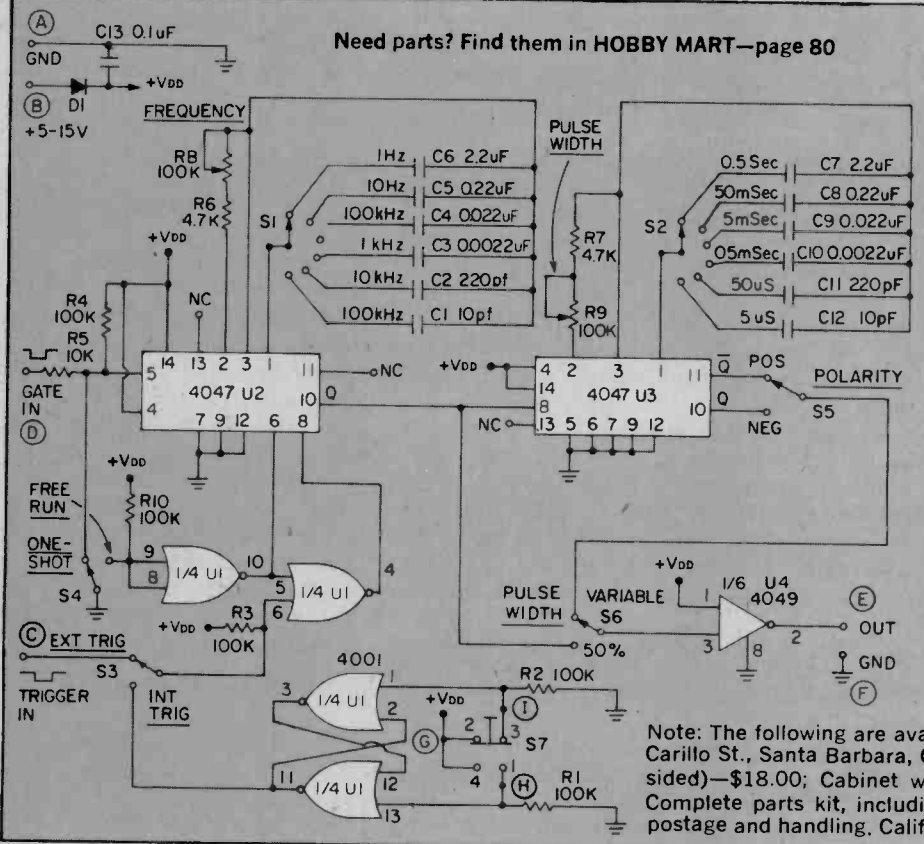
be sensitive to clock pulsewidth variations. With this pulse generator, you will be able to check the operating margins of such a circuit.

If you wish to drive a TTL circuit at 1MHz with this pulse generator, it may be done by operating the pulse generator from a voltage source between 10-volts and 15-volts and by using an external type 4050 IC to level-shift the output pulse to the TTL level. The 4050 would be powered from a 5-volt source.

The pulse generator is not calibrated per se. The component values are chosen so that the ranges are overlapping on both ends of the vernier control. It was designed so, in order to accommodate the changes in the operating frequency and pulsewidth associated with different supply voltages. It is suggested that either a scope or a

(Continued on page 82)

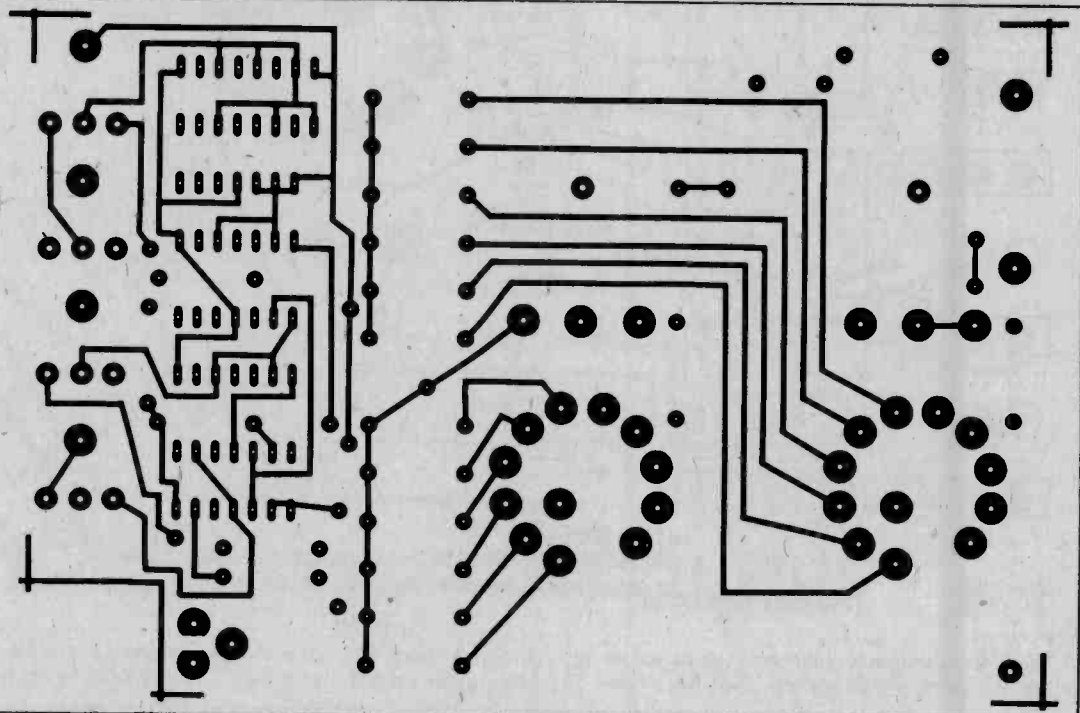
Need parts? Find them in HOBBY MART—page 80



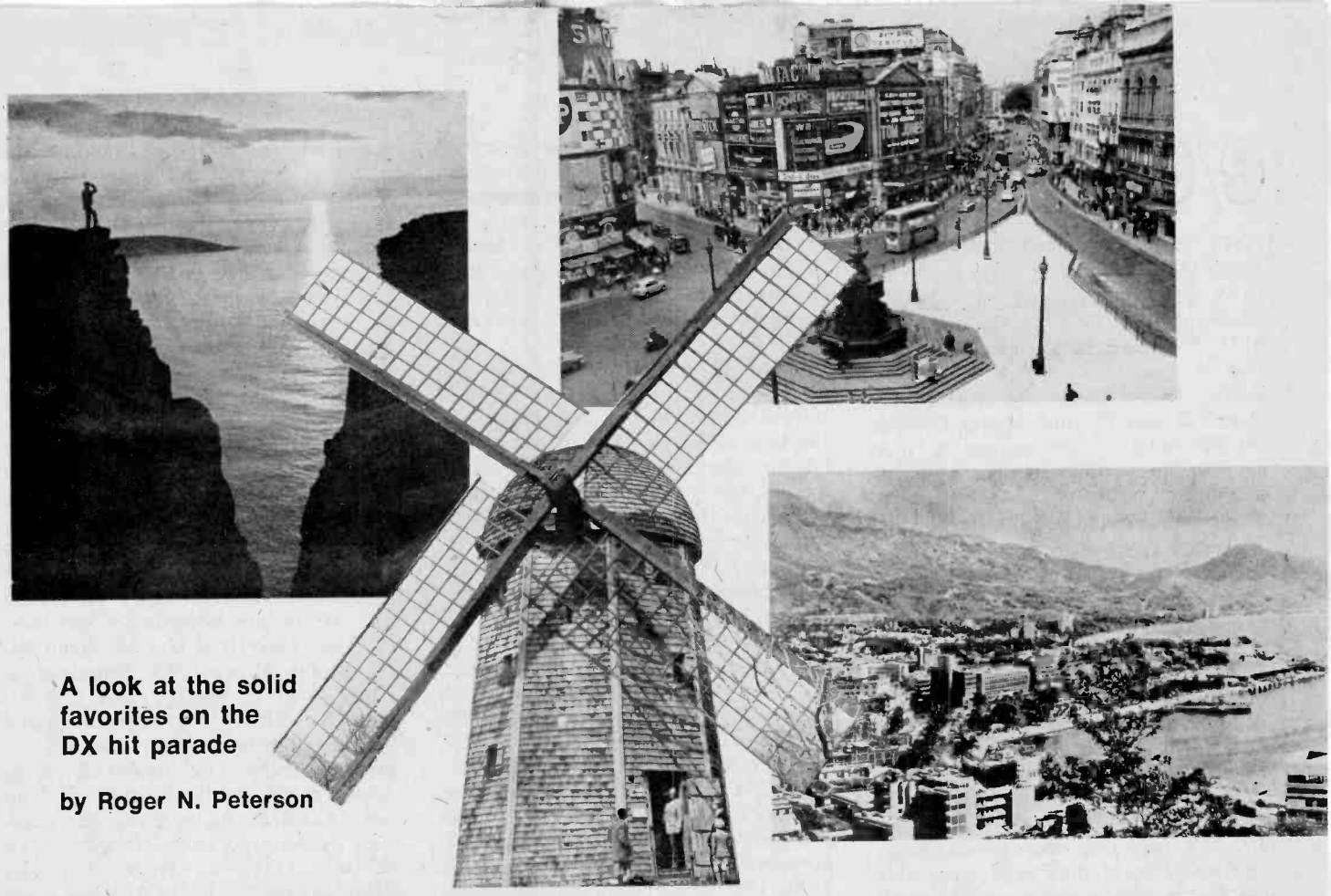
PARTS LIST FOR PULSTAR

C1, C12—10-pF ceramic disc capacitor, 100-VDC
C2, C11—220-pF ceramic disc capacitor, 100-VDC
C3, C10—0.0022-uF mylar capacitor, 100-VDC
C4, C9—0.022-uF mylar capacitor, 100-VDC
C5, C8—0.22-uF mylar capacitor, 100-VDC
C6, C7—2.2-uF tantalum capacitor, 25-VDC
C13—0.1-uF ceramic disc capacitor, 100-VDC
D1—1N4148 diode
R1 to R4, R10—100,000-ohm, ¼-watt resistor
R6, R7—4,700-ohm, ¼-watt resistor
R5—10,000-ohm, ¼-watt resistor
R8, R9—100,000-ohm, linear-taper potentiometer
S1, S2—2-pole, 6-position, non-shorting rotary switch (Radio Shack #275-1386)
S3 to S6—SPDT toggle switch
S7 — SPDT momentary-contact pushbutton switch
U1—CD4001 quad NOR gate
U2—CD4047 astable/monostable multivibrator
U3—CD4047 astable/monostable multivibrator
U4—CD4049 inverting hex buffer
U5—optional CD4050 non-inverting hex buffer (see text)
MISC: binding posts, knobs, plastic case, IC sockets (three 14-pin DIP, one 16-pin DIP), dry letter transfer kit for faceplate lettering, etc.

Note: The following are available from Engineering Resources, 221 W. Carillo St., Santa Barbara, CA 93101: Screen-printed PC board (double-sided)—$18.00; Cabinet with front panel drilled and labled—$15.00; Complete parts kit, including all of the above—$65.00 plus $3.25 for postage and handling. California residents add 6% sales tax. No CODs.



This is the full-scale circuit board template for PULSTAR. Check your finished board for unwanted foil bridges and continuity of the long foil paths before attempting to assemble the project. This precaution can save a lot of headaches later on.



A look at the solid favorites on the DX hit parade

by Roger N. Peterson

DX Programming

AMONG SHORT WAVE RADIO fans, the DX program can be the most important source of information. A good program will give weekly changes in station broadcast times and frequencies, bring news about short wave matters, tip the listener off to a new station, and also give helpful technical advice on antennas, new receivers, etc.

The DX program has become so popular, that today there are 24 international broadcasters with weekly programs of this type. Unfortunately, not all of these programs are first rate. Some, for example, broadcast very dated information. Others, in their programs beamed to the U.S., give us too much information that is useless. It may be interesting, for example, to hear that a listener in Finland has picked up a station in Siberia on a new frequency, but the chances of a listener in the U.S. being able to tune it in are remote.

Sources of Information. The DX news program is, of course, only as good as its sources of information. These might include the broadcaster's own monitoring efforts. Or the station may subscribe to a commercial monitoring source, such as the BBC's service which supplies changes in broadcast times and frequencies all over the world on a regular periodic basis.

Another important source of information are reports sent in by listeners themselves. Most DX broadcasters quote the names and countries of their informants, and thus encourage other listeners to contribute.

The DX Club bulletins are also handy sources for some DX reporters. These may not have very fresh news by the time they are received by the broadcaster, but at least he knows the information will probably have value to listeners in the part of the world where the bulletin originated.

Technical Talk. Not all DX programs concentrate on news for the shortwave listener. Some instead conduct technical discussions or answer questions sent in by listeners. Other programs offer prize contests for the DXer to enter. Again, like the DX news broadcasters, some of these technical programs are excellent, others are poor.

Let's look at some of these programs in some detail, starting with the best now on the air—

Radio Canada International's DX Corner. This is the very best from the standpoint of news for the North American shortwave enthusiast. Glenn Hauser gives the changes in broadcast times and frequencies plus other news, and his material is very current. Glenn is the editor of both the *Review of International Broadcasting* and the *Listener's Notebook* in the North American Short Wave Association's monthly bulletin, and he has lots of sources for his news. You can hear this every Sunday at 0100 (GMT) on 5960 kHz; 0200 on 9535 and 5060; 0300 on 9535, 11845, 9755 and 5960 kHz; and at 0400 on 9535 and 5960 kHz.

BBC World Radio Club. This is a different type of program in that it doesn't concentrate on news (although it usually contains some) but instead gives helpful advice on antennas, noise suppression, and other technical information. Reg Kennedy, the editor, conducts a lively, always-interesting program. Occasionally the program offers a prize contest that apparently gets listeners from all over the world to enter. You can hear it on Sundays at 0745 GMT on 9510 kHz; Mondays at 1115

e/e DX PROGRAM

GMT on 5990, 6195, 11,750 and 5,260 kHz; Tuesday at 2100 GMT on 6175, 7325, 11,750 and 15,260 kHz; Wednesday at 2315 GMT on 6120, 6175, 9510 and 11,750 kHz. Membership is open to all. Write to: World Service Radio Club, BBC World Service, P.O. Box 76, Bush House, London WC2B 4PH. You'll receive a nice membership certificate, plus a useful program covering all BBC broadcasts to the U.S. Best of all, it's free.

Radio Sweden's "Sweden Calling DXers." This is one of the oldest DX shows and was conducted by Arnie Skoog who got to be known throughout the world for these famous broadcasts. Arnie retired last year and the show is now conducted by George Wood, who is American, and seems to know what the North American DXer wants to hear. This again is a show that concentrates on news, and a great deal of the information comes directly from listeners. Not only does George encourage informants by reading their name over the air, he also sends a weekly newsletter to regular contributors. You can hear this program on Tuesdays at 1415 GMT on 21,505 kHz and Wednesdays at 0245 GMT on 11,705 and 9695 kHz.

"Swiss Shortwave Merry-Go-Round." Here's another excellent program for technical information. It features the "Two Bobs"—Bob Thomann and Bob Zanotti. They devote a good deal of time to answering letters from listeners on shortwave topics. Unfortunately they are only on twice a month. Hear them on the second and fourth Saturdays of every month at 1315 GMT on 21,630 kHz. Also at 0145 GMT on 9725 or 6135 kHz.

Radio Nederland's "DX Juke Box." Again, one of the old-timers of DX programs. The title comes from their practice of playing jazz in between DX news announcements. This excellent program is hosted by Dick Speekman. He answers technical questions from listeners and also gives radio propagation reports. In order to give helpful information to listeners in all parts of the world, Dick divides his programs up into regional reports. The first weekly program of the month is a report on Pacific stations by Arthur Cushins of New Zealand. On succeeding weeks, he has Jan Tuner of Sweden, Glenn Hauser of the U.S.A., and Victor Goonetilleke of Sri Lanka. Thus, you can be sure of getting some useful information no matter what part of the world you reside in. This program has another interesting feature. You can enroll in one of many free correspondence courses that are offered. Write for the DX Information Service Catalog, Radio Nederland, P.O. Box 222, 200JG Hilversum, Holland. Tune in for the program on Thursdays at 0230 GMT on 9590 or 6165 kHz.

Radio RSA's "DX Corner." This used to be one of the finest DX programs offered on the air. However, recently the host of the program, Gerry Wood, left the station and it remains to be seen if his successor, Peter Martins, can sustain the pace set by his predecessor. Aside from being highly entertaining, Gerry Wood kept his listeners very well informed on the African broadcasters. His successor seems to be following up in this area. If you are at all interested in DXing the African scene, you would be well advised to tune to this program. You can hear it on Saturdays at 0200 GMT on 15,220, 11,900, 9610 or 9585 kHz.

HCJB's "DX Party Line." Strange as it may seem, this Ecuadorian station puts out one of the most popular DX programs. Much of their information comes from *SPEEDX*, a publication put out by one of this country's most popular shortwave radio associations. Some people complain about this station's mixing religious comments with the DX news. However, the station is a religious one, and if you listen you simply have to hear what they have to say. You can hear "DX Party Line" on Tuesdays, Thusrdays and Sundays at 0230 GMT on 11,915 or 9560 kHz.

Summing Up. The programs listed above are, in the author's opinion, the pick of the DX programs. All are broadcast in English and usually have a very strong signal into the U.S.A. There are, of course, numerous other programs also offered in English, but most that I have heard are not on a par with the above. If, however, you are interested in specific areas, you may wish to try some some additional stations. *Radio Australia*, which used to have a very popular DX show, now puts out some DX information on their "Club Forum" program, which can be heard on Saturdays at 0240 GMT on 17,795 or 21,740 kHz. Radio Finland has a fair program on the first Saturday of the month. Try for it (reception not too dependable) at 1300 GMT on 15,210 kHz. If you are interested in the Russian and other Iron Curtain countries, try Radio Moscow on Saturdays at 23:40 GMT on 9490, 11,860, and numerous other frequencies. Radio Prague (Czechoslovakia) has a good program, and you can hear it on Thursdays at 0100 and 0300 GMT on 7345 and 5930 kHz. Radio Budapest broadcasts its DX program to North America at 0400 GMT on Wednesdays and Saturdays on 15,225, 11,910, 6160 and 6000 kHz.

Among the newer DX programs to come on the air is Radio Israel. Its "Calling All Listeners" program can be heard on Sundays at 2000 and 2230 GMT on 11,655, 9815, or 7412 kHz. So far as I know, Radio Peking in China hasn't started a DX program yet. But take heart, they probably will one of these days. Everybody's getting into the act! ■

Here are the faces behind the voices—Clayton and Helen Howard, hosts of the DX Partyline program heard over HCJB, Quito, Ecuador, The Voice of The Andes.

The BBC's Bush House control panel routes World Service programming throughout the globe. Obviously, this is not typical of most national radio services. Then again, neither is the BBC.

e/e BASIC COURSE IN ELECTRICITY & ELECTRONICS

This series is based on material appearing in Vol. 4 of the 5-volume set, BASIC ELECTRICITY/ELECTRONICS, published by Howard W. Sams & Co., Inc. @ $22.50. For information on the complete set, write the publisher at 4300 West 62nd St., Indianapolis, Ind. 46268.

CATHODE-RAY TUBES IN TV SETS AND OSCILLOSCOPES

WHAT YOU WILL LEARN. When you have finished reading this article you will have learned how the cathode-ray tube, which is the display device for oscilloscopes, as well as for all television receivers, works. In addition, you will know what the differences are between cathode-ray tubes used in 'scopes and those used in TVs.

THE CATHODE-RAY TUBE

The cathode-ray tube (which we'll refer to as CRT from here on) is a large vacuum tube which has three main parts. They are, first, the **electron gun,** which produces a steady stream of electrons and aims them at the large, flat end of the tube, second, **deflecting** devices, which move the electron beam in accordance with the signal to be observed, and third, the chemical coating on the large flat end of the CRT, commonly called the **screen.**

The oscilloscope displays electrical signals on the screen to show what's going on in electrical or electronic circuits. The TV set shows pictures transmitted from the TV station. In both cases the CRT used in the 'scope or the TV set are almost exactly the same.

The main difference in the picture tube in TV sets and the CRT in scopes today is that the electron beam is moved back and forth in the TV set *electromagnetically,* by coils of copper wire placed around the neck of the tube, while the electron beam in a 'scope is moved about by the changing *electrostatic* voltages between small deflection plates inside the neck of the tube. In fact, the earliest TV picture tubes were electrostatic-deflection CRTs, and during the Korean War, when copper for the magnetic deflection coils was scarce, TV set makers stopped making electromagnetic-deflection picture tubes and went back to the earlier, electrostatically-deflected tubes!

THE CRT IN OSCILLOSCOPES

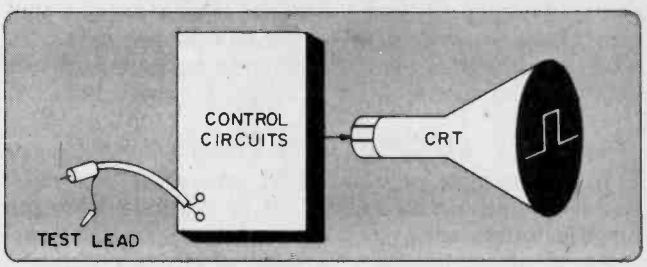
The oscilloscope is really a not-very-exact *measuring* instrument for voltages and waveforms which also shows what the voltages or signals *look* like. Although it *can* be pretty exact in its measurement of signals, only the most expensive 'scopes are nearly as precise as even cheap meters, so their main purpose is usually to show what the signals look like.

The oscilloscope contains, in addition to the CRT, a power supply which generally provides 2,000-volts or more, and some control circuits which take the signal voltage(s) to be displayed, amplify and otherwise process them and feed them to the CRT for display.

'Scope CRTs have a screen usually made of phosphorescent (give off light when struck by electrons) chemicals which create a green display. Some very expensive 'scopes use CRTs with blue, or even purple-emitting phosphor-coated screens. TV sets of course have screens with white light-emitting screens (in black and white sets).

The CRT in oscilloscopes uses electrostatic deflection, with the deflecting voltages applied to the vertical-deflecting plates and to the horizontal deflecting plates, as shown in the diagram.

SIMPLIFIED OSCILLOSCOPE



The signal voltage size is indicated by the *amplitude* (height, up-and-down dimension) of the beam movement on the screen. The *time period* (duration) is shown by the distance the beam travels across the screen horizontally, from left to right.

By relating the time a signal takes to its amplitude (size) and its shape, we can get a very accurate idea of what's going on in most circuits at any desired point.

QUESTIONS

Q1. A waveform can be described in terms of its vertical and horizontal dimensions. What are these dimensions? a_____, t_____.

Q2. A cathode-ray tube can display a picture on its face, or screen. What causes the picture to appear?

Q3. An oscilloscope is made up of a cathode-ray tube and a group of control circuits. What is the function of the control circuits?

ANSWERS

A1. The vertical and horizontal dimensions of a waveform are **amplitude** and **time.**

A2. The picture on a CRT is developed by a **moving electron beam** that strikes and illuminates a chemical coating on the inside face of the tube.

A3. The function of the oscilloscope control circuits is to process, amplify, and deliver the **signal** to the CRT.

THE CRT IN TV SETS

The cathode-ray tube is the display device in the television set. The CRT operates by moving a controllable beam of electrons across the inside face of the tube. The number of electrons in the beam is determined by the blacks, grays, and whites of the scene the TV camera is viewing. White is produced by a large number of electrons striking a chemical coating on the inside of the tube. The electrons cause the coating to give off light. Black is achieved by stopping the electron flow, and shades of gray are obtained by varying the amount of electrons between the amounts required for black and white.

The picture is "painted" on the screen by the narrow electron beam moving back and forth across the tube many times a second. This movement is due to varying magnetic fields produced by a set of horizontal and vertical deflection coils around the CRT's neck.

The principle of putting a picture of a waveform on the screen of an oscilloscope is similar. The movement of the electron beam in the 'scope is controlled *electrostatically* so that the beam traces out the pattern of the waveform being measured. As in the TV tube, the electron beam illuminates a coating on the inside of the tube.

ELECTROSTATIC FIELDS

To understand how the CRT operates, you must know that an electrostatic field is a space in which electric forces act.

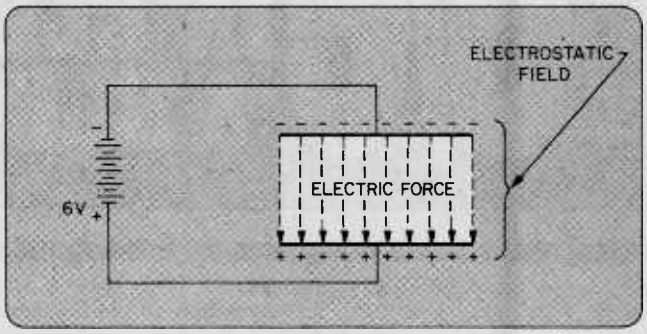
An electrostatic field can be developed between two charged plates. If one plate is negative with respect to the other, the direction of the electric force can be determined.

In the drawing shown, lines of electric force take a direction from negative to positive. This means a negatively-charged body entering the field would be moved downward (from negative to positive). A positively-charged body, however, would be moved upward (positive to negative). (Like charges repel, and unlike charges attract). How do you think an electrostatic field is formed?

An electrostatic field is formed with a voltage source and a pair of metallic plates to hold the charges.

If a 6-volt battery is connected to the plates in the manner shown, the battery will draw elecrons from the bottom plate and deposit them on the top plate until the difference in potential between the plates

ELECTROSTATIC FIELDS



equals the battery voltage. The potential of the plate having an excess of electrons will be negative. The other plate, being deficient in electrons, will be positive.

QUESTIONS

Q4. What is an electrostatic field?

Q5. What causes an electrostatic field to exist between two metallic plates?

ANSWERS

A4. An electrostatic field is a region in which **electric forces** are acting.

A5. An electrostatic field is formed when one plate has an excess of and the other a deficiency of electrons.

ELECTROSTATIC FORCES BETWEEN CIRCULAR AND TUBULAR PLATES

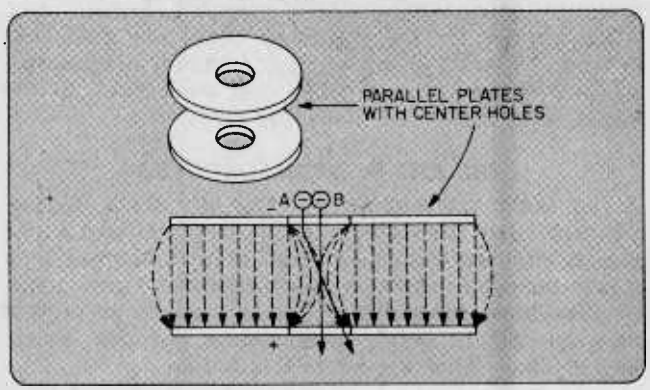
In the drawing, an electrostatic field between two plates having center holes is shown. Observe the curvature of the force lines under the holes.

PRODUCING AN ELECTROSTATIC FIELD

Since its path is parallel to the force lines, electron B will pass straight through the axis (center line) of the holes. Electron A starts in the same direction as electron B. When electron A enters the field, it turns in the direction of the force lines. Just before it leaves the field, it is turned even further and in the direction of the curvature of the force lines.

Suppose a small and a large cylinder, both charged with a positive potential, are placed so the electrons

ELECTROSTATIC LENS I

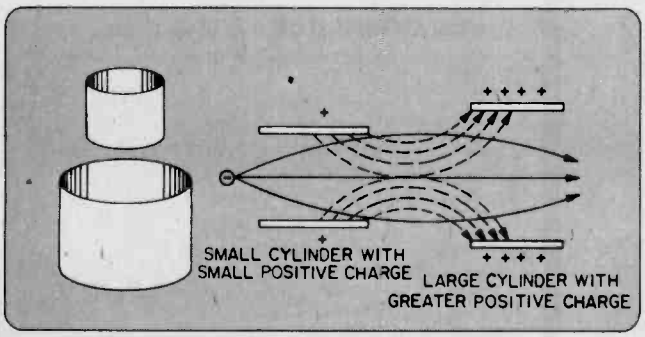


must pass through them. Also suppose the larger cylinder has a more positive charge. The distribution of the lines of force would look like the next illustration.

An electron in the space at the left of the small cylinder would be attracted toward the cylinder by the positive charge. If the electron was travelling along the axis of the cylinder, it would pass through without crossing a line of force. As it approached the larger, more positively charged cylinder, the velocity of the electron would increase.

An electron entering the small cylinder at an angle will cut the lines of force and be turned in their direction as shown by the top and bottom electron paths.

ELECTROSTATIC LENS II



ELECTROSTATIC FOCUS

As it approaches the larger cylinder, the electron will be accelerated by the higher positive potential. Because of the higher electron velocity, the force lines in the larger cylinder will have a smaller turning effect on the electron. If the difference of potential between the cylinders is adjusted properly, the electrons will unite at a given distance after passing through the second cylinder. The action of the electrons as they pass through the influence of the two cylinders provides a convenient method of focusing the beam.

QUESTIONS

Q6. As an electron approaches the larger cylinder, the velocity of the electron will .....

Q7. Why is the above statement true?

ANSWERS

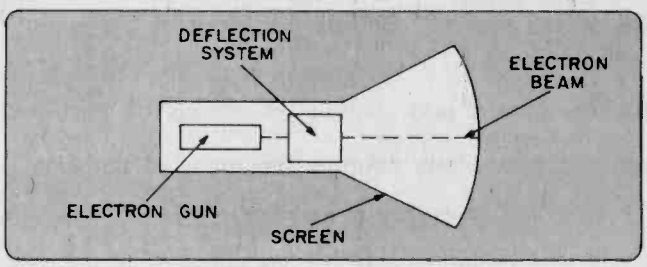
A6. As an electron approaches the larger cylinder, the velocity of the electron will **increase.**

A7. The above statement is true because the larger cylinder is **more positively charged.** It will attract the electron with a greater force, thereby increasing the velocity of the electron.

ELECTRON GUN

Cathode-ray tubes used in oscilloscopes consist of an *electron gun,* a *deflection system,* and a *fluorescent screen.* All elements are enclosed in an evacuated container, usually glass. The electron gun generates electrons and focuses them into a narrow beam. The deflection system moves the beam across the screen in the manner desired. The screen is coated with a material that glows when struck by the electrons.

BASIC CATHODE-RAY TUBE



An electron gun has a cathode to generate electrons, a grid to control electron flow, and a positive element to accelerate electron movement. The control grid is cylindrical in shape and has a small opening in a baffle at one end. The positive element consists of two cylinders, called anodes. They also contain baffles (or plates) having small holes in their centers. The main purpose of the first anode is to focus the electrons into a narrow beam on the screen. The second anode speeds up the electrons as they pass.

CATHODE AND GRID

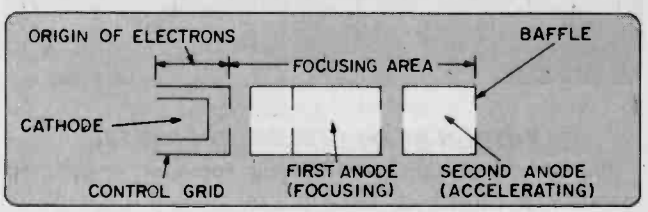
The cathode is indirectly heated and emits a cloud of electrons. The control grid is a hollow metal tube placed over the cathode. A small opening is located in the center of a baffle at the end opposite the cathode. The grid is maintained at a negative potential with respect to the cathode.

A high positive potential on the anodes pulls electrons through the hole in the grid. Since the grid is near the cathode, it can control the number of electrons that are emitted. As in an ordinary vacuum tube, the negative voltage of the grid can be changed to vary electron flow or stop it completely. The brightness of the image on the fluorescent screen is determined by the number of electrons striking the screen. Intensity (brightness) can, therefore, be controlled by the voltage on the control grid.

FOCUS CONTROL

Focusing is accomplished by controlling the electrostatic fields that exist between the grid and first anode and between the first and second anodes. Study the diagram. See if you can determine the paths of electrons through the gun.

DIAGRAM FOR Q8 and Q9



QUESTIONS

Q8. Which element controls the number of electrons

striking the screen in the drawing titled *electrostatic fields*?

Q9. Which element controls the focus of the beam?

ANSWERS

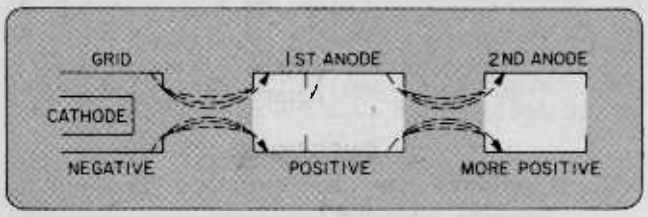
A8. The **control grid** controls the number of electrons striking the screen.

A9. The **first anode** controls the focus of the beam.

ELECTROSTATIC LENSES

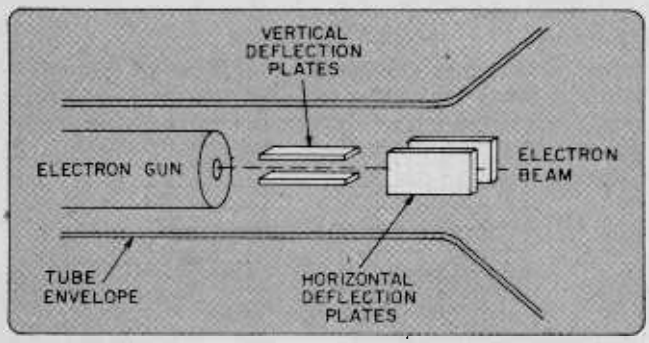
The next diagram shows electrons moving through the gun. The electrostatic field areas are often referred to as *lenses*. The first electrostatic lens causes the electrons to cross at a focal point within the field. The second lens bends the spreading streams and returns them to a new focal point.

ELECTRON GUN "LENSES"



The diagram also shows the voltage relationships on the electron-gun elements. The cathode is at a fixed positive voltage with respect to ground. The grid is at a variable negative voltage with respect to the cathode. A fixed positive voltage of several thousand volts is connected to the second (accelerating) anode. The potential of the first (focusing) anode is less positive than the potential of the second anode. It can be varied to place the focal point of the electron beam on the screen of the tube. Control-grid potential is established at the proper level to allow the correct number of electrons through the gun for the desired intensity.

ELECTRON GUN AND BEAM FORMATION

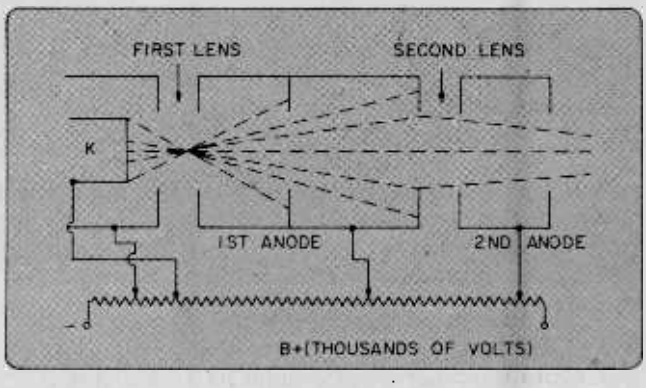


ELECTRON-BEAM DEFLECTION SYSTEM

The electron beam is developed, focused, and pulled toward the screen by the electron gun. It appears on the screen of the CRT as a small, bright dot. If the beam were left in one position, the electrons would soon burn away the illuminating coating in that one area. To be of any use, the beam must move. As you have learned, an electrostatic field can bend the path of a moving electron, or an electron stream.

Assume the beam of electrons passes through an electrostatic field between two plates. Since electrons are negatively charged, they will be deflected in the direction of the electric force (from negative to positive). The electrons will follow a curved path through the field. When the electrons leave the field, they will take a straight path to the screen at the angle at which they left the field. Although the beam is still wide (the focal point is at the screen), all the electrons will be traveling toward the same spot. This is assuming, of course, that the proper voltages are existing on the anodes which produce the electrostatic field. Changing the voltages changes the focal point of the beam.

ELECTRON GUN FIELDS



QUESTION

Q10. Why are the electrostatic fields between electron-gun elements called lenses?

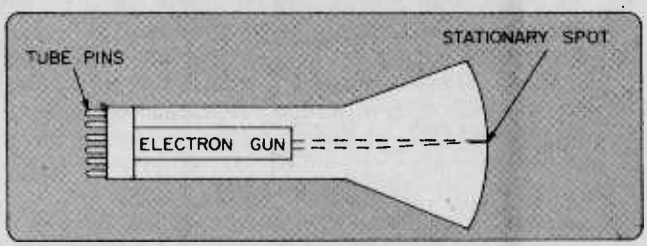
ANSWER

A10. They are called lenses because the fields **concentrate and focus** the electron streams in the same manner that optical lenses bend light rays.

VERTICAL AND HORIZONTAL PLATES

If two sets of deflection plates are placed at right angles to each other inside a CRT, the electron beam can be controlled in any direction.

CRT WITHOUT DEFLECTION



By varying the voltage between the two vertical-deflection plates, the spot on the face of the tube can be made to move up and down. The distance will be proportional to the change in voltage between the plates. Changing the voltage difference between the

horizontal-deflection plates will cause the beam to move a given distance from one side to the other. There are directions other than up-down and left-right. The beam must be deflected in all directions.

Note the double diagram. You can see that the beam may be moved to any position on the screen simply by moving it both vertically and horizontally.

In the top diagram, position A of the beam is in the center. It can be moved to position B by going up two units and then right two units. Movement of the beam is the result of the simultaneous action of both sets of deflection plates. The electrostatic field between the vertical plates moves the electrons up an amount proportional to two units at the screen. As the beam passes between the horizontal plates, it is moved to the right an amount proportional to two units.

QUESTION

Q11. In the right figure, how many units, and in which direction, will each set of deflection plates move beam A′ to B′?

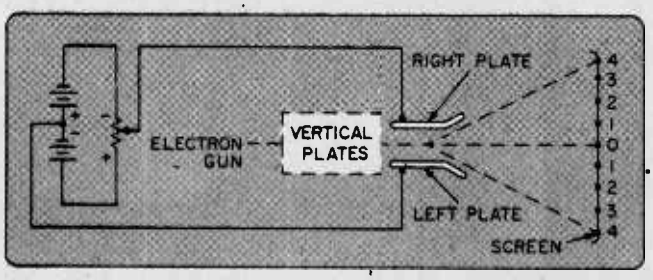
ANSWER

A11. The vertical plates will move the beam **down three units.** The horizontal plates will move the spot **one unit to the left.**

VOLTAGE CONTROL OF HORIZONTAL PLATES

Assume that the resistance of the potentiometer in the figure is spread evenly along its length. When the arm of the potentiometer is at the middle position, there is the same potential on each plate. Since there is zero potential between the plates, an electrostatic field is not produced. The beam will be at zero on the screen. If the arm is moved downward at a uniform rate, the right plate will become more positive than the left. The electron beam will move from 0 through 1, 2, 3, and 4 in equal time intervals. If the potentiometer arm moves at the same rate in the other direction, the right plate will decrease in positive potential.

HORIZONTAL PLATES—TOP VIEW



The beam returns to the zero position when the potential difference between the plates again becomes zero. Moving the arm toward the other end of the resistance will cause the left plate to become more positive than the right. The direction of the electric force reverses, and the beam moves from 0 through 4′. If the movement of the potentiometer arm is at a linear (uniform) rate, the beam will move at a steady rate.

AMPLITUDE VERSUS TIME

Do you recall the statement made earlier that waveforms could be described in terms of amplitude and time? You have just seen how the movement of the beam depends on both potential (amplitude) and time.

From zero time to 1-second, the waveform in the diagram is at zero volts. In the CRT the vertical plates remain at the same potential difference while the potential difference between the horizontal plates increases 1 unit in the direction necessary to move the beam toward the right. When time is equal to 1-second, the waveform rises to +2-volts. The potential difference between the vertical plates increases enough to move the electron beam 2 units in the positive direction. From 1 to 4-seconds, the waveform remains at +2-volts and then decreases to −2-volts. As the horizontal-plate potential difference increases by 3 units, the vertical potential remains the same (+2 units) and then drops sharply 4 units. For the next 3-seconds, the waveform remains at −2-volts. In the CRT, the potential difference between the vertical plates remains unchanged as the horizontal potential increases uniformly.

QUESTIONS

Q12. Waveforms can be described in terms of a_____ and t_____.

Q13. The horizontal-deflection plates are used to reproduce the a_____ t_____. (choose one)

Q14. The vertical-deflection plates are used to reproduce the a_____ t_____. (choose one)

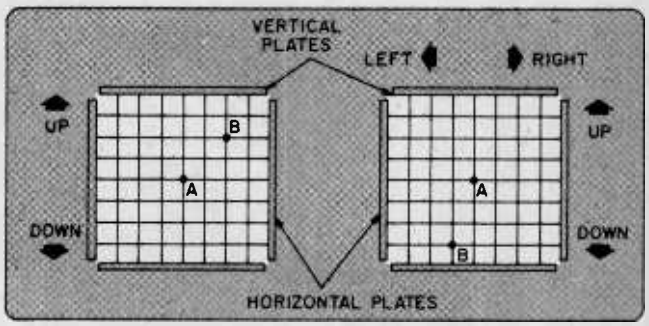
ANSWERS

A12. Waveforms can be described in terms of **amplitude** and **time.**

A13. The horizontal-deflection plates are used to reproduce the **time component.**

A14. The vertical-deflection plates are used to reproduce the **amplitude component.**

DEFLECTION OF CRT BEAM



WHAT YOU HAVE LEARNED

An electron gun contains a cathode (to emit electrons), a control grid (to control the intensity of the trace on the screen), a first anode (to develop the electric lenses that focus the beam on the screen), and a second anode (to accelerate the electrons toward the screen). Deflection plates in vertical and horizontal pairs are used to position the beam on the screen. ■

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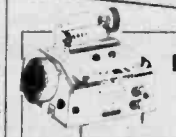

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These unique printers feature precision Swiss construction. 18 key columns are divided into 16 for numerals, and 2 for alphabetical and trig figures, and mathemetical functions. Each wheel is 12 position. Utilizes 2.75" wide adding machine tape, and dual color ribbon. Printing technique: parallel pressure printing, multiple copies. Print Rate: 3 lines per second. Operating voltage: 22 to 28 VDC. Comes in original packing w/roll of tape. Size 6-1/2" x 3-1/8" x 5-3/8". Wt. 7 lbs Cat. No. 92CU5545

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Cat. No. 92CU5696
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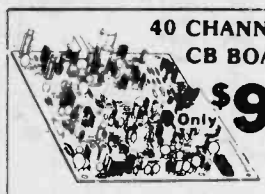

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Poly Paks buys up factory close-out from Hy gain so you gain! Boards have Heatsunked 9 Watt Amp Chip, RF and Mod Transistors, and National Semi MM series PLL. May be used for 10 meter conversion (see 6 month series "CB to 10" in 73 Mag.) The parts alone make it an offer you can't refuse
Cat. No. 92CU5680

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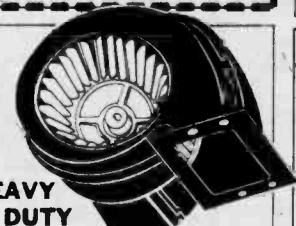

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50	25	Axial	.19
50	100	Axial	.21
100	15	Axial	.23
100	50	Axial	.35
220	25	P.C.	.32
300	25	P.C.	.33
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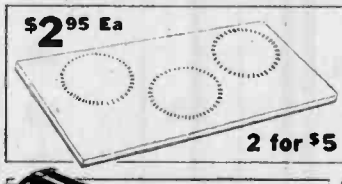

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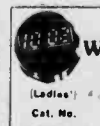

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Hi-Fi Reports

(Continued from page 24)

When you are listening to the tape playbacks look for the ones that have the most powerful high-frequency reproduction. That's where the riff-raff loses out.

Throughout this article I've included some photos of tapes that have passed the muster in our lab. They give excellent performance on most machines that have their bias matched to the tape. They are also consistent from one end of the reel to the other—no small achievement even in these days of high technology. If you would like to know more about tape and the product lines of the various tape manufacturers, then circle the appropriate reader service numbers on the card in this issue.

So, the next time someone tells you—"The only tape to get is XYZ Cyanoxide, because it works great for me,"—you'll know that it may be good, but it may not be right for you. After all, one persons tape might just be another's poison. ■

Pulstar

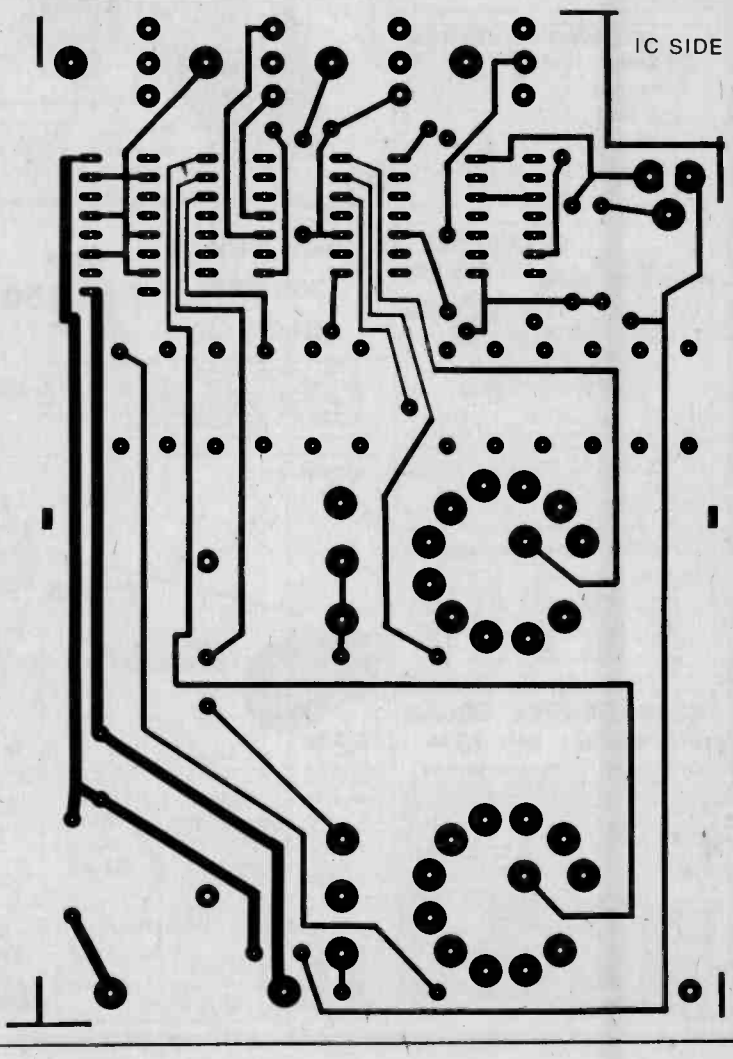
(Continued from page 72)

counter is used to monitor the output to determine operating frequency and pulsewidth, if accuracy is required.

The output frequency and pulsewidth will vary with applied supply voltage, mostly on the high range. On that range, the maximum operating frequency at 5-volts is about 600 kHz. At 10-volts and above, it is 1 MHz. This is due to limitations of the chip.

The gating feature allows you to generate pulse bursts containing a specific number of pulses.

The one-shot feature of the pulse generator may be used to manually single-step counters, toggle flip-flops, and trigger one-shots. All in all, it's a great piece of test equipment for checking out your digitital creations. ■



This is the full-scale template for the etching of the component side of the PC board. Holes for the component leads match up on both sides, so don't be fooled into thinking that these are two separate boards. It's the same board with two different patterns.

Home Computers

(Continued from page 37)

It will be exciting to see what other peripherals of this sort are released. Mountain Hardware has just released a calendar/clock board to add exact timing to their controller.

What's next? Who can say? All that is certain is that being in home computers is being where the action is! ■

Computer Readout

(Continued from page 54)

the printer is busy printing the letter "G," the CPU is spending most of its time twiddling its electronic thumbs waiting until the printer is ready for it to send the next character to be printed,

A time sharing system makes use of these idle moments by paying attention to other console terminals. To do this, it "polls" them one after another in much the same way an automobile distributer services spark plugs in rapid succession. The operating system also has to assign certain portions of memory to each user and keep track of who is where and when.

In addition, the system must keep track of priorities: if two terminals are ready for its attention at the same time, it must decide "who's on first." Thus, in a time sharing computer, our operating system not only plays the role of file clerk and scheduler, but, it seems, that of diplomat.

Time shared systems on microcomputers seem to be *the* coming thing for small to medium sized businesses. Studies have shown that what a small businessman needs is a system with four terminals or less which sells for under $10,000. And manufacturers are currently falling all over each other trying to meet that need.

A typical such system might be found in a parts store where inventory control is critical. One terminal might be out at the counter or in the shipping area. Sales and shipments are entered here and the computer then automatically subtracts the parts from the inventory file and adds the sale amount to the ledger file.

Back in the warehouse, there could be a terminal where incoming parts would be entered and added to the inventory file. Meanwhile, in the office, inventory reporting and bookkeeping could be done using both fiiles with a third terminal along with a printer. And all this could be (and *is* being) done by a single computer with the necessary memory, disk space, and an efficient operating system.

One thing must be noted, though. There is a distinct difference between the operating system and the various programs and computer languages which do the actual programs and calculations that the user finds useful. The operating system actually just does the housekeeping. But it represents something more, something very important.

The operating system provides a software *interface* between a computer language like BASIC or a large application program like "General Ledger" and the piece of hardware that is the actual computer. So we often speak of a language or a program that will run *under* a certain operating system. That means, no matter what sort of funny piece of hardware it may be, if a certain operating system has been adapted to run on it, any piece of software written to run "under" that operating system will run on that machine also.

D.O.S. A number of manufacturers have produced Disk Operating Systems to run on their machines. Processor Technology has PTDOS, Heathkit has HDOS, Cromemco has CDOS, etc. There is also a very popular operating system which has been modified to fit a wide variety of computers. It is called CP/M and was produced by Digital Research (P.O. Box 579, Pacific Grove, CA 93950). The reason CP/M (for Control Program/Micro) is so popular is that it has been adapted to run on a number of different machines.

Programs written by many independent software companies need then only be written in such a way that they run under CP/M and they can then be used on any computer that has a CP/M and they can then be used on any computer that has a CP/M operating system. This is a big incentive for independent producers of software to get busy and write programs that are CP/M compatible because they know they will find a large market among users of many different systems.

Having more software available in turn makes the computer more versatile for the user, and increases its value to him. Expanding a personal computer from a hobby to a serious tool for business or career still represents a sizeable investment. The add-ons are themselves expensive, but the user should look beyond that to the features of the operating system he will be using—both at what he can do with the system itself and how much more of the world of micro-computer software it will open up to him. ■

DXing Intrigue

(Continued from page 43)

to focus on an important news event on a given day. Then, over a period of some hours, tune in news broadcasts from five or six different stations around the globe and note how each treats the same news event. You should get a wide range of comment and opinion and get a first hand, "ear-witness" understanding of the issue from all sides and viewpoints. Edit the snippets of the various newscasts into one tape segment and you've got 10 or 15 minutes of fascinating listening!

Station Picking. What stations should you choose? The choice is up to you and it really depends on the subject matter you're hunting. However, a very good place to start is with the British Broadcasting Corporation. The BBC has a strong reputation for complete, fair and accurate newscasts. Because of its timing, the best opportunity is to listen to the BBC's World Service news at 0000, that is, Midnight, GMT. This is followed at 0015 by the well-known Radio Newsreel program, which is so well respected here in the U.S. that it is picked up daily by the Public Broadcasting Service and relayed over the PBS radio network.

There are a number of frequencies to choose, but, at this writing, 9,515 kHz offered good reception of the BBC's World Service. But because of the nature of shortwave, it may change as well as the other frequencies cited. However, normally a little tuning around the shortwave dial will allow you to locate any frequency changes.

You may try the Voice of America, or Radio Havana Cuba, or South Africa's Radio RSA. Canada? Try both the Radio Canada International and the domestic CBC Northern Service. News buffs sometimes maintain that the domestic Canadian news, intended for listeners in the remote northern parts of that country, is better than that offered by the foreign service.

At 0100, Radio Peking has its own brand of news on 7,120 kHz

If you can understand a foreign language, try comparing what a certain station tells its own people in its home service, and what image of the news it portrays to the world in its English language foreign service.

Whether you operate your shortwave news listening post regularly, every day in your leisure time, or only now and again, you'll find it fun and fascinating, and you'll get a kick when, thanks to SW, you scoop Walter Cronkite on that big story! ■

Simply Basic

(Continued from page 69)

TION, FREQUENCY, TIME, and LOCATION. The section that accommodates the retrieval system lies between lines 3000 and 3770. Rather than enlarge the program by having a separate section for each *keyword*, or word used to reference data, the four commands are simply merged into this one section, and all the data is processed here. Lines 3000-3030 determine what COMMAND you are using, and lines 3080-3130 sort the data file to look for the data that fits your needs. Instructions for using the program can be found at lines 190 to 320, but the program is really self-explanatory. You will see that most of the COMMAND functions are similar in operation, which makes de-bugging a snap. ■

```
SAMPLE RUN OF "SWL LOGBOOK"
RUN
WHAT SECTOR DO YOU WISH TO START AT? 1200
DO YOU NEED INSTRUCTIONS? YES

SWL LOGBOOK: A COMPUTERIZED LOGBOOK
FOR SHORT WAVE LISTENERS. IT CAN STORE
AN UNLIMITED AMOUNT OF DATA (WITHIN THE
SPACE LIMITATIONS OF YOUR DISK). AND
IS EASILY ACCESSIBLE OR RETRIEVABLE.
THE COMMANDS ARE:

START     TO ENTER DATA ONTO DISK
UPDATE    TO ADD DATA TO EXISTING DATA FILE
TIME      TO REFERENCE AN ENTRY BY TIME
STATION   TO REFERENCE A PARTICULAR STATION
FREQUENCY TO REFERENCE ENTRIES BY FREQUENCY
LOCATION  TO REFERENCE ENTRIES BY LOCATION
FILE COPY TO COPY DATA FILE TO A NEW SECTOR
LIST      TO LIST ENTIRE DATA FILE
EXIT      TO LEAVE PROGRAM

COMMAND? START
NEED INSTRUCTIONS ON PROCEDURE? YES
 NTER DATA IN THE FOLLOWING ORDER:
(1) DATE (IN FORM XX/YY/ZZ)
(2) STATION     (3) FREQUENCY
(4) TIME (IN GMT)     (5) LOCATION
SEPARATE DATA ENTRIES WITH COMMAS

TYPE Q,,,, TO EXIT START MODE
? 02/13/79,ETLF,7180 KHZ,1700,ETHIOPIA
? 03/14/79,CFRZ,6070 KHZ,2100,CANADA
? 04/06/79,G3AP,14 MHZ,1345,ENGLAND
? 04/21/79,G3CX,7 MHZ,1500,ENGLAND
? 05/02/79,2NR,7100 KHZ,1335,AUSTRALIA
? Q,,,,
COMMAND? LIST
DATE      STATION    FREQUENCY TIME LOCATION
02/13/79  ETLF       7180 KHZ  1700 ETHIOPIA
03/14/79  CFRZ       6070 KHZ  2100 CANADA
04/06/79  G3AP       14 MHZ    1345 ENGLAND
04/21/79  G3CX       7 MHZ     1500 ENGLAND
05/02/79  2NR        7100 KHZ  1335 AUSTRALIA

COMMAND? LOCATION
LOCATION? ENGLAND
DATE      STATION    FREQUENCY TIME LOCATION
04/06/79  G3AP       14 MHZ    1345 ENGLAND
04/21/79  G3CX       7 MHZ     1500 ENGLAND
```

ELEMENTARY ELECTRONICS INDEX TO ADVERTISERS

Bargain Beams

(Continued from page 52)

each of the wires at the center and attaching to the longer dipole wires as shown. Chart II gives the proper dipole lengths for each element. Care must be taken that the dipole wires are not shorted to each other except at the center connections. Tape all the wire elements to the pipe supports with a wrap of electrical tape approximately every foot.

Now you are ready to make the parasitic elements. Chart III gives the lengths of the directors and reflectors for channels 2 through 13. Spacing for both directors and reflectors are the same in this antenna.

Selective Tuning. If you are interested in receiving a better signal on channel 3, for example, a piece of plastic pipe 92 inches long would be used to support a small wire of the same length, which becomes the reflector. This parasitic element is placed 29 inches behind dipole element 1 (the back dipole element). The wire is not cut at the center on the reflector or directors. A plastic pipe about 83½ inches long, and a wire the same length, become a director and is placed 29 inches in front of dipole element number 4 (the front dipole element).

Now you are ready to attach the elements to the wood beam. The simplest way of fastening them to the wood is to use ½-inch electrical conduit straps and small bolts and flat washers. The reflector is mounted at the back of the beam (see Figure 5), the dipole elements are placed in front of the reflector about ten inches to one foot from each other and the director, or directors, are at the front.

On the under side of the beam, between elements 2 and 3 (This is the best point if one reflector and one director are used.) some gadget must be attached so that the beam can be fastened to the TV mast. One way of doing this is to use a 2-inch by 2-inch block of wood through which holes have been bored to receive a TV mast U-clamp. Large flat washers must be used with the U-clamp if this method is followed. It is well to paint the wood beam for protection from the weather.

Phasing. Wire the dipole elements together with small size insulated wire, being careful to cross the wires between elements as shown in Figure 4. It is necessary to do this so that the dipole elements are out of phase with each other. The 300-ohm twinlead, or a

(Continued on page 88)

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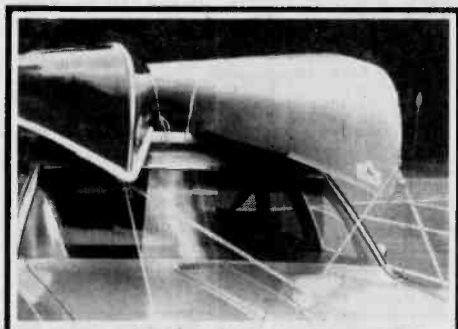

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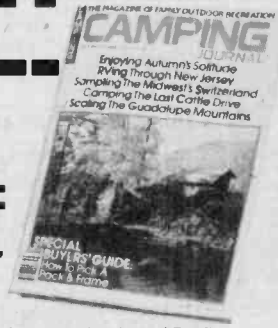

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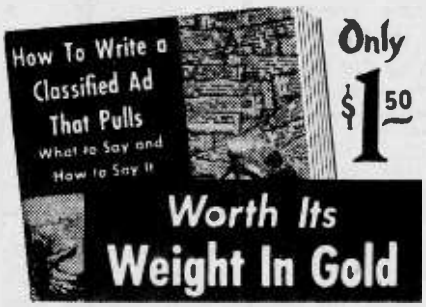

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Classified Continued

Bargain Beams

(Continued from page 84)

coax transformer, are attached to the front dipole element (element 4). Solder all joints.

When stations are being received from different directions, more than one antenna is usually required because these antennas are so directional. There is then the question of how to feed the signal from two different antennas to one receiver. Connecting the two antennas directly together doesn't work well because so many different frequencies are involved and a length of twinlead that will work well for one channel usually will not work well for some others.

A simple way to handle the problem is to use two twinleads and switch antennas at the back of the TV set, using a DPDT switch of some kind.

By accident the author discovered a way in which the two antennas may be tied together. At least the method works well with the two prototype antennas. The 300 ohm twinlead from the top antenna is brought down to the front dipole element of the lower antenna and wrapped three times around the element at its center. The twinlead then goes on into the house where it is connected to the TV set. The twinlead from the lower antenna follows the other twinlead down the mast and the two twinleads are taped flat against each other for several feet—eight feet in this case.

If these construction details sound complicated don't let it worry you. The antenna is really quite simple to build, and it works well. ■

Ham Contest

(Continued from page 64)

the pertinent information being transmitted. This can consist of: The RS(T) report, the contact serial number (increasing with the number of stations worked), the ARRL section (check to see which one you live in), the state, the country, and the global zone (again, check to make sure of which one you live in).

Most contests usually require only two or three of the above elements, and if you cannot find out in advance which ones will be needed, simply listen for a while to some of the other operators in the contest before going on the air. The worst that can happen is that you'll all be equally wrong, thereby hurting nobody's feelings.

Getting in on the Fun. If you opt to participate, you should be aware that most of the larger contests require preprinted entry/log forms. The usual exceptions to this rule are the state/district QSO parties.

Specific rules, start and stop times, and approximate frequencies to be used should be determined ahead of time. Most of the major Amateur Radio magazines carry contest information

Conclusion. Granted that contests are not for everybody, you will never find out if you don't try at least a couple. Two good starters are the ARRL's Novice contest, and the state/district QSO parties. The pressures are lower, the pace a bit more leisurely, and the chance to add more states and countries to your log is almost as good as in the larger contests. You don't have to win to have a lot of fun. ■

Kathi's CB Carousel

(Continued from page 59)

TRC-459. It's a well thought-out, notably easy-to-use computer. It is not loaded with complex, little used, or unneeded features just to impress you

First Class Unit. As for performance, strictly first-class all the way. Receiver sensitivity measured 0.4 uV for 10 dB S+N/N. Adjacent channel rejection measured 65 dB. SSB opposite sideband rejection was a touch under 50 dB, and the AGC action was an amazing 3 dB. You can have the volume control cranked wide open to dig a weak signal out of the noise, and if a local opens up across the street she won't sound much louder. A really great AGC. The S-meter is "Scotch"; it takes 150 uV for an S-9 meter reading; but then, the S-meter reading has absolutely no bearing on performnace. It just means you won't be giving every flea-power signal a "40 dB over S9" report.

The transmitter delivered exactly 4 watts AM output and 12 P.E.P. watts SSB. Modulation limiting was the *umax* (not clipped—low distortion) type. The microphone sensitivity for 85% modulation was —48 dB, and the modulation was clean. Almost every station I worked commented on the crisp, clean sound.

Summing Up. As far as I am concerned the Realistic TRC-459 ranks as one of the outstanding modern transceivers. It might very well become one of the legendary models. It will be interesting to see how Radio Shack will improve upon this one on future years.

For more information on the Realistic TRC-459 circle No. 32 on the reader service coupon ■

LITERATURE LIBRARY

389. You can't buy a bargain unless you know about it! *Fair Radio Sales'* latest electronics surplus catalog is packed with government and commercial buys.

388. SWLs need Gilfer's Shortwave Mail Order Catalog for economy one-stop armchair shopping. From From top-notch rigs to reporting pads, Gilfer supplies all your hobby needs.

372. *Olson* continues to amaze hobbyists with their jammed packed 48-page newspaper catalog. It's a bargain buyer's bonanza.

327. *Avanti's* new brochure compares the quality difference between an Avanti Racer 27 base loaded mobile antenna and a typical imported base loaded antenna.

362. A new catalog crunched full of military, commercial and industrial surplus electronics for every hobbyist is offered by *B&F Industries*. 44 pages of bargains you've got to see!

366. *Poly Paks* penny sale is a project builder's dream. 24-page free cataog ets you do the shopping at home.

384. The entire ine of *B&K Precision* test instruments comes in a condensed catalog. Scopes, testers, counters, generators, etc., for every hobbyist's bench are illustrated.

310. *NCE (Newman Computer Exchange)* has just issued their Spring/Summer 1979 "Mini-Micro" catalog, and it's full of hard-to-find equipment. Money-saving offers are listed on such items as all Data General and LSI-11 equipment.

322. A new 20-page, full-color TRS-80 Microcomputer Catalog has just been issued by *Radio Shack*. The catalog includes complete, current information on the TRS-80 Microcomputer, its peripherals and accessories with plain-language descriptions, application ideas and detailed specifications.

386. If you're lookng for books on computers, calculators, and games, then get *BITS, Inc* catalog. It includes novel items.

335. The latest edition of the *TAB BOOKS* catalog describes over 450 books on CB, electronics, broadcasting, do-it-yourself, hobby, radio, TV, hi-fi, and CB and TV servicing.

338. "Break Break," a booklet which came into existence at the request of hundreds of CBers, contains real life stories of incidents taking place on America's highways and byways. Compiled by the *Shakespeare Company*, it is available on a first come, first serve basis.

345. For CBers from *Hy-Gain Electronics Corp.* there is a 50-page, 4-color catalog (base, mobile and marine transceivers, antennas, and accessories). Colorful literature illustrating two models of monitor-scanners is also available.

393. A brand new 60-page catalog listing Simpson Electric Company's complete line of stock analog and digital panel meters, meter relays, controllers and test instruments has just come out. Other new products are listed also.

385. Amateur Radio buffs and beginners will want the latest *Ham Radio Communications Bookstore* catalog. It's packed with items you should be reading today!

373. 48-page "Electronic Things and Ideas Book" from ETCO has the gadgets and goodies not found in stores and elsewhere.

382. Buys by the dozens in *Long's Electronics* super "Ham Radio Buyer's Guide." Good reading if you're in the market for a complete station or spare fuses.

383. If you're a radio communicator, either ham, SWL, scanner buff or CBer, you'll want a copy of *Harrison Radio's* "Communications Catalog 1979." Just what the shack book shelf needs.

380. If your projects call for transistors and FETS, linear and digital ICs, or special solid-state parts, then look into *Adva Electronics'* mini-catalog for rock bottom prices.

301. Get into the swing of microcomputer and microprocessor technology with *CREI's* new Program 680. New 56 page catalog describes all programs of electronics advancement.

302. Giant savings are what *Burstein Applebee* has in store in their latest mail order catalog. Everything from CB test equipment to name brand audio wares are advertised. Telephone accessories and pocket calculators too!

305. A new 4-page directional beam CB antenna brochure is available from *Shakespeare*. Gives complete specs and polarization radiation patterns for their new fiberglass directional antennas.

371. Your computer system needn't cost a fortune. *Southwest Technical Products* offers their 6800 computer complete at $395 with features that cost you extra with many other systems. Peripheral bargains are included here.

374. *Radatron's* Catalog 1006 lists many projects from a self-contained portable lab station for an electricity-electronics course to many texts, lab manuals, and applied activities.

306. *Antenna Specialists* has a new 32-page CB and monitor antenna catalog, a new amateur antenna catalog, and a complete accessory catalog.

307. *Atlas* calls their 210X and 215X the perfect amateur mobile rigs. Their 6-page, full-color detailed spec sheet tells all. Yours for the asking.

330. There are nearly 400 electronics kits in *Heath's* new catalog. Virtually every do-it-yourself interest is included—TV, radios, stereo and 4-channel, hi-fi, hobby computers, etc.

392. The opening of the new Software of the Month Club has been announced by *Creative Discount Software*, which is giving out membership enrollment applications now. The Club plans to have separate branches for users of the Apple II, TRS-80, Ohio Scientific, Exity, Pet and CP/M based systems.

312. *E.D.I. (Electronic Distributors, Inc.)* carries everything from semi-conductors to transformer/relays to video cameras. In prices ranging from 19¢ to $500, products appear from over 125 electronic parts manufacturers. The catalog is updated 3 times a year.

313. Get all the facts on *Progressive Edu-Kits* Home Radio Course. Build 20 radios and electronic circuits; parts, tools, and instructions included.

390. *Whitehouse & Co.*, your "hard to find parts specialist," offers over a dozen parts and kits in their latest catalogue, featuring an entire section on gunnplexers for Amaeur Radio buffs.

318. *GC Electronics* offers an "Electronic Chemical Handbook" for engineers and technicians, It is a "problem solver" with detailed descriptions, uses and applications of 160 chemicals compiled for electronic production and packaging. They are used for all types of electronic equipment.

320. *Edmund Scientific's* new catalog contains over 4500 products that embrace many sciences and fields.

321. *Cornell Electronics'* "Imperial Thrift Tag Sale" Catalog features TV and radio tubes. You can also find almost anything in electronics.

328. If you are into audio, ham radio, project building, telephones, CB or any electronics hobby you'll want *McGee's* latest catalog of parts and gadgets. Hard to find parts fill each page, so get a copy of the catalog from *McGee* today!

329. *Semiconductor Supermart* is a new 1979 catalog listing project builders' parts, popular CB gear, and test equipment. It features semiconductors—all from *Circuit Specialists*.

333. Get the new free catalog from *Howard W. Sams*. It describes 100's of books for hobbyists and technicians—books on projects, basic electronics and related subjects.

354. A government FCC License can help you qualify for a career in electronics. Send for Information from *Cleveland Institute of Electronics*.

355. New for CBers from *Anixter-Mark* is a colorful 4-page brochure detailing their line of base station and mobile antennas, including 6 models of the famous Mark Heliwhip.

391. A new software products catalog for the Apple II Computer has just been issued by *Charles Mann & Associates*. The booklet contains business accounting, accounts receivable, inventory, BASIC teaching and other special purpose business applications.

359. *Electronics Book Club* has literature on how to get up to 3 electronics books (retailing at $58.70) for only 99 cents each . . . plus a sample Club News package.

364. If you're a component buyer or specifier, you'll want this catalog of surplus bargains: industrial, military, and commercial electronic parts, all from *Allied Action*.

365. *Electronic Supermarket* has a new catalog of almost everything in the field—transformers, semiconductors, tv parts, stereos, speakers, P.C. boards, phones, wire and cable, tools, motors.

375. *Compucolor Corp.* has a personal computer system with an 8-color integral display, a typewriter-like keyboard, and a mass storage device. Programs are ideal for checkbook and income tax figuring.

377. We can't enumerate all the products in *John Meshna, Jr.'s* catalog of surplus electronic parts: power supplies; computer keyboards; kits for alarms, clocks, speakers; and more.

378. *Delta Electronics* is a complete parts source for electronics experimenters. Discrete parts, modules, boards, subassemblies and complete gadgets. Get *Delta's* 120-page catalog today.

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Got a question or a problem with a project—ask Hank! Please remember that Hank's column is limited to answering specific electronic project questions that you send to him. Personal replies cannot be made. Sorry, he isn't offering a circuit design service. Write to:

Hank Scott, Workshop Editor
ELEMENTARY ELECTRONICS
380 Lexington Avenue
New York, NY 10017

Holds Tight

What is capture effect? A local car-audio salesman used the term, and when I asked him to explain, he said, "You know." Hank, I don't!

—K. M., North Canton, OH

An FM receiver can minimize the effect of a weak station operating on or near the frequency of a strong station. This is called capture effect! The capture effect causes the receiver to lock on the stronger signal by suppressing the weaker, but can fluctuate back and forth. When the two are of nearly equal strength, the receiver alternates abruptly back and forth between them. This rare instance usually happens in a travelling car as it passes from one city to another.

LED Drive Update

A while back I generalized by saying that LED devices available to hobbyists draw 20 mA under normal operating conditions. Well, close is not good enough. The table below lists various TTL and CMOS logic circuits and their maximum designed drive capability for interfacing with LED lamps.

Product	Description	Drive Current
74 Series	TTL gates	16 mA
74H Series	TTL high-speed gates	20 mA
74S Series	TTL Schottky gates	20 mA
74LS Series	TTL low-power Schottky gates	8 mA
74L Series	TTL low-power gates	3.6 mA
4049,4009	CMOS inverting buffer	3.mA
4050,4010	CMOS non-inverting buffer	3 mA
74C906	CMOS inverting buffer	8 mA
74C901/02	CMOS buffer	3.4 mA

The Decades Are Coming

I read in an equipment spec sheet that "the frequency rolloff was —20 dB per decade." What does it mean?

—J.N., Salt Lake City, UT

Rolloff indicates a drop in output as frequency increases (or decreases). In this case, the manufacturer chose to say that the drop measured was by decades; simply, the decades following 100 Hertz would be 1 kHz, 10 kHz, 100 kHz, etc. Other manufacturers prefer to give rolloff in octaves; at 800 Hertz the octaves would be 8 kHz, 16 kHz, 32 kHz, etc. If the rolloff in a particular circuit was —6 dB per octave, this would be equivalent to —20 dB per decade. Look to an eventual switch to decade vs. octave use in specifying circuit performance in non-audio equipment.

Catch the Bus

I don't see how a bus in a computer can send and receive signals.

—C. M., Denver, CO

A bus is a length of wire or copper strip. It can't do anything except sit there and conduct electrons through it. Actually, a bus is an electrical path over which digital (pulse) information is transferred, from any of several sources to any of several destinations. As common sense would have it, only one transfer of information can take place at any one time. While such transfer is taking place, all other sources that are connected to the bus must be shut down. As many receivers as necessary may be connected to the bus. For example, a CPU program can be "listed" on the video monitor as it is being "dumped" into a cassette.

TV to Ham

I see many 300-ohm twin lead antenna wire ½-wave antennas used for FM-broadcast reception. Can the same be used to QRP on 40 to 10 meters?

—D. E., Butte, MT

Good idea for low power or emergency antenna. The table below gives the overall length of the ribbon twin lead. Both ends must be spliced together and soldered. The feeder (also twin lead of any length) should be connected at the center of the antenna to one of the leads that is cut apart.

Meters	Halfwave length at midband (inches)
40	56'5"
20	28'6"
15	19'0"
10	14'0"

Starter CPU

I want to learn about microcomputers, but I want to do it from the ground up. I know BASIC very well, but I want to get down to "machine language" and start at the beginning. What chip should I start with?

—A. K., Austin, TX

This is a personal choice which some may disagree with. I'd select the 6800 chip. There are about 150 op codes, or machine instructions, to learn. Also, there are several good learning kits on the market and many good text books on the 6800 CPU. I suggest you pick up a copy of *Using the 6800 Microprocessor* by Elmer Poe, published by Howard W. Sams & Co., Inc., 4300 West 62nd St., Indianapolis, IN 46268. The book sells for $6.95. Start there and you're launched.

Help Wanted

In many cases, readers are reluctant to part with manuals, schematic diagrams or literature on equipment they own. Hank suggests that you send a post card to the person in need offering to send copies of the literature or diagrams. Quote the price necessary to do this. For example, my library has a copier that makes 8½ x 11 copies for only 9 cents per page. Actually, I get my copies from my local insurance agent at no cost as long as I don't make a hog of myself. When you get the go-ahead and check on the return mail, make the copies quickly and post them at once. Be a nice guy, and when you need help (like one of the listings below), some friend will lend a helping hand.

Δ Paco (Precision Apparatus) RF signal generator, Model G-30; needs schematic diagram and/or manual; Henry M. Cantor, 21 Friendly Ct., Babylon, NY 11702.

Δ Universal 224-M 23-channel SSB CB transceiver; needs schematic diagram; Carl Clarkston, 2-989 Wollaston St., Victoria, B.C., Canada V9A-5B1.

Δ Advance OS-15 oscilloscope made in England; schematic diagram and instruction manual urgently requested; Henry Milowski, 224½ King St., Welland, Ontario, Canada L3B-3J7.

Δ Knight Safari I; needs old unit for parts salvage; Robert Grandy, Lot 51, 300 W. Linda Vista, Roswell, NM 88201.

Δ Philco Model 37-602 AM receiver; needs schematic diagram; Henry M. Cantor, 21 Friendly Court, Babylon, NY 11702.

Δ Paco RC Bridge, Model C-20; needs schematic diagram; E. M. McBride, 604 W. Troup St., Valdosta, GA 31601.

Δ RCA Volt Ohmyst (VTVM); needs schematic diagram (possibly from 1950's RCA tube manual); Theodore R. Walker, 1753 Kettering Rd., Alco, TN 37701.

Δ Hallicrafters SX-25, schematic diagram and alignment instructions; Roy Kingsland, 5570 Foothill Rd., Rocklin, CA 95677. (Roy helped out H. D. Scoreghl who asked for help in the Jan./Feb. 1979 issue of ELEMENTARY ELECTRONICS).

Δ RCA VOM kit, Model 54/055, part no. 12650; need schematic diagram to identify value of burned-out resistor; Steve R. Young, 10,000 #2 Road, Richmond, B.C., Canada (Sorry, no Canadian Zip number given).

Δ Zenith—the Fisher—Model 500; needs owner's manual; Wes Robertson, Rt. 3, Box 383, Bogalusa, LA 70427.

Δ Symphonette Model LCR500 FM/AM radio; needs schematic diagram; G. Kussner, 215 2nd Isle No., Port Richey, FL (no zip given). ■

Lab Test Elementary Electronics For Yourself

Get switched on

elementary Electronics

In case you're not all that familiar with us, we're *not* a publication for electrical engineers and other wizards. *No way.* ELEMENTARY ELECTRONICS is expressly for people who like to build their own projects and gadgets—and maybe get a little knee-deep in tape, solder and wire clippings in the process.

In fact, we have a sneaking suspicion that our readers like us because they think we're just as bug-eyed and downright crazy over great new project ideas as they are. And I guess they're right!

E/E thinks of you who dig electronics as the last of a special breed. It's more than just the "do-it-yourself" angle—it's also the spirit of *adventure*. In this prepackaged, deodorized world, building your own stereo system, shortwave receiver, darkroom timer or CB outfit is like constructing a fine-tuned little universe all your own. And when it all works perfectly—it really takes you to another world.

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Ever hanker to build a sharp-looking digital clock radio? Or to hook up an electronic game to your TV? Or an easy-to-build photometer that makes perfect picture enlargements? Or a space-age Lite-Com so you and the family can talk to each other on a light beam? We've got it all to get you started.

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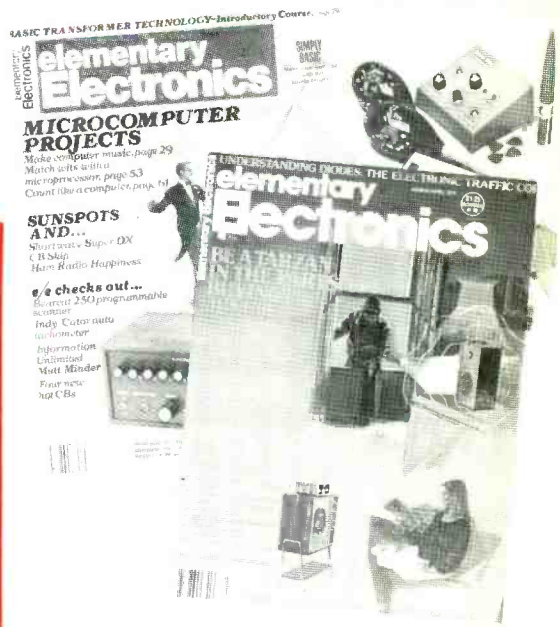

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In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio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

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FROM OUR MAIL BAG

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

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

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