CONVERT A SCANNER TO THE CB CHANNELS

Elementary Electronics

02342

JANUARY-FEBRUARY
1977
$1.00

elementary Electronics

FOR BEGINNERS
UNDERSTANDING OSCILLOSCOPES
OUR BASIC COURSE

FIRST 40-CHANNEL CB TRANSCEIVER LAB TEST REPORT

FACTS ON CB ANTENNAS – Can they handle the full 40?

Ping Pong is King Kong

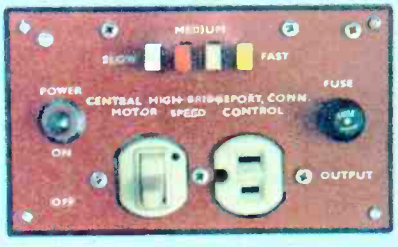
e/e checks out a low-cost video game kit

Power Up Your Antique Radio

Build an Inexpensive Battery Eliminator

A DAVIS PUBLICATION

Programmable electronic chimes kit by Heathkit lets you play any tune up to 16 notes

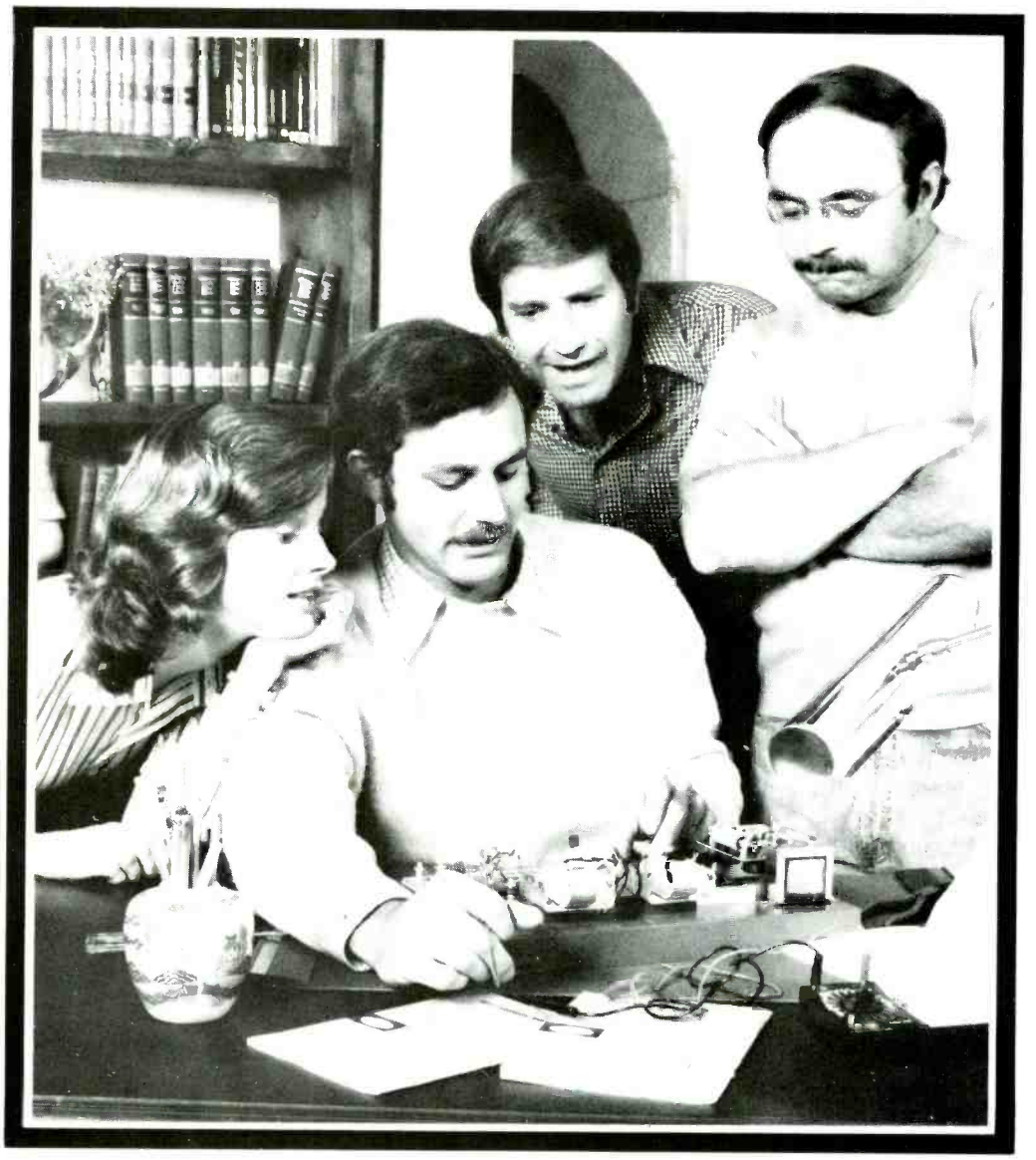


Select-A-Speed motor control—a classroom project anyone can build

Become a CB service maven with B&K's CB Servicemaster

Herb Laney's a tough-minded optimist. How about you?

Herb takes his future seriously. Without worrying about it. He knows his CIE training is giving him valuable skills in electronics. Skills a lot of people will be glad to pay for. And that's good reason for all the optimism in the world. How about you?



Learning new skills isn't something you just breeze through. Especially in electronics. You've got to really *want* success if you're going to build your skills properly.

Herb knew that right from the start. But he also knew what rewards he could earn if he took some time and did it right. He knew that, in today's world, people who really *know* electronics find a lot of other people . . . even whole industries . . . looking for their help.

How about you? How much do you want that thrilling feeling of success . . . of being in demand? Enough to work for it?

Why it pays to build skills and know-how.

One of the things that got Herb interested in electronics is that electronics seems to be something just about *everybody* needs. Almost everywhere you look these days—in a business office . . . a manufacturing plant . . . a department store . . . a doctor's office . . . a college . . . even your own home you'll find all kinds of electronic devices.

That spelled "opportunity" to Herb. Plus he liked the idea of having a set of skills that might lead to jobs in places as different as a TV station . . . a hospital . . . an airport . . . a petroleum refinery.

But what Herb liked *most* about electronics is that it's just plain *interesting*. Even though it takes time and effort to learn, the subject is so fascinating it *almost* doesn't seem like "studying" at all!

How CIE keeps you interested.

CIE's unique study methods do a lot to *keep* you interested. Since electronics starts with ideas . . . with principles . . . CIE's Auto-programmed™ Lessons help you get the idea—at your own most comfortable pace. They break the subject into bite-size chunks so you explore each principle, step by step, until you understand it thoroughly and completely. *Then* you start to use it.

How CIE helps you turn ideas into reality.

Depending on the program you choose, CIE helps you apply the principles you learn in a number of different ways.

If you're a beginner, you'll likely start with CIE's Experimental Electronics Laboratory. With this fascinating workbench lab, you actually perform over 200 experiments to help you grasp the basics! Plus you use a 3-in-1 precision Multimeter to learn testing, checking, and analyzing.

In some programs, you build your own 5MHz triggered-sweep, solid-state oscilloscope—and learn how to "read" waveform patterns . . . how to "lock them in" for closer study . . . how to understand and interpret what they tell you.

To help you develop practical, skill-building knowledge you then receive a Zenith 19" diagonal

solid-state color TV featuring nine removable modules. You learn how to trace signal flow . . . how to detect and locate malfunctions . . . how to restore perfect operating standards.

What to do first.

Get all the facts. Send for CIE's FREE school catalog and career information package TODAY. Check *all* the CIE programs—and see which one's right for you. Do it now.

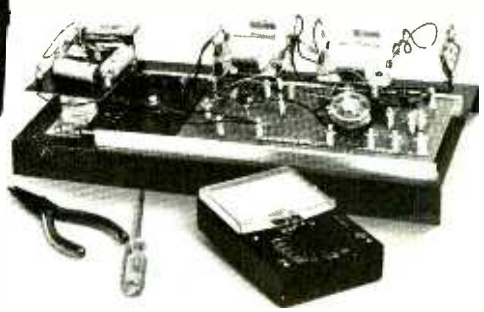
Why it's important to get your FCC License.

More than half of CIE's courses prepare you for the FCC License exam. In fact, based on continuing surveys, better than 4 out of 5 CIE graduates who take the exam get their License!

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

Free catalog!

Mail the card. If it's gone, cut out and mail the coupon. If you prefer to write, mention the name of this magazine. We'll send you a copy of CIE's FREE school catalog—plus a complete package of independent home study information! For your convenience, we'll try to have a representative call to help you with course selection. Mail the card or coupon . . . or write: CIE, 1776 East 17th Street, Cleveland, Ohio 44114.



CIE **Cleveland Institute of Electronics, Inc.**
1776 East 17th Street, Cleveland, Ohio 44114
Accredited Member National Home Study Council

☐ **YES . . .** I want to succeed in electronics. Send me my FREE CIE school catalog—including details about all electronics courses—plus my FREE package of home study information! EL-77

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CITY _____
STATE _____ ZIP _____
AGE _____ PHONE (area code) _____

Check box for G.I. Bill information: ☐ Veteran ☐ Active Duty

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ELEMENTARY ELECTRONICS (Vol. 17, No. 1) is published bimonthly by Davis Publications, Inc., at 229 Park Ave. So., New York, N.Y. 10003. One year subscription (six issues)—$6.50. Second-class postage paid at New York, N.Y. 10003, and at additional mailing office.

elementary electronics

January/February 1977
Volume 17, No. 1

Dedicated to America's Electronics Hobbyists—Including Electronics Digest®

Illustration by Ron Macarthy

AUTHORS IN THIS ISSUE

Christine Begole, Electronic Assembly Class of Central High School, Bridgeport, CT, Herb Friedman, Jim Fred, James A. Gupton, Jr., Don Jensen, Kathi Martin, Norm Myers, C. M. Stanbury, II, and the ELEMENTARY ELECTRONICS Editorial Staff.

Experience is the best teacher. You might settle for any CB first time around. Understandably. A lot of people think they're all pretty much alike. But you'll soon discover that, like everything else, there are exceptions.

Ask the pros. America's long distance truckers. These guys talk CB day in and day out. And they demand the best. That's why truckers refer to the Cobra 29 as "The Diesel Mobile."

Listen to Cobra. You'll hear a big difference. Because the Cobra 29 gives you features which assure crystal clear reception. Like switchable noise limiting and blanking, to cut out practically all pulse and ignition interference. Add squelch control and RF gain and you've got exceptional—adjustable—receiver clarity. Even in the heaviest CB traffic. You also get Delta Tuning which makes up for the other guy, because even off-frequency transmitters are pulled in. Perfectly.

Talk to Cobra. And you know you're punching through. One glance at the 29's over-sized illuminated meter tells you just how much power you're punching out and pulling in. For voice modulation the DynaMike delivers at 100%. Same way with power: The 29 transmits at maximum power levels.

Sooner or later you'll get a Cobra. And you'll get engineering and craftsmanship second to none. Performance that will make your first CB seem obsolete. Reliability and durability that have set standards for the industry. Above all, you'll get power. The power to punch through loud and clear like nothing else. Because when it comes to CB radio, nothing punches through loud and clear like a Cobra

Cobra

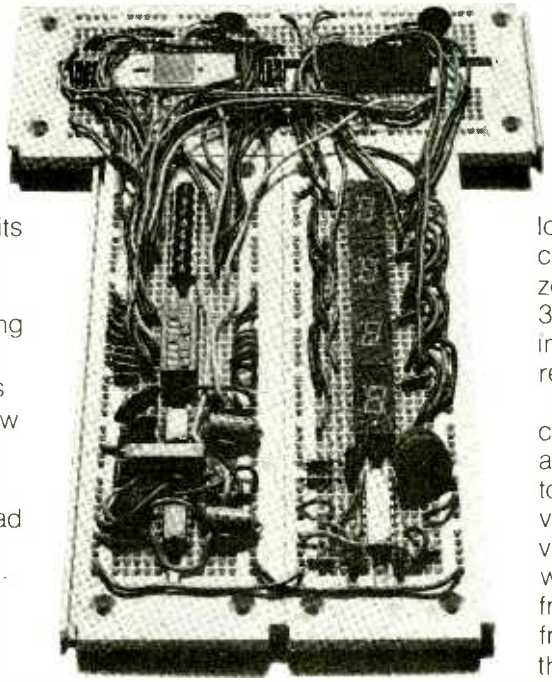
Punches through loud and clear.

Cobra Communications, Products of Dynascan Corp.
1801 W. Belle Plaine, Chicago, Illinois 60613

CIRCLE 25 ON READER SERVICE COUPON

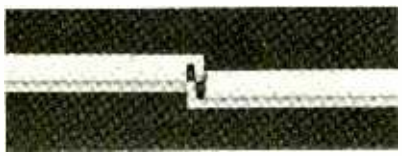
IF YOUR FIRST CB ISN'T A COBRA YOUR SECOND ONE WILL BE.

ANNOUNCING THE FIRST NEW BREAKTHROUGHS IN SOLDERLESS BREADBOARDING



Whether you design or build circuits for fun or for profit, you owe it to yourself to discover how fast and easy CSC solderless breadboarding can be. Now, more than ever. Because of three new breakthroughs in breadboard design. And our new EXPERIMENTOR™ sockets** that make the most of them.

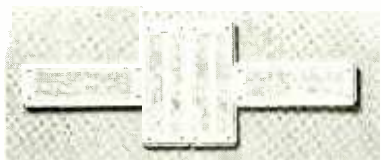
1. Price Who says a quality bread board has to be expensive? For as little as $9.95, CSC's EXPERIMENTOR sockets let you design, assemble and modify circuits as fast as you can push in—or pull out—component leads. On a rugged one-piece socket with 550 solderless tie-points (94 five-point terminals *and* two 40-point bus strips).



Sockets lock together, snap apart to handle any size circuit with ease.

But don't let the low price fool you: EXPERIMENTOR sockets are precision-molded of durable, abrasion-resistant material, and feature CSC's non-corrosive, prestressed nickel-silver contacts for positive connections and longer life. All contacts are identified, too...with molded-in designations for easier circuit assembly and diagramming.

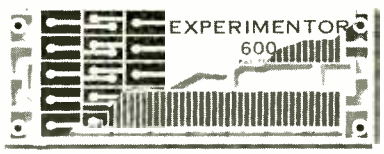
2. Compatibility CSC EXPERIMENTOR sockets end the "big-chip blues." They're the only ones with full fan-out capabilities for microprocessors and other larger DIP's, as well as 4-16-pin units. EXPERIMENTOR 600's 6/10" center is ideal for microprocessor's, clock chips, RAM's, ROM's, PROM's, etc. While EXPERIMENTOR 300's smaller 3/10" center is perfect for smaller DIP's. Both units, of course, accept transistors, LED's, resistors, capacitors, pot's—virtually all types of components with plug-in ease. As well as #22-30 solid hook-up wire for interconnections. Eliminating heat and lead damage to expensive components. And saving you more money, on parts.



Mix or match both models; arrange them vertically or horizontally.

3. Flexibility With CSC EXPERIMENTOR sockets, you can arrange your breadboard to suit your circuit...instead of vice versa. An exclusive snap-together interlocking system lets you instantly connect them. Vertically or horizontally. So you can mix or match 3/10 and 6/10" centers...expanding or contracting to meet your requirements.

CSC EXPERIMENTOR sockets can be used alone, or mounted on any convenient flat surface, thanks to molded-in mounting holes and vinyl insulation backing that prevents shorts. You can mount them with 4-40 flat-head screws from the front, or 6-32 self-tapping screws, from the rear. But however you use them, EXPERIMENTOR sockets are an unbeatable way to build and test twice the projects in half the time.



Both models feature 94 five-point terminals (vertical lines) and two 48-point bus strips (one strip shown).

WHY WAIT? CSC EXPERIMENTOR sockets are available now from your CSC dealer, or by phone from CSC, at $9.95* for the 300 and $10.95* for the 600. Call 203-624-3103 (East Coast) or 415-421-8872 (West Coast)—major credit cards are accepted.

*Manufacturer's suggested list price
Prices subject to change without notice
U S Pat No D235 554

CONTINENTAL SPECIALTIES CORPORATION

44 Kendall Street, Box 1942, New Haven CT 06509
203-624-3103/TWX 710-465-1227
West Coast office Box 7809 San Francisco CA 94119
415-421-8872/TWX 910 372 7992

CIRCLE 20 ON READER SERVICE COUPON

THE STAFF

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Another Heathkit Color TV breakthrough...

There's never been a Color TV System like this before.

A Bold New Concept In TV

The new GR-2001 TV system is the most sophisticated, best performing color TV kit we've ever designed, but it is also much more. It is the heart of a total home viewing system — a Computer TV!

Complete Programming Capability

With its optional Programmer, this Computer TV system allows you to program your set for an entire evening's viewing. The top bank of 8 keys [1] accesses the static NMOS RAM and turns the on-screen clock display into a computer CRT readout which allows you to see your "program" as you enter it through the bank of 12 keys below the programmer panel. The selected time appears in the first four digits of the clock display, the channel number appears in the last two. First, enter the time at which you want the set to change channels. Next, enter the channel number you want. Then the memory takes over. While you sit back and relax, the Programmer automatically changes to the right channel at the right time. You can program up to 32 channel changes within two 12/24-hour periods!

Those two programming periods add extra versatility. Program the first for your daytime viewing schedule, the second for evening shows. Or, program the first for week nights, the second for weekends. You can even preselect the programs young children can watch — once the programmer is engaged, the manual keyboard is disconnected and can only be reactivated by the remote control or by pressing the correct button on the programming panel.

You can even program the set to return to manual operation at a preselected time, then resume automatic operation at another time. When the last program you want to see is over, the set can be programmed to switch to an empty channel. This will cause the screen to go blank and the on-screen readout to flash on and off indicating that it is time to turn the system off with the front panel pushbutton or optional remote control.

Convenient Remote Control

The optional wireless remote control [2] lets you adjust volume, turn the set on or off, adjust tint, activate the digital readout, scan up or down through the preselected channels, and turn the optional programmer on and off — all at the touch of a button. This wireless remote control has improved circuitry for greater range and reliability and is the best we've ever offered.

Random Access Tuning

The 3 x 4 keyboard [3] lets you instantly choose any of up to 16 preselected stations — up to 24 with the optional eight channel accessory. Switch from VHF to UHF, up or down, in any sequence, and be tuned in instantly without switching through empty channels. Up and down buttons on the keyboard also let you scan all the preselected stations.

Automatic Antenna Rotor Control

A Heathkit exclusive! With the optional antenna rotor control [4], you can program the GR-2001 to automatically rotate your outdoor antenna system as it changes from one channel to another, for optimum reception on every channel. No special knobs to turn, no buttons to push. You can select up to eight separate antenna headings with up to three stations per heading. It's perfect for areas where stations are in widely separated locations.

Superb Color and Sound

The TV set itself contains dozens of circuit refinements and improvements designed to give you the best picture and performance you've ever seen. The Automatic Gain Control circuit, for example, has been significantly improved to better resist airplane flutter. And since you build it yourself, you can be assured of a set that is free of mass production "glitches" that show up all too often in other sets now on the market. Other improvements are listed below.

Separate Audio IF Stage

The audio circuitry is probably the finest on any commercial set in the world. The sound signal has its own separate IF stage [5] to dramatically reduce the "buzz" caused by the picture carrier modulating the sound. You can hear the difference — especially if you use the output jack to connect the GR-2001 to your stereo system. The built-in wide-range speaker offers excellent fidelity as well. It's one of the first sets ever to give you real hi-fi sound from a TV!

Phase-Locked-Loop Horizontal and Vertical Hold Circuits

New phase-locked-loop horizontal and vertical oscillators [6] "lock-in" on any channel for a picture that's rock-steady and stable. There are no conventional vertical and horizontal hold controls because you never need them! There are no alignment problems either, so you get consistently excellent pictures year after year.

Black-Matrix Picture Tube

The GR-2001's 25″ (diagonal) ultra-rectangular picture tube [7] provides one of the brightest, sharpest pictures in the world. The tube is fully shielded to maintain outstanding color purity by eliminating stray magnetic fields.

Easy To Assemble

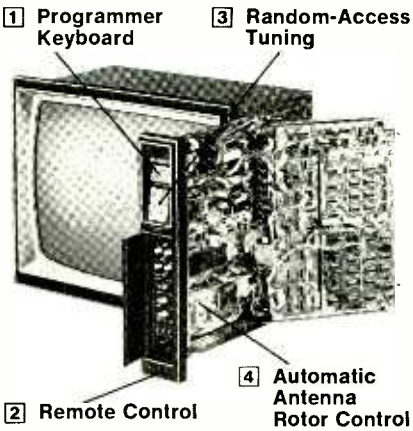
Though the GR-2001 is one of our more complex kits, the average person shouldn't have any difficulty in assembling it. A step-by-step illustrated manual will lead you through assembly right up to troubleshooting and testing. And if you do happen to need assistance, help is only a phone call away. A complete staff of Technical Consultants will answer all your questions. We won't let you down.

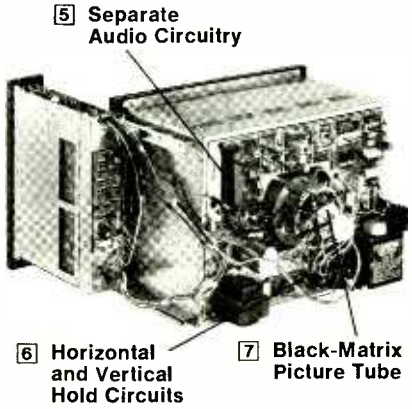
GR-2001 Specifications

Deflection: Magnetic 90°.
Focus: Electrostatic.
Convergence: Magnetic.
Antenna Input Impedance: VHF: 300Ω balanced or 75Ω unbalanced. UHF: 300Ω balanced.
Picture IF Carrier: 45.74 MHz.
Sound IF Carrier: 41.25 MHz.
Color IF Subcarrier: 42.17 MHz.
Sound IF Frequency: 4.5 MHz.
Video IF Bandwidth: 4.08 MHz at 6 dB down.
Hi-Fi Output: Frequency Response: ±1 dB, 50 Hz to 15 kHz.
Output Voltage: Greater than 1.0 V RMS.
Audio Output: 4Ω or 8Ω, 2 Watts.
Power Requirement: 110 to 130 Volts AC, 60 Hz, 200 Watts.
Kit Net Weight: 146 lbs.
GR-2001 TV kit alone (chassis, picture tube and one speaker): 699.95

Send for your FREE copy of our new catalog containing almost 400 fun and practical electronic kits.

Heath Company, Dept. 139-25
Benton Harbor, Michigan 49022





CIRCLE 1 ON READER SERVICE COUPON

the world's only computerized TV system.

some straight answers about Citizens Band

Q. How much should I spend for a good CB set?

A. Cost will vary dependent upon brand, model and features. For example, you can buy a Browning for as little as $140 or as much as $750. Your decision – whatever the brand – should be based upon your intended use.

Q. With so many brands from which to choose, how can you know you are making a wise decision?

A. The best course is to ask the advice of knowledgeable CBers – your personal "survey" will be well worth the effort.

Q. Where should I go to purchase a CB radio?

A. The CB specialty store is built on electronics know-how and able to give sound advice, installation, service and a wide selection of antennas and accessories.

Browning may not be your first set, but – when you do get serious about CB and begin to discover Browning's superior performance ... you'll begin to understand why CBers have relied upon the name Browning since Citizens Band began almost two decades ago.

See Browning's entire line of products at your nearby CB specialty store.

browning®
bringing people together

browning laboratories, incorporated, laconia, new hampshire 03246

CIRCLE 3 ON READER SERVICE COUPON

Hey, look me over

Showcase of New Products

New Telescope

There's nothing like it under the stars, say engineers at Edmund Scientific, Barrington, New Jersey. They're talking about Edmund's new portable 4¼-in. Newtonian richest field reflector telescope—a breakthrough in telescope design. Designed with a 3½-degree field of view, you will see more stars in a single view than with any other type telescope. It offers the clearest, brightest, most spectacular wide angle view of moon, stars, comets and galaxies you will ever see. It sells for $149.95. Here are additional features of the new 'scope: Pre-collimated and ready to use, 4¼-in. f/4 parabolic primary mirror, ⅛-wave diagonal is on coated optical window that seals optics from moisture and dust, standard 28mm Kellner eyepiece (gives 15X, higher with other eyepiece or Barlow), take it anywhere—it's portable, place it on the ground on a card table or hood of a car. Camera adapter assembly is available from Edmund. No internal adjustments are required to switch from eyepiece viewing to camera. For more information, write to Edmund Scientific, 380 Edscorp Bldg., Barrington, NJ 08007.

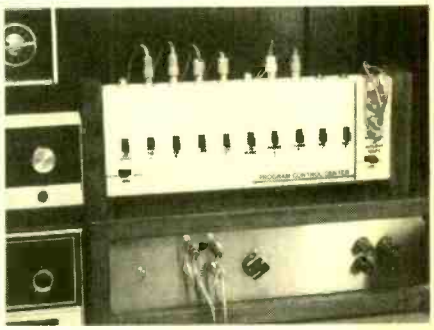
CIRCLE 70 ON READER SERVICE COUPON

Audio Program Control Center

The new Audio Program Control Center is an audio master control for connecting and switching all types of stereo and mono audio components to your tape recorder and Hi-Fi amplifier. With an Audio Program Control Center, your Hi-Fi system is instantly ready to tape record all the action.

You can now tape AM/FM, TV, Fire Police and Emergency, CB, Home Intercom Action, Amateur, Aircraft or Short-wave programs as you listen to them through your Hi-Fi system. Your friends will enjoy copying and swapping tapes and phono records with you. If you are a musician, you will enjoy making tapes of

(Continued on page 12)



CIRCLE 68 ON READER SERVICE COUPON

HEY, LOOK ME OVER

(Continued from page 11)

yourself while you sing or play with a pre-recorded instrumental background. Available at $19.95 postpaid from Powercom Corp., P.O. Box 454, Troy, NY 12181.

Autoranging Frequency Counters

A new autoranging frequency counter has been added to the test instrument line of Hickok Electrical Instrument Company. The new unit, designated the Model 380, is available with autoranging and autodecimal for "hands-off" operation. Large, bright 0.3-in. LED numerals make up the seven-digit display. Fast update is featured with 1.1 second update in **Auto** mode below 10 MHz and 5 second update in **Speed Read** mode or

CIRCLE 67 ON READER SERVICE COUPON

above 10 MHz. Users can use the 380 for communications repair, CB service, on-line audio, and TV. Model 380 is the basic autoranging counter with 80 MHz range. No overrange is required with seven digits and autoranging. The full frequency is displayed with 1 Hz resolution to 10 MHz. Above 10 MHz the decimal point shifts automatically and all digits except the least significant digit, are displayed. Provision is made for an external time base input on the rear panel. Standard time base stability is 10 ppm. Price is $259.00. For additional information on the Hickok 380 Frequency Counter or other Hickok test instruments, contact: Instrumentation & Controls Division, The Hickok Electrical Instrument Company, 10514 Dupont Avenue, Cleveland, OH 44108.

Solderless Breadboards

Before the era of modern solderless breadboards, designing and testing any given electronic circuit was an aggravating, tedious, time-consuming task. First a circuit would have to be designed on paper, then it would have to be translated into a circuit board parts layout for either point-to-point or printed circuit wiring. If a printed circuit were to be used, as was most often the case, the circuit layout would have to be transferred to a copper-clad board, the copper

(Continued on page 14)

LIVE IN THE WORLD OF TOMORROW... TODAY!

And our FREE 164 PAGE CATALOG is packed with exciting and unusual values in electronic, hobby and science items — plus 4,500 finds for fun, study or profit... for every member of the family.

A BETTER LIFE STARTS HERE

SUPER POWER FOR ANY AM RADIO

New antenna assist turns a tiny transistor into a tiger, has pulled in stations up to 1000* miles away! Just set beside radio (no wires, clips, grounding) and fine-tune Select-A-Tenna's dial to same frequency—"gangbusters"! Great for clearing weak signals in radio depressed areas, off-coast islands, crowded frequency stations. Solid state—uses no electricity, batts., tubes.

Stock No. 72,095EK **$19.95 Ppd.**

ULTRA SELECT-A-TENNA
No. 72,147 EK (*OVER 1000 MI.) **$24.95 Ppd.**

3000 MI. POWER FOR AM RADIOS

Remarkably Clearer Reception!

Get ball games from distant cities, your old home town, up to 3000 miles away (subject to local conditions). Deluxe Ultrasensitive AM Antenna pre-amplifies signal before it goes into your hi-fi AM receiver or tuner inputs. Nulls interference. Great for marginal AM reception areas! Shielded ferrite rod 6¾ lb. directional indoor antenna has 2-stage FET amplifier with frequency & sensitivity controls for precise selection, optimum reception. Easily atchd.; 110 VAC, 60 cycles.

No. 72,263EK (3⅜ x 9⅛ x 11") **$177.50 Ppd.**

PRO ELECTRONIC SOUND CATCHER

Parabolic mike w/ 18¾" reflecting shield & 2 I.C.'s in amplifier magnifies signals 100X that of omni-directional mikes. Catch a songbird ½ mile off; QB's huddle strategy; sounds never before heard. Super directivity gives highest signal to noise ratio poss. Safe: auto. cuts off ear damaging noises. Earphones, tape recorder output, tripod socket. Req. two 9v trans. batt. (not incl).

No. 1649EK (5½ LB.) **$299.00 Ppd.**

BIG EAR "TOY" MODEL #80,176EK **$ 36.25 Ppd.**

BUILD THIS COMPUTER, SAVE $27

Assembled, our amazing electronic digital computer is $45. New kit lets you build it for almost ⅓ that! Easy to program, fun to operate; solve problems, play games, try to outwit it. Program it, give it problems, get results from electronic readout. Quickly learn "what makes a computer tick," how to program, soon program w/ *your* problems, data. 14 x 15" unit has 3 movable registers, patch cords & plugs; 2 manuals, cards, dice. Req. 3 AA batts., soldering.

No. 72,105EK (HI-IMPACT PLASTIC) **$17.95 Ppd.**

NEW! THE UNIQUE EDMUND 4¼", f/4 NEWTONIAN RICHEST FIELD REFLECTOR TELESCOPE

Patent Pending

Clearest, brightest, most spectacular wide angle views of moon, stars, comets, galaxies ever—and portable! See heavenly wonders! Sets up in seconds (pre-collimated, ready to use). Pop the eyepiece in, focus—and zing! 3½° field of view gives you more stars in a single view than any other type 'scope! Bright, crisp, finely resolved images. For sky gazing and earth gazing! Take it anywhere (only 17", 10 lb.), easily use it over your shoulder (has adjustable carrying strap), in your lap, on a tripod; rotate the spherical base on its own mount for use on a table, car hood. Top quality optical system features 4¼", f/4 parabolic primary mirror (⅛ wave, 17" F.L.); std. 28mm Kellner eyepiece (15X). **No other telescope like it.** Great Christmas gift—it's even bright red!

No. 2001EK **$149.95 Ppd.**

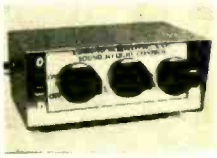
LOW COST PORTABLE INFRARED EYE

For Infrared crime detection surveillance, security system alignment, I.R. detection, laser checking, nite wildlife study, any work req. I.R. detection & conversion to visible spectrum. Self-cont. scope incls. I.R. light source (90' nite vision!), 6032 I.R. converter tube, f/3.5 telephoto lens, adjust. triplet eyepiece, auto lighter adapter. 1.6X, focuses 10' to inf.; 6, 12v DC. **Not avail. to CA res. exc. authd. pers./sci., educ.**

No. 1683EK (11 x 14¼ x 3") **$299.95 Ppd.**

BINOCULAR STYLE: AS ABOVE, BUT 2.5X
No. 1685EK (SUPER BRIGHT I.R. EYE) **$329.95 Ppd.**

SEE MUSIC IN PULSATING COLOR



New 3-Channel Color Organ adds to music listening pleasure, lets you modulate 3 independent strings of colored lamps with intensity of your music to create an audio "light show." They flash, vary in brightness related to music's rhythm, pitch, volume—pulsating lighting performance to music! Fully assembled & priced half that of others, the Edmund Sound To Light Control is a terrific value. Plug in, turn on!

No. 42,309EK (ASSEMBLED) **$17.95 Ppd.**

No. 42,336EK (UNASSEMBLED) **$14.95 Ppd.**

KNOW YOUR ALPHA FROM THETA!

For greater relaxation, concentration, monitor your Alpha/Theta brainwaves w/audible or visible signal on Biosone II. Has 3 feedback modes, outputs to monitor logic signal, filter sel. feedback, broad sensitivity control; other professional feats. of $200-up units. Easily operated 4-lb. portable has total brainwave monitoring capability! Req. 2 9v tr. batteries.

No. 1668EK (9½ x 5⅝ x 4¼") **$149.95 Ppd.**

LOW COST STARTERS' UNIT (PORTABLE)
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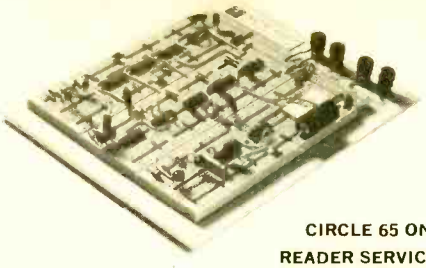
CIRCLE 11 ON READER SERVICE COUPON

HEY, LOOK ME OVER

(Continued from page 12)

selectively etched, holes drilled, and components soldered in place. Then, if a component proved the wrong value, it would have to be desoldered and a new one soldered in place. If the printed pattern were in error, a whole new board would have to be layed out, etched, drilled, filled and soldered. Then A P Products came up with the idea of arranging a breadboard with a matrix of interconnected holes. The interconnections are made by conductive spring clips that grip each component lead



CIRCLE 65 ON READER SERVICE COUPON

firmly to establish a good electrical connection without soldering. The matrix of holes was layed out in a tenth-inch spacing pattern to conform with standard component lead spacing. Circuit designing now becomes plug-in-easy. IC's and/or discrete components plug into the solderless breadboard and ordinary 22 gauge solid wire jumpers are used to interconnect them. A given circuit can now be prototyped in minutes rather than hours or days. Solderless breadboards and breadboarding aids come in many sizes and prices, capable of circuits as simple as you like or as complicated as a small computer. If you have questions about what solderless breadboards can do, how much they cost, or what's available contact A P Products at Box 110, 72 Corwin Drive, Painesville, OH 44077. A P Products has available a free catalog of their ACE ALL Circuit Evaluator solderless beradboards, Super Strips, Terminal and Distribution Strips, IC Test Clips and accessories.

In-Dash Entertainment Center

The outstanding J.I.L. 846 is an 8-track tape player and AM/FM-Stereo radio combination unit that will fit in-dash in virtually all cars. One of the unit's most popular features is the "5 or 5" tuning option. The '5 or 5' option lets the user set tuning buttons to 5 AM, 5 FM stations or a combination of both.

CIRCLE 63 ON READER SERVICE COUPON

Other outstanding features include a cartridge slot door that doubles as a radio dial, flipping out of the way when a cartridge is inserted; slide bar band selector; local/distance switch; channel selector and indicator lights; and front-to-rear fader control. AFC, MPX muting, volume, tone and balance controls are also provided. Model 846 has a handsome reversible faceplate (walnut grain/leather look) and adjustable shafts. The unit's dimensions are 2⅝-in. high x 5½-in. deep x 7¼-in. wide. Priced at $199.95. For further information on the 846 and the complete J.I.L. 8-track line, write to: J.I.L. Corporation of America, Dept. P., 737 W. Artesia Blvd., Compton, CA 90746.

Fully Automatic Car Alarm

Autoalarm is a sophisticated, fully automatic, electronic alarm system based on IC logic circuitry. The Autoalarm is connected to your auto's standard electrical system and is operated by simply turning your ignition key off. There is a special holding feature that permits you to unload packages, briefcases, etc. and only arms the system after all inputs are closed. The door switch circuits activate the alarm system and you have a nominal 8 second period in which to insert and turn the ignition key. The intruder cannot turn the system off, thus causing

(Continued on page 16)

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Now Includes
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YOU DON'T HAVE TO SPEND
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The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL.

You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis.

You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying instructional material.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the low price you pay. The Signal Tracer alone is worth more than the price of the kit.

THE KIT FOR EVERYONE

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

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

PROGRESSIVE TEACHING METHOD

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

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

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

THE "EDU-KIT" IS COMPLETE

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

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, 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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• SET OF TOOLS

- SOLDERING IRON
- ELECTRONICS TESTER
- PLIERS-CUTTERS
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- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING
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SERVICING LESSONS

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

FROM OUR MAIL BAG

J. Stataitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend $240 for a Course, but I found your ad and sent for your Kit."

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."

PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.

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Please rush me free literature describing the Progressive Radio-TV Course with Edu-Kits. No Salesman will call.

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CIRCLE 17 ON READER SERVICE COUPON

HEY, LOOK ME OVER

(Continued from page 14)

the horn to blow in insistent intermittent blasts. If the thief attempts to remove the CB Radio or other wired accessories, or by-passes the door circuits, he causes an immediate triggering of the alarm. When the alarm is set off, the horn will blast for 2 to 3 minutes and then stop

CIRCLE 66 ON READER SERVICE COUPON

and rearm itself to protect your auto from further intrusion. Additional protection may be extended to include items such as boat trailers, pick-up tool boxes, storage compartments, etc. with optional accessory switches. A special feature provides headlight protection by blowing your horn continuously if you leave the lights on, turn off the key and open the door to leave the car. Sells for $34.95. For further information, write to R.P.I., Inc., 13740 Midway Rd., Suite 509, Dallas, TX 75246.

Gold Plate Small Metal Objects

Chem Services Corporation in Colorado has a complete gold plating kit designed especially for the home. The kit comes with easy to follow instructions, all materials, including gold in chemical solution to gold plate objects. Everything is included except an inexpensive 6-volt

CIRCLE 64 ON READER SERVICE COUPON

lantern battery, available anywhere. Instructions are clear cut and easy to follow and right from the start it is possible to gold plate coins, jewelry, small tools, etc. professionally without previous experience. The complete price of the CSC 24K Gold Plating Kit is only $14.95 each plus $1.50 for postage and handling. Available from Chem Services Corporation, P.O. Box 1087, Manitou Springs, CO 80829.

Color/Bar-Pattern Generator

EICO's new Model 388 Color Generator delivers accurate signals for test and alignment of any color or black-and-white television receiver. By using an LSI integrated circuit chip, EICO was able to reduce the number of components formerly required and thereby increase the generator's reliability. The Model 388 provides the following displays, projected on channels 2, 3 or 4: Gated Rainbow Pattern for chrominence adjustment with ten standard color bars; single dot for static convergence adjustment; dot raster for final convergence, nonlinearity

CIRCLE 59 ON READER SERVICE COUPON

correction, pincushioning; single vertical line for horizontal centering; eight vertical lines for width and nonlinearity adjustments; single horizontal line for vertical centering; eight horizontal lines for height and nonlinearity adjustment; single crossbar for centering and positioning; and crosshatch pattern for final convergence, pincushioning and nonlinearity correction. The Model 388 operates from two standard 9-volt batteries or it can be used with rechargeable nickel-cadmium cells. Suggested user net it $99.95. For more information, write EICO Electronic Instrument Co., Inc., 283 Malta Street, Brooklyn, NY 11207.

Breakerless Electronic Ignition Kit

Introduction of a new optical type electronic breakerless ignition system, the Tiger I-b, for pre-1975 cars, has been annouced by Tri-Star. The sensor is equipped with an infra-red LED light emitting diode that "looks" at the cams on the distributor shaft, and switches the trigger unit at the proper instant. There are no moving parts in the system, according to a company spokesman. It is not necessary to remove the distributor

CIRCLE 62 ON READER SERVICE COUPON

shaft to install the unit. The solid state Tiger I-b unit is not affected by a loose distributor shaft or worn bearing that often cause irregular firing by mechanical, magnetic or reluctance type signal

(Continued on page 18)

A few minutes alone with our new LED frequency counter and you'll know what we mean. The FC-1 speaks for itself. Quietly. With all the features and craftsmanship the serious CBer demands.

The FC-1 indicates transmitter frequencies in a range from 5 KHz to 40 MHz, on a big, bright, five-digit LED display. Two crystal controlled time base ranges offer ±100 Hz accuracy on the lower range or ±1 KHz on the upper range. With the flip of a switch.

Other features include a two position sensitivity switch, AC operation, or DC operation with positive or negative grounding.

Craftsmanship? The FC-1 is built to be rugged and sensitive. To help you get all the power and punch that high-priced set you're so proud of was built to give. Siltronix guarantees it with a comprehensive testing program and a full warranty against defective parts and labor. And with the reputation of being the CB sister of another top name in radio electronics, Swan.

If you're on the look-out for a hot new accessory, look for the Siltronix FC-1. You won't find it just anywhere. Only at the better pro radio shops. Even then you may have some trouble, because these meters seem to be disappearing off the shelves quicker than you can say LED. If you need help, call us for the name of the Siltronix dealer nearest you.

It's worth some extra looking. The Siltronix FC-1, built to quietly dazzle your ears off.

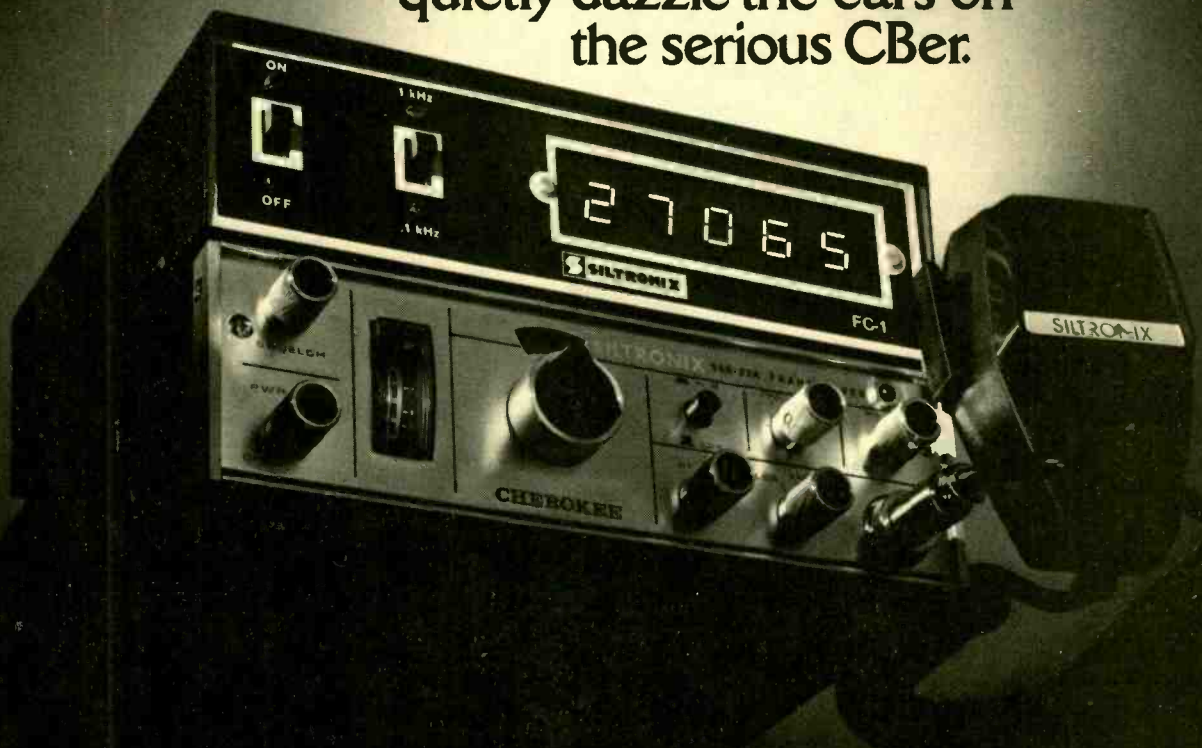
Sells for $169.95.

SILTRONIX

A Division of Cubic Corporation 330 Via El Centro
Oceanside, CA 92054 (714) 757-8860

CIRCLE 28 ON READER SERVICE COUPON

The Siltronix FC-1. Built to quietly dazzle the ears off the serious CBer.



HEY, LOOK ME OVER

sources the Company said. The conversion kit contains sensor mounting brackets in the hardware packet to fit most cars, allowing the wholesaler to stock just one unit instead of several models to fit most cars. Priced at $53.95. For more information on the Tiger I-b Breakerless ignition kit and other ignition kits, just write to Tri-Star Corp., P.O. Box 1727, Grand Junction, CO 81501.

Dumb Terminal Kit

Lear Siegler became the first major peripherals manufacturer to enter the fast-growing computer hobbyist market by introducing a do-it-yourself assembly kit for its ADM-3 "Dumb Terminal." Priced at $875 (as opposed to $1,280 for a factory-assembled model), the Dumb Terminal kit gives the builder a full 24-line, 12-inch screen capable of displaying 1,820 characters at 80 per line. The standard set is 64 ASC11 characters generated in a 5x7 dot matrix displayed as upper case, plus punctuation and control.

Kit comes with two basic assemblies: the CRT section which is premounted in the cabinet and the display electronics section, with keyboard control and power supply also pre-mounted. Lear Siegler has simplified assembly for the builder with a building-block approach by providing the PC board with sockets ready for easy installation of all integrated circuits. Owners will connect the Dumb Terminal to their own micro or mini. Or, using an acoustic coupler, call a remote computer and transform their setup into a home grown data processing center. Purchased software games, such as Star Trek, will take on a new light when displayed on the Dumb Terminal screen. It will replace a teletypewriter and offers software games such as Star Trek will take on a new light when displayed on the Dumb Terminal screen. The ADM-3 will also directly replace a teletypewriter, offering software compatibility through both a switch selectable 20 mA current loop interface and the EIA standard RS232C interface for direct connection to the conventional computer port. Data is entered via the Dumb Terminal's 59 keyboard keys and is displayed at the bottom line of the screen. Advancing to a new line causes the entire page to scroll upward, typewriter style. Full keyboard control of the display is provided by keys for Clear Screen, Carriage Return, Line Feed, Space Bar, Backspace, and Character Overwrite keys. End of line is announced by an audible tone. Either full- or half-duplex operating mode is switch-selectable as is a synchronous transmission of 7- or 8-bit ASC11 characters, with speed ranging from 75, through 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600 tc 19,200. Word format can be chosen from 9-, 10-, or 11-bit words with odd, even or no parity, plus one or two stop bits. For more information, write to Lear Siegler, Inc., EID/Data Products Group, 714 North Brookhurst Street, Anaheim, CA 92803. ■

CIRCLE 71 ON READER SERVICE COUPON

"Now, this is a digital clock!"

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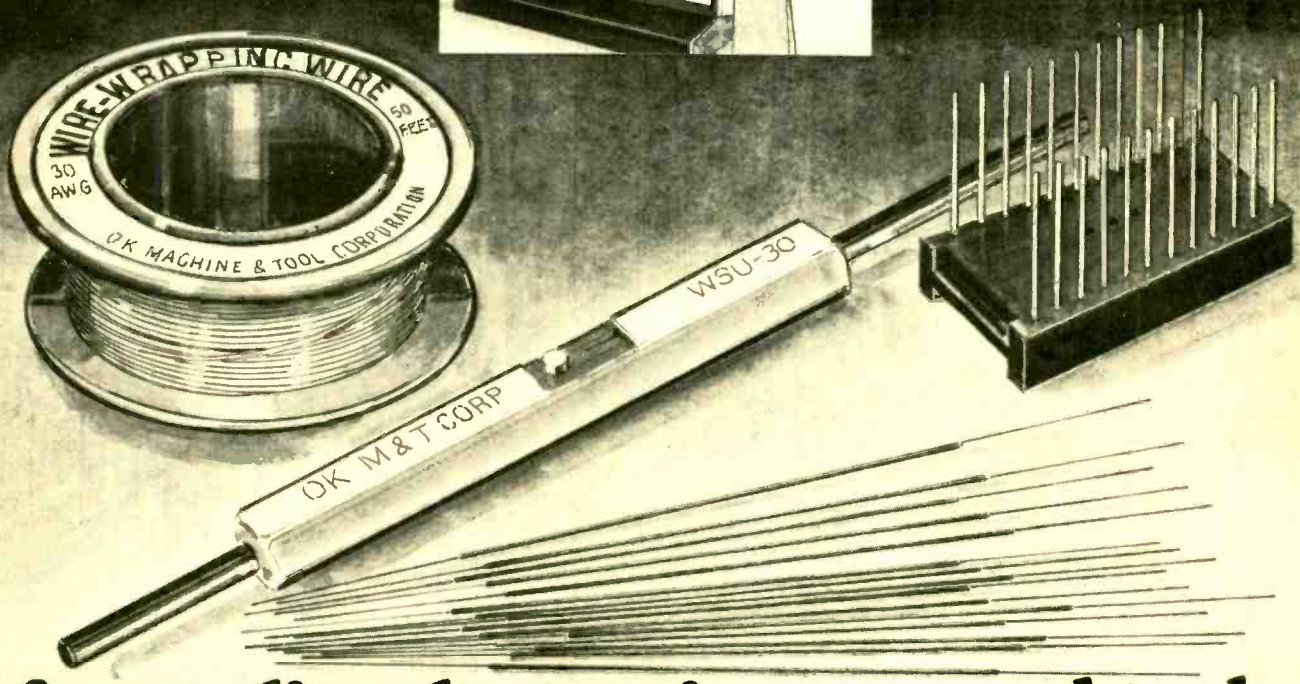
wire wrapping center...



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CIRCLE 41 ON READER SERVICE COUPON

BOOKMARK
BY BOOKWORM

Edison's Finest! In 1959 *From Tin Foil to Stereo—Evolution of the Phonograph* by Oliver Read and Walter L. Welch first appeared. Modest publishing success was achieved, with no thought of following up-dated editions. Since that time, libraries found it impossible to keep their editions in good order because of overuse. New copies were unobtainable, with one edition selling for as much as $200. Why? *From Tin Foil to Stereo* still remains the most comprehensive and best illustrated story of the phonograph from 1877 to the late 1950's. Up-dated in 1976, the second edition may very well enjoy the same fate. It makes good reading and an excellent source of detailed phonograph data from antiquity. Published by Howard W. Sams & Co. Inc., 4300 West 62nd Street, Indianapolis, IN 46268.

Soft cover
550 pages
$9.95

Beyond Shortwave. So you are a hot shortwave DXer? Try your luck at VHF and UHF probes and you'll wind up a bust! Unlike shortwave DXing, there is no highband DXing until some abnormal propagation occurs. So, to get an informative introduction to the top of the band DXing, get a copy of *Beyond Shortwave-Introduction to TV, FM and V-UHF Radio DX* by the Worldwide TV-FM DX Association. The booklet starts by discussing the difference between Sporadic E and tropo skip and goes on to meteor scatter and F2 skip. Get a copy today from WTFDA, P.O. Box 163, Deerfield, IL 60015.

Soft cover
32 pages
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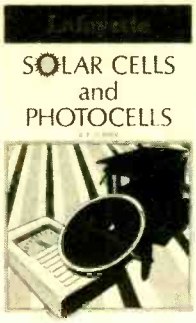
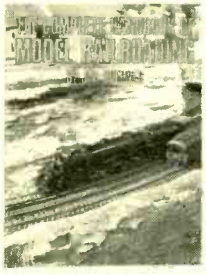
Light Action. Here, neatly packed in one small book are all the information and many project ideas experimenters will ever need. Written by Rufus P. Turner, Ph.D., *Solar Cells and Photocells* is a collection of selected practical applications of photocells addressed to experimenters, whether experienced or beginners. Pick up your copy at any Lafayette Radio parts store or order direct. Write to Lafayette Radio, Dept. PR/EE, 111 Jericho Turnpike, Syosset, NY 11791.



Soft cover
96 pages
$3.95

For Electronics Casey Jones. Here, in one book, are all the nuts-and-bolts techniques of putting a model pike together, plus the inside story of the big railroads—how they're built and how they work. This book is a complete "how-to" guide to all the facets of model railroad planning, construction and operation. It's *The Complete Handbook of Model Railroading*, by James Buehner, which covers literally everything, including planning, construction, operation, maintenance, repair, landscaping, electrical/electronics wiring, building from scratch, etc. The key to realism in model railroads is *scale*, the reduction of everything, down to the last, minute detail, in exact proportion to its real-life size. The meaning and types of scale (N, O, HO, etc.) and other secrets of realism in modeling are introduced. Published by Tab Books, Blue Ridge Summit, PA 17214.



Soft cover
350 pages
$6.95

Super Catalog. Radio Shack's new 1977 Electronics Catalog, featuring their exclusive line of products for home entertainment, hobbyists, CBers and experimenters, is now available from Radio Shack stores and dealers, nationwide. The all-new 164-page catalog marks Radio Shack's 56th year in business and includes 100 full-color pages describing the company's complete lines of products. Prices in the new catalog are reported to be, on the average, within 1% of the company's previous (1975) prices. That's keeping inflation down! Among the new items introduced in the catalog are: eight new stereo FM/AM receivers; an all-new line of pocket calculators ranging in price from $10.95 for a 5-function model, to $39.95 for a scientific slide-rule calculator; plus

(Continued on page 22)

7400N TTL

SN7400N*	.16	SN7459A	.25	SN74154N*	1.00
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SN7439N	.25	SN74125N	.60	SN74193N*	.89
SN7440N	.15	SN74126N	.60	SN74194N	1.25
SN7441N	.89	SN74132N	1.09	SN74195N	.75
SN7442N	.59	SN74136N	.95	SN74196N	1.25
SN7443N	.75	SN74141N	1.15	SN74198N	1.75
SN7444N	.75	SN74142N*	4.00	SN74199N	1.75
SN7445N	.75	SN74143N*	4.50	SN74200N	5.59
SN7446N	.81	SN74144N*	4.50	SN74279N*	.90
SN7447N*	.69	SN74145N	1.15	SN74293N*	.89
SN7448N	.79	SN74147N	2.35	SN74365N	.75
SN7450N	.26	SN74148N	2.00	SN74366N	.75
SN7451N	.27	SN74150N	1.00	SN74367N	.75
SN7453N	.27	SN74151N	.79		
SN7454N	.20	SN74153N	.89		

MANY OTHERS AVAILABLE ON REQUEST
20% Discount for 100 Combined 7400's

CMOS

CD4000	.25	CD4035	1.85	74C04N	.75
CD4001	.25	CD4040	2.45	74C10N	.65
CD4002	.25	CD4044	1.90	74C20N	.65
CD4006	2.50	CD4042	1.50	74C30N	.65
CD4007	.25	CD4044	2.51	74C42N	2.15
CD4009	.59	CD4046	2.75	74C73N	1.50
CD4010	.59	CD4047	.79	74C74	1.15
CD4011	.25	CD4049	.79	74C90N	3.00
CD4012	.25	CD4050	.79	74C95N	2.00
CD4013	.47	CD4051	2.95	74C107N	1.25
CD4016	.56	CD4053	2.95	74C151	2.90
CD4017	1.35	CD4060	3.25	74C154	4.00
CD4019	.55	CD4066	1.75	74C157	2.15
CD4020	1.49	CD4069	.45	74C160	3.25
CD4022	1.25	CD4071	.45	74C161	3.25
CD4023	.25	CD4081	.45	74C163	3.00
CD4024	1.50	CD4511	2.50	74C164	3.25
CD4025	.25	CD4518	2.50	74C173	2.60
CD4027	.69	CD4566	3.00	74C193	2.75
CD4028	1.65			74C195	2.75
CD4029	2.90	74COON	.39	MC4044*	4.50
CD4030	.65	74C02N	.55	MC14016*	.56

LINEAR

LM309H	.80			LM1310N	2.95
LM301H	.35	LM370N	1.15	LM1351*	1.65
LM301CN	.35	LM373N	3.25	LM1414N	1.75
LM302H	.75	LM377N	4.00	LM1458C	.65
LM304H	1.00	LM380N	1.39	LM1496N	.95
LM305H	.95	LM380CN	1.05	LM1556V	1.85
LM307CN	.35	LM382N	1.79	LM2111N	1.95
LM308H	1.00	LM383N	1.79	LM2901N	2.95
LM308CN	1.00	LM390CN	1.05	LM3065N	.69
LM309H	1.10	LM391N	1.79	LM3900N	.55
LM309K	.99	LM392N	1.79	LM3905N	.60
LM310CN	1.15	NE501K	8.00	LM3909*	1.25
LM311H	.90	NE510A	6.00	LM5556N	1.85
LM311N	.90	NE531H	3.00	MC5558V	1.00
LM318CN	1.50	NE536T	6.00	LM7525N	.90
LM319N	1.30	NE540L	6.00	LM7535N	1.25
LM320K-5	1.35	NE550N	.79	8038B*	4.95
LM320K-5.2	1.35	NE555V*	.45	LM7545O	.49
LM320K-12	1.35	NE560B*	5.00	75451CN	.39
LM320K-15	1.35	NE561B*	5.00	75452CN	.39
LM320T-5*	1.75	NE562B*	5.00	75453CN	.39
LM320T-5.2	1.75	NE565H*	1.25	75454CN	.39
LM320T-8*	1.75	NE565N*	1.75	75491CN	.79
LM320T-12*	1.75	NE566CN*	1.25	75492CN	.89
LM320T-15	1.75	NE567H*	1.95	75494CN	.89
LM320T-18*	1.75	NE567V*	1.50	**RCA LINEAR**	
LM320T-24	1.75	LM703CN	.45	CA3013	2.15
LM323K-5*	9.95	LM709H	.29	CA3032	2.56
LM324N	1.80	LM709N	.29	CA3035	2.48
LM339N	1.70	LM710N	.79	CA3039	1.35
LM340K-5	1.95	LM711N	.39	CA3046	1.30
LM340K-6	1.95	LM723H	.55	CA3059	3.25
LM340K-8	1.95	LM723H	.55	CA3060	3.25
LM340K-12	1.95	LM733N	1.00	CA3080	.85
LM340K-15	1.95	LM739N	1.00	CA3081	2.00
LM340K-18	1.95	LM741CH	.35	CA3082	2.00
LM340K-24	1.95	LM741CN	.35	CA3083	1.60
LM340T-5	1.75	LM7414N	.39	CA3086	.85
LM340T-6	1.75	LM747H	.79	CA3089	3.75
LM340T-8*	1.75	LM747N	.79	CA3091	10.20
LM340T-12	1.75	LM748H	.39	CA3123	2.15
LM340T-15	1.75	LM748N	.39	CA3130	1.39
LM340T-18*	1.75	LM1303N	.90	CA3140	1.25
LM340T-24	1.75	LM1304N	1.19	CA3600	1.75
LM350N	1.00	LM1305N	1.40	RC4194	5.95
LM351CN	.65	LM1307N	.85	RC4195	3.25

74LS00 TTL

74LS00	.39			74LS139	1.95
74LS02	.39	74LS74	.65	74LS151	1.55
74LS03	.39	74LS75	.79	74LS153	1.89
74LS04	.45	74LS76	.65	74LS157	1.55
74LS05	.45	74LS83	2.19	74LS162	2.25
74LS08	.39	74LS85	2.49	74LS163	2.25
74LS10	.39	74LS86	.65	74LS164	2.25
74LS13	.79	74LS90	1.25	74LS175	1.95
74LS14	2.19	74LS92	1.25	74LS181	3.69
74LS20	.39	74LS93	1.25	74LS190	2.85
74LS26	.49	74LS95	2.19	74LS191	2.85
74LS27	.45	74LS96	1.89	74LS192	2.85
74LS28	.49	74LS107	.65	74LS193	2.85
74LS30	.39	74LS109	.65	74LS194	2.25
74LS32	.45	74LS112	.65	74LS195	2.25
74LS40	.49	74LS132	1.55	74LS257	1.89
74LS51	.39	74LS136	.65	74LS260	.55
74LS55	.39	74LS138	1.89	74LS279	.79
74LS73	.65			74LS670	5.95

DATA HANDBOOKS

7400	Pin-out & Description of 5400/7400 ICS	$2.95
CMOS	Pin-out & Description of 4000 Series ICS	$2.95
Linear	Pin-out & Functional Description	$2.95

ALL THREE HANDBOOKS $6.95

100 PER STRIP MOLEX PINS

Intended for use as an inexpensive substitute for IC sockets. Also perfect for use as board connectors and in subassemblies.

SPECIAL — 100/1.49 — 1000/12.00

CONSUMER ELECTRONICS

PONG / SUPER PONG

SINGLE GAME $55.00
4 GAMES IN ONE $79.95

PONG — FOR YOUR HOME TV

GAMES INCLUDED IN SUPER PONG ARE:
- PONG
- CATCH
- SUPER PONG
- HANDBALL

FEATURES OF PONG AND SUPER PONG

- Incremental speed on volleys increases excitement
- Playing field adjusts to any size screen
- Game appears in color or in black & white, depending on television set.
- Unmistakable "PONG" sound accompanies each volley
- Digital scoring flashes on the screen between each point.
- 2 player challenge or Solitaire
- Hooks up simply to any model television set, the screen actually becomes the playing field.
- English and other techniques can be used to make any member of the family a Pong champion.
- Battery operated by 4 size "D" flashlight batteries included with the Unit.

AC Adaptor (Eliminates Batteries) $9.95

ATARI

DISCRETE LEDS

.125" dia.

XC209Red	10/$1
XC209Green	4/$1
XC209Yellow	7/$1
XC209Orange	4/$1

.190" dia.

XC111Red	10/$1
XC111Green	4/$1
XC111Yellow	4/$1
XC111Orange	4/$1

.200" dia.

XC22Red	10/$1
XC22Green	4/$1
XC22Yellow	4/$1
XC22Orange	4/$1
SSL-22RT	4/$1

.185" dia.

XC526Red	10/$1
XC526Green	4/$1
XC526Yellow	4/$1
XC526Orange	4/$1
XC526Clear	4/$1

.200" dia.

XC556Red	10/$1
XC556Green	7/$1
XC556Yellow	7/$1
XC556Orange	7/$1
XC556Clear	7/$1

.085" dia.

MV50 .085" dia. Micro red LED 6/$1

DISPLAY LEDS

TYPE	POLARITY	HT		TYPE	POLARITY	HT	
MAN 1	Common Anode	.270	2.95	MAN 3620	Common Anode-orange	.300	1.75
MAN 2	5 x 7 Dot Matrix	.300	4.95	MAN 3640	Common Cathode-orange	.300	1.75
MAN 3	Common Cathode	.125	.39	MAN 4710	Common Anode-Red	.400	1.95
MAN 4	Common Cathode	.187	1.95	DL701	Common Anode-red	.300	1.85
MAN 7	Common Anode	.300	1.25	DL707	Common Anode	.300	1.50
MAN 7G	Common Anode-green	.300	1.95	DL 728	Common Cathode	.500	2.95
MAN 7Y	Common Anode-yellow	.300	1.95	DL 747	Common Anode	.600	2.25
MAN 52	Common Anode-green	.300	1.75	DL 750	Common Cathode	.600	2.49
MAN 64	Common Anode-red	.400	1.75	DL 33B	Common Cathode	.110	.99
MAN 72	Common Anode	.300	1.25	FND70	Common Cathode	.250	.75
MAN 74	Common Cathode	.300	1.50	FND503	Common Cathode	.500	1.29
MAN 82	Common Anode-yellow	.300	1.75	FND507	Common Anode	.500	1.29
MAN 84	Common Cathode-yellow	.300	1.75				

IC SOLDERTAIL — LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100		1-24	25-49	50-100
8 pin	$.17	.16	.15	24 pin	$.38	.37	.36
14 pin	.20	.19	.18	28 pin	.45	.44	.43
16 pin	.22	.21	.20	36 pin	.60	.59	.58
18 pin	.29	.28	.27	40 pin	.63	.62	.61
22 pin	.37	.36	.35				

SOLDERTAIL STANDARD (TIN)

14 pin	$.27	.25	.24	28 pin	$ .99	.90	.81
16 pin	.30	.27	.25	36 pin	1.39	1.26	1.15
18 pin	.35	.32	.30	40 pin	1.59	1.45	1.30
24 pin	.49	.45	.42				

SOLDERTAIL STANDARD (GOLD)

8 pin	$ .30	.27	.24	24 pin	$ .70	.63	.57
14 pin	.35	.32	.29	28 pin	1.10	1.00	.90
16 pin	.38	.35	.32	36 pin	1.75	1.40	1.26
18 pin	.52	.47	.43	40 pin	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

10 pin	$.45	.41	.37	24 pin	$1.05	.95	.85
14 pin	.39	.38	.37	28 pin	1.40	1.25	1.10
16 pin	.43	.42	.41	36 pin	1.59	1.45	1.30
18 pin	.75	.68	.62	40 pin	1.75	1.55	1.40

50 PCS. RESISTOR ASSORTMENTS $1.75 PER ASST.

ASST. 1	5 ea.	10 OHM 27 OHM	12 OHM 33 OHM	15 OHM 39 OHM	18 OHM 47 OHM	22 OHM 56 OHM	1/4 WATT 5% — 50 PCS.
ASST. 2	5 ea.	68 OHM 180 OHM	82 OHM 220 OHM	100 OHM 270 OHM	120 OHM 330 OHM	150 OHM 390 OHM	1/4 WATT 5% — 50 PCS.
ASST. 3	5 ea.	470 OHM 1.2K	560 OHM 1.5K	680 OHM 1.8K	820 OHM 2.2K	1K 2.7K	1/4 WATT 5% — 50 PCS.
ASST. 4	5 ea.	3.3K 8.2K	3.9K 10K	4.7K 12K	5.6K 15K	6.8K 18K	1/4 WATT 5% — 50 PCS.
ASST. 5	5 ea.	22K 56K	27K 68K	33K 82K	39K 100K	47K 120K	1/4 WATT 5% — 50 PCS.
ASST. 6	5 ea.	150K 390K	180K 470K	220K 560K	270K 680K	330K 820K	1/4 WATT 5% — 50 PCS.
ASST. 7	5 ea.	1M 2.7M	1.2M 3.3M	1.5M 3.9M	1.8M 4.7M	2.2M 5.6M	1/4 WATT 5% — 50 PCS.
ASST. 8R		All Seven Resistor Assortment					$10.95 ea.

5-25 PCS. .05 ea 30-95 PCS. .04 ea 100-495 PCS. .03 ea 500-995 .0275 ea.

SINGLE TURN ⅜" CERMET POTENTIOMETER

- Resistance Tolerance ± 20%
- High Power —0.5 Watt at 70°C
- Wide Operating Temp. Range —55°C to +125°C

$.89

STANDARD RESISTANCE VALUES
50Ω 100Ω 500Ω 1K 2K 5K 10K 20K 50K 100K 200K 500K 1 MEG

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MINIATURE TOGGLE

DPDT				JMT	1	2-9	10-20	30-99
	ON	OFF	ON	221	2.95	2.55	1.87	1.70
	ON	NONE	ON	223	2.95	2.15	1.58	1.43
	ON	OFF	ON	121	2.35	1.95	1.43	1.30
	ON	NONE	ON	123	2.05	1.65	1.21	1.10

PUSH BUTTON

SPDT — SERIES PB, PB1
Maintained Action Switch — Push To Make Contact And Push Again To Release Action
Momentary Action Switch — Normally Open or Normally Closed. (For N.C. circuit use terminals 2 & 1, for N.O. 2 & 3, for N.C. and N.O. 1, 2 & 3.)

PB-123 $1.75
PB-126 $1.75

5 AMP RATINGS

THUMBWHEEL SWITCHES

THUMBWHEEL SWITCH ONLY

Part No.	Description	Price
SR 12	Single Pole 10 Position	$2.50
SR 12	Decimal	3.00
SR 21	10 Position BCD only	2.50
SR 21		3.00

Ordering: Order desired switch or switches and add necessary accessories for your particular application

SF — Front Mount SR — Rear Mount

SERIES SF Front Mount Assembly

SERIES SR Rear Mount Assembly

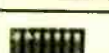
ACCESSORIES

Part No.	Description	Price
SR EP	End Plate (Pair)	.50
SR DP	Divider Plate (each)	.40
SR BB	Blank Body (each)	.40
SR HB	Half Body (each)	.40

ACCESSORIES

Part No.	Description	Price
SR EP	End Plate (pair)	$ .50
SR DP	Divider Plate (each)	.40
SR BB	Blank Body (each)	.40
SR HB	Half Body (each)	.40

DIP SWITCH



These switches feature seven SPST slide switches in a molded dip. They are ideally suited for microprocessor applications

$1.95

CLIPLITE !! 4/$1.00

NEW LED MOUNTING SYSTEM

- CLIPLITE mounts from the front of the Panel in a .250 hole on 3/8" centers. Panel thickness from 1/16" to 1/8".
- CLIPLITE equalizes and increases the brightness of commonly used wide beam LEDS.
- CLIPLITE is to be used with XC556 LEDS.
- Specify colors—red, green, amber, or yellow when ordering.

ZENERS—DIODES—RECTIFIERS

TYPE	VOLTS	W	PRICE	TYPE	VOLTS	W	PRICE
1N746	3.3	400m	4/1.00	1N4005*	600 PIV	1 AMP	10/1.00
1N751A	5.1	400m	4/1.00	1N4006*	800 PIV	1 AMP	10/1.00
1N752	5.6	400m	4/1.00	1N4007*	1000 PIV	1 AMP	10/1.00
1N753	6.2	400m	4/1.00	1N3500	50	200m	6/1.00
1N754	6.8	400m	4/1.00	1N4148	75	10m	15/1.00
1N959	8.2	400m	8/1.00	1N4154	35	10m	12/1.00
1N965B	15	400m	4/1.00	1N4305	75	25M	20/1.00
1N5232	5.6	500m	28	1N4734	5.6	1w	28
1N5234	6.2	500m	28	1N4735	6.2	1w	28
1N5235	6.8	500m	28	1N4736	6.8	1w	28
1N5236	7.5	500m	28	1N4738	8.2	1w	28
1N456	25	40m	6/1.00	1N4742	12	1w	28
1N458	150	7m	6/1.00	1N4744	15	1w	28
1N485A	180	10m	5/1.00	1N1183	50 PIV	35 AMP	1.60
1N4001	50 PIV	1 AMP	12/1.00	1N1184	100 PIV	35 AMP	1.70
1N4002	100 PIV	1 AMP	12/1.00	1N1185	150 PIV	35 AMP	1.70
1N4003	200 PIV	1 AMP	12/1.00	1N1186	200 PIV	35 AMP	1.80
1N4004	400 PIV	1 AMP	12/1.00	1N1188	400 PIV	35 AMP	3.00

SCR AND FW BRIDGE RECTIFIERS

C36D	15A @ 400V	SCR	$1.95
C38M	35A @ 200V	SCR	1.95
2N2328	1.6A @ 200V	SCR	.50
MDA 980-1	25A @ 50V	FW BRIDGE REC	1.95
MDA 980-3	25A@ 200V	FW BRIDGE REC	1.95

TRANSISTORS

MPS A05	5/$1.00		PN3567	3/$1.00	PN4249	4/$1.00
MPS A06	5/$1.00		PN3568	4/$1.00	PN4250	4/$1.00
2N2219A	3/$1.00		PN3569	4/$1.00	2N4400	4/$1.00
2N2221	4/$1.00		2N3704	5/$1.00	2N4401	4/$1.00
2N2222A	5/$1.00		2N3705	5/$1.00	2N4402	4/$1.00
2N2369	5/$1.00		2N3706	5/$1.00	2N4403	4/$1.00
2N2369A	4/$1.00		2N3707	5/$1.00	2N4409	5/$1.00
FN2415	5/$1.00		2N3711	5/$1.00	2N5086	4/$1.00
2N2484	4/$1.00		2N3724	$ .65	2N5087	4/$1.00
2N2906A	4/$1.00		2N3725	$1.00	2N5088	4/$1.00
2N2907A	5/$1.00		2N3903	5/$1.00	2N5089	4/$1.00
2N2925	5/$1.00		2N3904	4/$1.00	2N5129	5/$1.00
2N3053	2/$1.00		2N3905	4/$1.00	2N5209	5/$1.00
2N3055	$ .99		2N3906	4/$1.00	2N5961	5/$1.00
MJE3055	$1.00		2N4013	3/$1.00	C106B1SCR	2/$1.00
MJE2955	$1.25		2N4C14	3/$1.00	2N5432	$2.00
2N3392	5/$1.00		2N4123	10/$1.00	40673	1.75ea.
2N3398	5/$1.00					

CAPACITOR CORNER

50 VOLT CERAMIC DISC CAPACITORS

	1-9	10-49	50-100		1-9	10-49	50-100
10 pf	.05	.04	.03	.001µF	.05	.04	.035
22 pf	.05	.04	.03	.0047µF	.05	.04	.035
47 pf	.05	.04	.03	.01µF	.05	.04	.035
100 pf	.05	.04	.03	.022µF	.06	.05	.04
220 pf	.05	.04	.03	.047µF	.06	.05	.04
470 pf	.05	.04	.035	.1µF	.12	.09	.075

100 VOLT MYLAR FILM CAPACITORS

001mf	.12	.10	.07	.022mf	.13	.11	.08
.0022	.12	.10	.07	.047mf	.21	.17	.13
.0047mf	.12	.10	.07	.1mf	.27	.22	.17
.01mf	.12	.10	.07	.22mf	.33	.27	.22

+20% DIPPED TANTALUMS (SOLID) CAPACITORS

.1/35V	.28	.23	.17	1.5/35V	.30	.26	.21
.15/35V	.28	.23	.17	2.2/25V	.31	.27	.22
.22/35V	.28	.23	.17	3.3/25V	.31	.27	.22
.33/3V	.28	.23	.17	4.7/25V	.32	.28	.23
.47/25V	.28	.23	.17	6.8/25V	.36	.31	.25
.68/35V	.28	.23	.17	10/25V	.40	.35	.29
1.0/35V	.28	.23	.17	15/25V	.63	.50	.40

MINIATURE ALUMINUM ELECTROLYTIC CAPACITORS

	Axial Lead				Radial Lead		
.47/50V	.15	.13	.10	.47/25V	.15	.13	.10
1.0/50V	.16	.14	.11	.47/50V	.16	.14	.11
3.3/50V	.15	.13	.10	1.0/16V	.15	.13	.10
4.7/25V	.16	.14	.12	1.0/25V	.16	.14	.11
10/25V	.15	.13	.10	1.0/50V	.16	.14	.11
10/50V	.16	.14	.12	4.7/16V	.15	.13	.10
22/25V	.17	.15	.12	4.7/25V	.15	.13	.10
22/50V	.24	.20	.18	4.7/50V	.16	.14	.11
47/25V	.19	.17	.15	10/16V	.14	.12	.09
47/50V	.25	.21	.19	10/25V	.15	.13	.10
100/25V	.24	.20	.18	10/50V	.16	.14	.12
100/50V	.35	.30	.28	47/50V	.24	.21	.19
220/25V	.32	.28	.25	100/16V	.19	.15	.14
220/50V	.45	.41	.38	100/25V	.24	.20	.18
470/25V	.33	.29	.27	100/50V	.35	.30	.28
1000/16V	.55	.50	.45	220/16V	.23	.17	.16
2200/16V	.70	.62	.55	470/25V	.31	.28	.26

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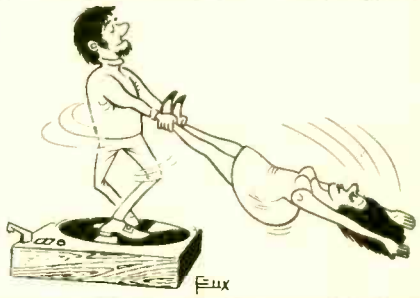

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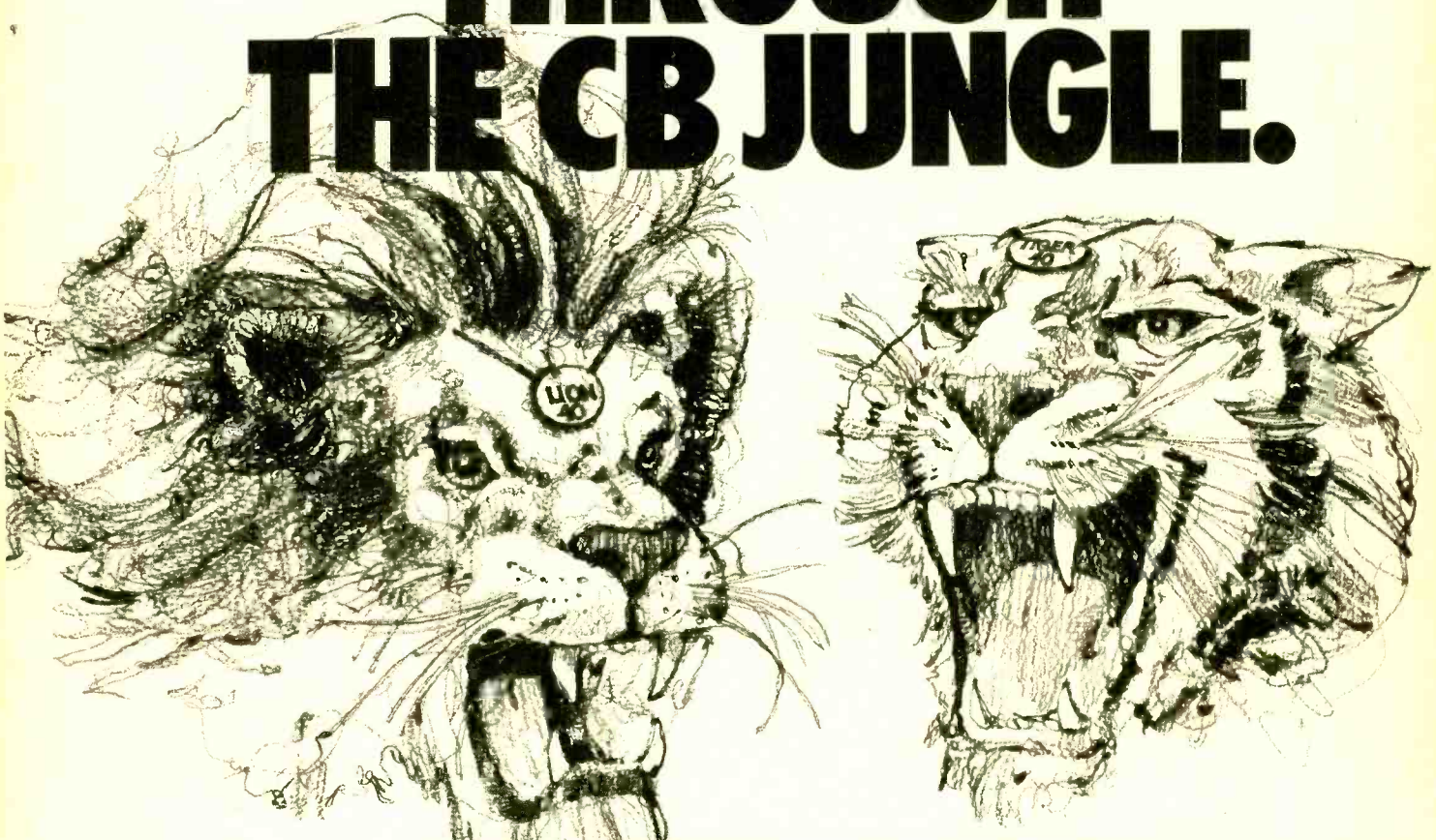

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CIRCLE 45 ON READER SERVICE COUPON

newscan

Electronics in the News!

Eyeball the Sun

Plastic "eyeballs" that follow the sun may become a new way to tap solar energy under a development program sponsored by a British unit of International Telephone and Telegraph Corporation which is developing the "eyeballs" which are basket-ball sized spheres containing lens arrangements that focus sunlight on solar cells which then generate electricity. All components are sealed inside the "eyeballs" which float on a bath of water. Each

Mounted on a gimbal system, the "eyeball" eyeballs the sun and delivers 7 watts of usable power. Installed with many other series and parallel units, the "eyeballs" can cook an omelet.

of the "eyeballs" can generate up to one volt, but higher voltages can be generated by using several units together in series.

Because the "eyeballs" float on water, they move freely. As the sun moves, its light tends to wander off the solar cell which is surrounded by four gas reservoirs like four large petals on a flower. When the sunlight touches any one of these, the heat expands the gas inside and moves a small magnet inside the eyeball. This reacts with an outside magnetic field and the unit swivels to look directly at the sun again.

The solar "eyeball" uses a gallium arsenide solar cell and a Fresnel lens radiation / collector / concentrator. Because it withstands high temperatures and does not saturate at high radiation intensities, the gallium arsenide solar cell can be used at the focus of the lens system. It is estimated that for a peak output of one kilowatt (the consumption of the burner on an electric stove), the installed cost would be from $650 to $1,000.

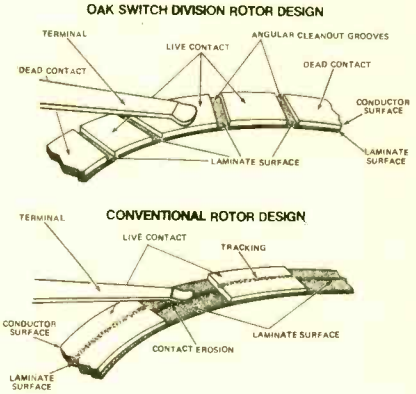
The design has numerous advantages. Motive power and directions are provided by the sun and, as a consequence of the "magnetic drive" principle, no external mechanical contacts are needed. All moving components are wear-free and sealed within the sphere. The modules can be assembled into arrays to increase power output with no cost disadvantage.

The volume of the gas reservoirs is not critical. Air is used as the working gas. The rate of expansion depends on the area of the collecting lens, but it is calculated to be easily capable of rotating a one-foot diameter sphere through 180° in a few seconds. Should a stray cloud disorient the "eyeball," it will look back at the sun in about a second.

40 From 60 is Possible

In case you are curious about the new 40-channel rotary switches that will be found in CB microphones and under front panels, don't tear your rig apart. We'll show you what is inside.

The rotary switch we'll look at is capable of up to 60 positions, (you need only 40 for CB) and is made by



These cutaway drawings illustrate some key differences between the new Oak rotor and conventional designs. Note that on the Oak rotor, the contact never touches the laminate surface, passing instead from electrically-dead metal to electrically-live metal. The cleanout grooves over which the terminals pass are specially designed to eliminate contaminants. On conventional designs, where the contact passes over both laminate and metal, tracking of each substance onto the other can cause intermittent opens on the live pads or shorts between two live pads.

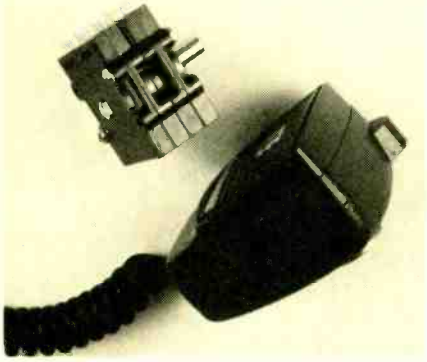
OAK Industries, Inc. Designated the Communicator Series Switch, the new product has three rotary switch design innovations.

As the contacts wipe across the rotor surface, they pass from electrically-dead metal to live metal, never touching the laminate, as in conventional switch designs. When a contact passes across laminate, it can—in time—scrape

particles onto the live metal, creating intermittent opens. This would really "Break One-Nine."

The dead and live metal areas on the rotor are separated by grooves that clean each contact as it passes over them. This also helps ensure that the contacts do not accumulate particles, and drag them from dead to live areas. Nor can metal be scraped on to laminate, creating a short between two live pads.

The printed circuit rotor has an integral cam that functions as the precision detent allowing each switch setting to stay put. The simplicity of the OAK design thus eliminates backlash from loose rotors. With conventional designs, the rotor and detent are separate wafers pinned together, possibly causing inaccurate switching.



A four-gang 60 section switch that is smaller than a CB microphone, will be a basic part in many of the new 40-channel CBsets appearing on the market after January 1, 1977.

The new rotary switch is applicable for communication equipment, including the new 40-channel CB sets, scientific instrumentation, and computers. Of course, the new switch, in single or multiple gang units, will see the most use in CB rigs where channel selection occurs in the hand-held microphone. The large demands for switches of this type have resulted in a new product development that CBers and other communicators will share.

Look Out for the Tsunami

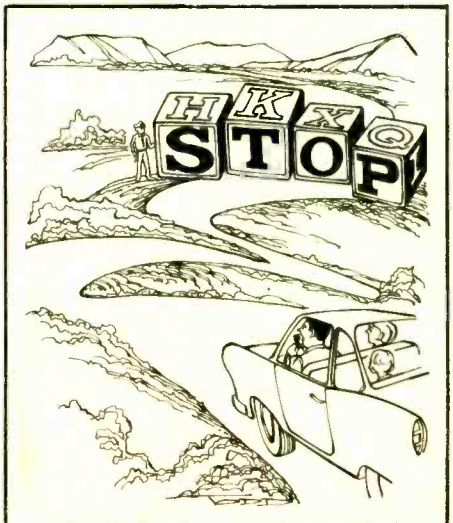
A major earthquake strikes the Pacific coast of Chile 7,000 miles from Hawaii. Death and destruction are left in its wake. Well before the news is flashed around the world, seismological alarms have propelled a team of scientists into action gathering data to prevent an even higher death toll in the event that a "tsunami"—the correct scientific term for what Americans mistakenly call a tidal wave—has been generated by the seismic upheaval.

The scientists are associated with the Pacific-wide Tsunami Warning System which was established in 1948 to provide early detection of tsunami's generated anywhere in the Pacific. The warning system, headquartered here, relies heavily on an extensive communications network provided in part by Hawaiian Telephone Company.

The tsunami warning system is headquartered at the National Weather Service's Honolulu Observatory-Geophysics which issues a "watch" when a tsunami is believed possible and a "warning" when its existence is confirmed. Thomas J. Sokolowski, a geophysicist at the observatory, is shown using a special Hawaiian Telephone conferencing system which, with one call, permits him to issue a simultaneous alert to 10 emergency and Civil Defense agencies on all the major islands in the state.

Created by an intense earthquake or undersea volcanic eruption, a tsunami is not tide-related at all. It is a series of low, almost undetectable waves which race silently across the ocean at speeds up to 600 miles an hour—much like the ripples formed by dropping a pebble in a pond, but on a much more colossal scale. Once they strike the shallower waters near land, the powerful incoming waves can rise as high as 100 feet, wreaking havoc on coastal areas thousands of miles from the site of their origin. Tsunami—pronounced "soo-na-me"—is a Japanese word which means "harbor wave".

Japan has been by far the most frequent victim of tsunamis, the worst of which occurred in 1896 when waves



"Break, Break . . . Smokies south of exit 28 with what looks like a road block . . . ten-four."

(Continued from page 25)

100 feet high killed 27,000 people. Hawaii is the most susceptible area of the United States for tsunamis, having been hit in 1946, 1952, 1957, 1960, 1964, and 1975. It was the death of 159 persons in Hawaii in the 1946 tsunami that led to the formation of the present warning network two years later by the U.S. Coast and Geodetic Survey. In 1973 responsibility for the system was transferred to the Pacific Region of the National Weather Service, an arm of the U.S. Commerce Department's National Oceanic and Atmospheric Administration.

A dozen Pacific nations participate in the system's network of 31 seismological stations to detect earthquakes and 50 tide stations which monitor ocean activity to determine if tsunamis are generated. The stations are scattered from Alaska to the tip of South America and west to Hong Kong, with stations on numerous islands in between.

The Pacific was selected as the initial site for the warning system due to the frequency of possible tsunamigenic earthquakes. Occasionally tsunamis do occur elsewhere, however. Atlantic-wide tsunamis have been generated in the past, but are considered rare.

The mission of system is to detect the location and magnitude of earthquakes and undersea volcanic eruptions in and around the Pacific. Then, if they are of a type that could generate a tsunami, the tide stations nearest the quake are asked to verify the existence of a tsunami. All stations relay their reports to the Honolulu Observatory for compilation and analysis.

Information arrives at the observatory by teletypewriter over several U.S. government communications networks provided in part by Hawaiian Telephone. The data is then processed by a central computer using recently installed Hawiian Telephone computer links which allow the necessary computations to be done in less than one-tenth the time required for manual processing.

If the data reveals that an earthquake or volcanic eruption could have produced a tsunami, the observatory issues a "tsunami watch" to all agencies participating in the system. Once the existence of a tsunami has been confirmed by the tide stations nearest the seismic disturbance, a "tsunami warning" is issued along with predictions of arrival times for the first waves at each point.

Hawaii citizens are well informed about evacuation procedures since the state's telephone directories are the only ones in the United States to have tsunami inundation maps in their information pages. The maps, which have apeared in every Hawaiian Telephone directory since 1959, show in detail which areas to evacuate.

(Continued on page 30)

"Care for some peanuts, Al?"

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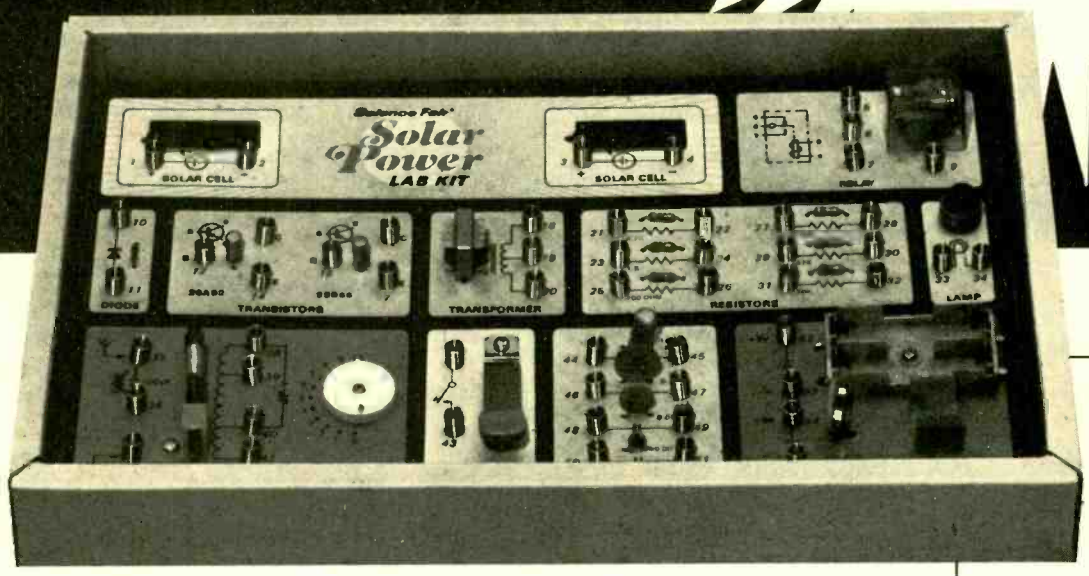

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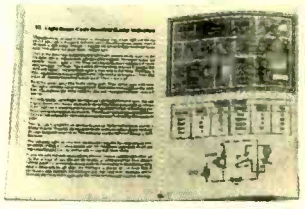

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DX central reporting

A world of SWL info!

☐ Antennas—that's a subject that brings in a lot of mail from you readers to DX Central.

What type of antenna should I use? How long should it be? How high? Indoor or outdoor? What about directionality? These are typical of the queries that show a lot of you have skywires on the mind.

Virtually everyone knows what an antenna is. And most have a pretty good idea of what an antenna does—captures electromagnetic energy transmitted from a distant station and converts it into an electron flow to your receiver. Then, of course, in your receiver it is changed into an audible signal.

Antenna design can be a complex subject. There are a number of books on the market, most of them written for radio amateurs (hams), with detailed information on constructing antennas. Because they emphasize transmitting antennas, get all involved with things like baluns and standing waves, SWLs often are turned off or scared off by these books. In fact, a receiving-only antenna is a whole lot less critical than one that is used for transmitting.

What would the ideal DXing antenna be like? Well, it would be broad band, that is, it would work well on all, or at least most, of the shortwave frequencies from the bottom to the top of the dial. It would be directional and have "gain." This means it would receive signals better from one direction than others, and that when compared to a simple dipole antenna, the signals from that direction would be stronger. Being directional, the antenna would have to be rotatable so it could be "pointed" in the direction of the desired SW signal. It should be of a convenient size and, finally, inexpensive to construct.

That's the ideal DXing antenna. And it *doesn't* exist!

There are antennas that are broad band, directional, have gain, are rotatable, compact and cheap to build. There are some antennas that have several of these characteristics. There are no antennas that have them all!

Beams with directors and reflectors, parallel elements fore or aft of the active portion of the antenna, offer gain and directionality. A look at your TV antenna will give you an idea of what a beam is all about. Then consider that the elements of a 49-meter band beam would be about 80-feet long and you can see the impracticality of building it, and the near impossibility of rotating it even if you could construct one.

Veteran DXers dream of rhombics, diamond-shaped wire antennas that can offer a maximum of signal increase, plus directionality. Rhombics are even more impractical for the SWL. A near ideal rhombic antenna for 60 meters would be well over a thousand feet from end to end and use more than two-thirds of a mile of wire! And just try to turn that baby around!

Frankly, lack of acreage precludes SWLs from using antennas offering gain and directionality on the lower shortwave bands.

Reluctantly, but practically, DXers usually must content themselves with antennas which are broad band, are of convenient size and are relatively-to-very cheap to construct. And that is obtainable.

Some SWLs swear by dipole antennas (and their big brothers, the folded dipoles). These are wire antennas, two lengths of wire cut to a pre-determined length, separated in the middle by an insulator, with insulators at each end. A dipole is center-fed by a balanced twin-lead coming from the receiver.

They work well but they are not especially useful for receiving over a wide range of frequencies. A dipole "cut" for 19 meters won't do wonders on 90 meters.

Thus, by matter of elimination, we are left with the SWL's old standby, known variously as the single wire, the "longwire" (though technically it should be longer than the average SWL's skywire to merit that name), the "inverted L" (because of the shape of the horizontal "flat top" and the vertical lead-in wires) or, rarely these days, the Hertz antenna.

The single wire antenna—a length of wire of any convenient size, preferably more than 20 feet and less than 150 feet, as high above the ground as practical, away from noise-makers like busy streets, power lines and neon signs, terminated at each end by non-conducting glass or ceramic insulators, end-fed by a single lead-in wire, leaving the horizontal "flat-top" at right angles and as short as possible—is my personal candidate for the SWL's all-around antenna.

A personal observation: There is probably no better—and I chose those words carefully—shortwave antenna for the DX listener who does not have the space or dollars to erect a very long, gain-providing antenna.

Here are a few more tips for the antenna builder:

Δ Use good, sturdy wire, such as No. 14 enameled copper, stranded copper antenna wire or, yes, even aluminum clothesline will work. Soldering a lead-in to aluminum can be tough, if not impossible!

Δ If possible, have your antenna run at right angles to any nearby power lines, but, for goodness sake, no crossing over them. Otherwise don't worry about which way the antenna is oriented. Essentially it will receive equally well from most directions.

Δ Solder all connections. Spray the solder joints with a clear plastic spray. In areas of high humidity or urban industrializaton, corrosion is a problem. Even under the best of conditions, in an urban setting figure on replacing your antenna wire every couple of years.

Δ In areas where thunderstorms are common, a lightning arrester is a wise idea and a good investment. Ever see a "fried" receiver?

Match It. Finally, with a random length single wire antenna, an antenna tuner, which will "match" your antenna to the receiver and frequency you're tuning, is often a very useful addition to your listening post.

Some receivers have antenna tuners built right in. Or a check of some of the amateur radio handbooks and construction project books will turn up some simple plans. And, several firms, including Gilfer Associates, Inc., Box 239, Park Ridge, NJ 07656, and SWL Guide, 414 Newcastle Rd., Syracuse, NY 13219, sell antenna tuner units.

SWL Guide has advertised a unit known as the TG Randomwire Antenna Tuner, a relatively simple device which is useful in tuning frequencies from 3.5 to 30 MHz.

More expensive, but more versatile, is a new unit, the M-1 Multi-tuner imported from England and sold by Gilfer. It contains five different antenna tuning circuits, switch-selected, with 50 tunable options to match any antenna to any receiver.

One last word: Tinkering with antennas is the one aspect of SWLing's technical side that the non-technical person can experiment with, inexpensively and without any real danger of doing any damage to himself or his equipment.

The Receiver Scene. A recently completed survey by Moira and Kim Elliott of the North American SW Association presents an interesting look at the types of shortwave receivers used by members of that club.

Some 750 members of that club, one of the best known and active DXing organizations in North America, answered the Elliott's questionnaire. The results show that those members own 1,144 receivers, or about one and a half sets each. The receivers used range in price from just a few dollars to one goodie price-tagged at $6,500! (National HR-600 series receivers!)

Several factors should be noted about the results. First, the club is comprised of persons who are, for the most part, serious shortwave listeners and DXers. As a result they probably spend more for their equipment than most casual listeners. Secondly, there is an entirely new generation of medium priced receivers coming on the market shortly, of which the Barlow-Wadley XCR-30 and the Drake SSR-1 are the first entries now available. Naturally, these new receivers are not among those ranking at the top in popularity. They haven't been on sale for very long. New Japanese-made Yaesu, Panasonic and Sony sets are only now beginning to become available, also.

DX Abbreviations

DX, DXing—Listening to distant stations, often shortwave stations, as a hobby.
GMT—Greenwich (or Universal) Mean Time, a common standard time reference equal to EST + 5 hours, CST + 6 hours, MST + 7 hours and PST + 8 hours.
kHz—kilohertz, most commonly used unit of frequency measurement; equal to 1,000 cycles per second.
MHz—Megahertz, 1,000 kilohertz.
Skywire—A listener's antenna.
SWL—Shortwave listener.

The top 10 receivers in popularity among the 750 NASWA members are:

Realistic DX150, DX150A, and DX160	16.3%
Drake SPR-4	10.1%
Allied (Radio Shack) SX-190	5.1%
Drake SW4, SW4A	4.6%
Barlow Wadley XCR-30	4.6%
Zenith Transoceanic	4.1%
Hammarlund HQ180, HQ180A	3.4%
Drake R4B, R4C	3.1%
Military Surplus R388, R390, R392	3.0%
Heath SB310, 313	3.0%

Over 100 other receiver makes and models were named in the survey, but none came in with over two per cent.

Bandsweep. Times in GMT, frequencies in kHz: **4,810**—A nice catch, which has been turning up with greater regularity and with rather decent signals of late is *La Voz de Galapagos*, on those strange islands off the coast of Ecuador. Programming is in Spanish, of course. Try here around 1200 or after 0400 . . . **5,980**—Another Latin sound with good signals has been *Radio Panamericana*, Lima, Peru, noted with light music and Spanish announcements until 0700 sign off . . . **9,690**—No I'm not in a rut. Another Spanish speaking nation is Argentina, but you can hear English programming from the government-owned *RAE* around 0300.

NEWSCAN

(Continued from page 26)

As effective as the warning system now is, there have been those who learned too late the result of not heeding the warnings. The waves that hit the city of Hilo, on Hawaii's north coast, in May of 1960 killed 61 people who either stayed in dangerous areas to see the waves or thought the warning would turn out to be a false alarm.

Once we know a tsunami is on its way, the system can only predict its arrival time—not its size. A variety of factors can cause tsunamis to range from a tide fluctuation of a few inches to a set of thundering waves 100 feet high.

The Man Who Won the Battle of the Atlantic

Who is Henri Busignies? He's the man whose invention, rescued from under the very eyes of the Nazis, swung the Battle of the Atlantic in favor of the Allies. He's the man whose innovations in aerial navigation helped assure safety for every airplane flight in the United States. He's the man with more than 140 important inventions. This is Henri Busignies, whose latest kudo is his designation as chief scientist emeritus of the worldwide International Telephone and Telegraph Corporation.

But, let's take a moment to go back to the beginning. Busignies was born at Sceaux, near Paris, in 1905. Busignies was a radio "ham" when he was 14, but he soon discovered that he was more interested experimenting with new radio circuits than in picking up New York or Sydney.

He studied at the Jules Ferry College at Versailles and in 1926 obtained a degree in electrical engineering from the Institute Normal Electro Technique in Paris. In 1926, while still studying, he obtained a patent on a radiocompass, a device that electronically "points out" the direction of radio stations.

In 1928 Busignies became an engineer with the ITT Paris Laboratories. For the next twelve years he developed radio direction finders, airplane radio navigation systems, and early radars. His automatic radio direction finder dramatically guided a plane from Paris to the Isle of Reunion, off Madagascar in 1936.

When Paris fell, much secret electronic work was being done by the ITT Paris Laboratory for the French Military. To prevent capture of the secrets by the Germans, drawings and laboratory notebooks were hidden and the working models of direction finders, aerial navigation equipment, and radars were disassembled and the parts were

(Continued on page 32)

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NEWSCAN

(Continued from page 30)

dispersed. Busignies and the other Laboratory personnel tried to assume the guise of scientists engaged in general research.

But this facade was shattered when, in an electronics plant elevator, Busignies was confronted by a Luftwaffe colonel who had previously known him and knew of his expertise in military electronics. The Colonel immediately expressed interest in learning of Busignies' current activities and suggested that they should have dinner together that very evening. Only by the fastest Gallic "footwork" was Busignies able to evade that invitation and those that followed.

Immediately after Busignies arrived in the U.S., a meeting was held with top U.S. military men. Among the technical treasures shown to them was Busignies' invention, later known as a High-Frequency Direction Finder or "Huff-Duff." Within a split second, this device pinpoints the direction from which a radio transmission is coming. It has a round-faced cathode-ray tube (a device like a TV tube) with a compass marking around its edge. When a radio signal is received, the tube instantly flashes an electronic pointer to show the direction. The U.S. military immediately recognized Huff-Duff as the means for exterminating the German U-boat "wolfpacks" that had been decimating Allied shipping on the Atlantic.

The U-boats required periodic radio communications with each other and with Germany to carry out their deadly mission. To avoid being located by means of their radio transmitters, the Germans kept their messages as short as possible. Later, they made their transmissions even shorter by first recording them on devices like tape recorders. Then, after surfacing, they "squirted" these messages to their destinations by playing the recordings very rapidly. A complete message would require less than a single second, after which the U-boat would quickly submerge to its lair in the safety of the depths. At the receiver, the messages were taken down by high-speed recorders and later read slowly.

Previous radio direction finders could not be operated quickly enough to pinpoint the transmitter direction. But Busignies' Huff-Duff could spot the direction instantaneously and accurately. It was quickly put into full production by ITT at the request of the U.S. Navy.

A network of Huff-Duff stations was established first along the East Coast and later along both U.S. coasts, aboard Navy ships, and the world over. When a German sub sent a message, two or more Huff-Duffs would get bearings on it and the subchasers would dash in for the kill.

But, the usefulness of Huff-Duff did not end with the submarine threat. A network of Huff-Duff sets formed an electronic transatlantic air navigation system used during the last two years of the war. Eventually the network, expanded to 1500 sets, covered also the Pacific and other areas and served until supplanted by the worldwide Loran system.

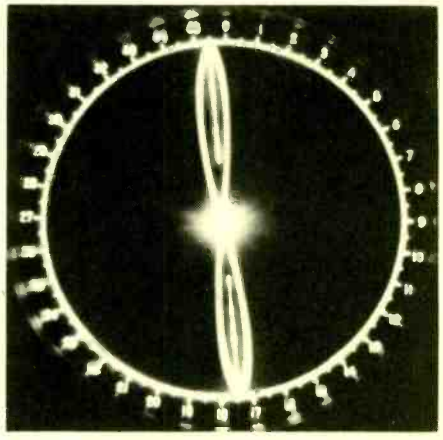
Another invention of Busignies has to do with radar. Visualize a soldier seated before a radar screen at a lonely U.S. outpost anxiously examining a bright spot marking an aircraft that is approaching from the direction of the enemy's lines. Is it an attacking enemy aircraft or one of our own returning from a mission? Suddenly the spot runs into and merges with the bright echoes from the terrain surrounding the radar station; the trees, villages, mountains, and other features of the countryside.

Quickly, the radar operator pushes a switch and, magically, the stationary echoes disappear. The camouflage is *scrubbed* away and the aircraft's echo stands out bright and clear.

The operator has used another early wartime Busignies' invention called moving-target-indicator (MTI) radar. Briefly, this ingenious circuit scrubs off the radar screen every echo from objects that are stationary, such as the terrain, and leaves only those echos from objects that are moving, such as aircraft.

In addition to military applications, the moving-target-indicator radar is used in all airport air traffic control to eliminate the confusing echoes from cities and all other stationary objects surrounding airports.

After the war, Busignies adopted the U.S. as his permanent domicile. His fields of interest expanded to include



Submarine at 355 degrees, says the electronic finger of a Huff-Duff display. The electronic finger of the device instantaneously points in the direction of arrival of a radio transmission.

Dr. Henri Busignies gives the first model of the automatic radio direction finder to the Museum of History and Technology of the Smithsonian Institution.

both space communications, the aeronavigation field, and aircraft instrument landing systems.

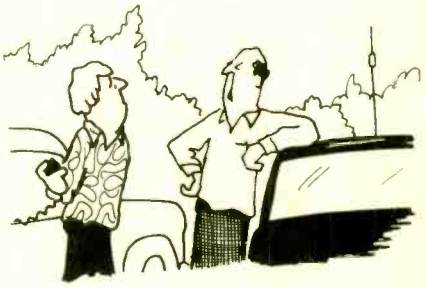
Busignies is a much-honored man. He received the Pioneer Award of the Aeronautical and Navigational Electronics Group of the Institute of Radio Engineers in 1958 for his radiocom-

(Continued on page 94)

THE PRI¢E OF PROGRE$$

by Jack Schmidt

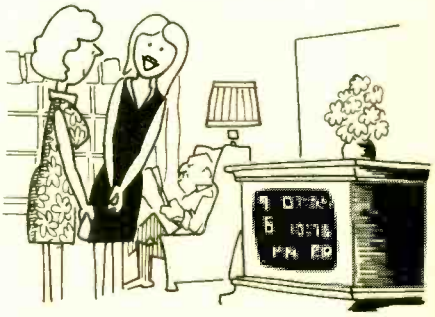
"This microwave oven destroys roasts three times faster!"



"Are you one of those who only have twenty-three channels?"

"I was on my way home when Sugar Belle called on 19 to tell me about the Wimble's sale!"

"It has something to do with 60-foot antenna limitation!"



"Dad built it from a kit. It flashes the date, time, inside and outside temp, everything but a picture!"

No other TV/Audio home study school puts prices in its ads. Why?

Maybe it's because they can't match these values.

No other school gives you a choice of five ways to learn TV/Audio servicing, with complete courses starting as low as $445 and convenient, inexpensive time payment plans. No other school includes both an engineered-for-training 25" diagonal color TV and a four-speaker Quadraphonic stereo in its best course. In fact, to even match this kind of thorough training at another school, you'd have to take an extra course costing hundreds of dollars more. We're proud to quote our prices because we believe you get top educational value from NRI.

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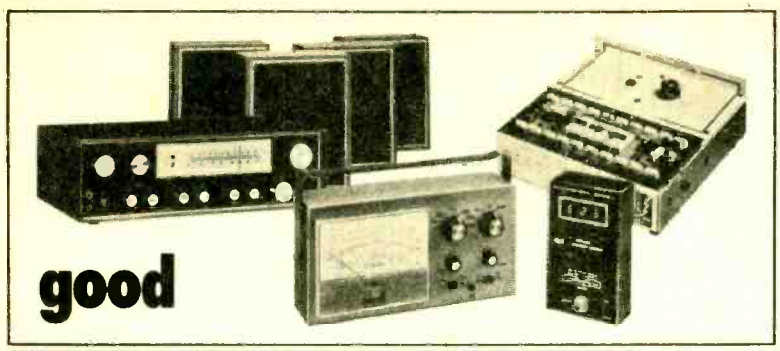


7 kits: Quadraphonic Stereo...

$445 or low monthly terms

A basic TV/Audio Servicing Course including 7 training kits for your experiments. You build your own 4-speaker Quadraphonic System, solid-state volt-ohmmeter, CMOS digital frequency counter, and electronics Discovery Lab. Includes 48 bite-size lessons (18 on color TV), 10 special reference texts with hundreds of servicing shortcuts, tips on setting up your own business, etc. This completely up-to-date course covers black & white and color TV, FM multiplex receivers, public address systems, antennas, radios, tube, transistor and solid-state circuits.

11 kits: Quadraphonic Stereo and B/W TV...$550

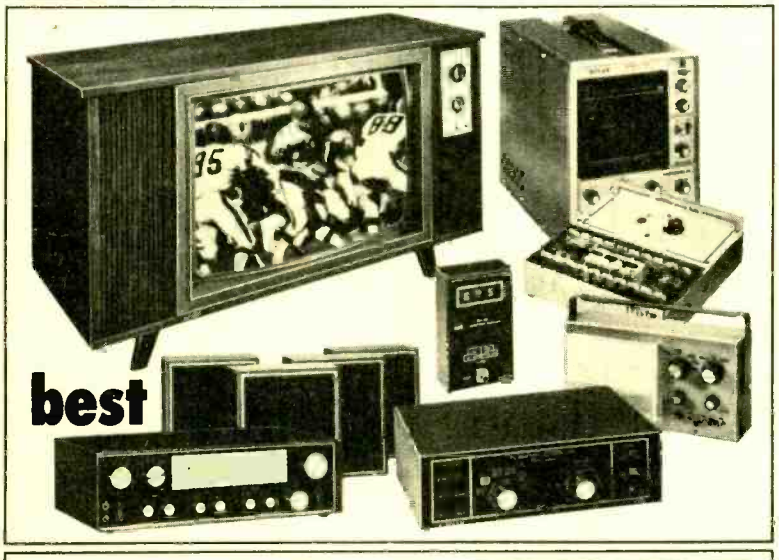
or low monthly terms

A complete course in B&W and Color TV Servicing, including 48 lessons (18 on color TV) 10 special reference texts and 11 training kits. Kits you build include 4-speaker Quadraphonic System, solid-state volt-ohmmeter, CMOS digital frequency counter, electronics Discovery Lab, plus a 12″ diagonal solid-state black & white portable TV to build and use. At each assembly stage, you learn theory and "Power-On" application of that theory in typical solid-state TV sets.

11 kits: 19″ diagonal Color TV...

$880 or low monthly terms

The course includes 42 lessons and 4 reference texts plus kits and experiments to build a superb solid-state 19″ diagonal color TV receiver . . . complete with cabinet, and engineered specifically for training by NRI's own engineers and instructors. This handsome set was designed from the chassis up to give you a thorough understanding of circuitry and professional trouble-shooting techniques. You build your own solid state volt-ohmmeter, CMOS digital frequency counter, and experimental electronics Discovery Lab.



14 kits: 25″ diagonal color TV and Quadraphonic Stereo...$1195.00

or low monthly terms

The-ultimate home training in Color TV/Audio servicing with 48 bite-sized lessons, 10 reference texts, and 14 training kits . . . including kits to build a 25″ diagonal color TV, complete with console cabinet; a 4-speaker Quadraphonic Center; a wide band, solid-state, triggered sweep, service type 5″ oscilloscope; digital integrated circuit color TV pattern generator; a CMOS digital frequency counter, and an electronics Discovery Lab. This gives you thorough TV and Audio training for hundreds of dollars less than the separate courses you'd have to take elsewhere.

This Master Course combines theory with practice, using the "Power-On" stages for experimentation and learning. Building NRI's equipment will give you the confidence and ability to service any color TV or Audio unit on the market. And you'll have a magnificent TV and quad unit for years of trouble-free performance.

Pro Color: 19″ diagonal color TV...

$665 or low monthly terms

An advanced Color TV Servicing Course for experienced technicians, 18 lessons, 5 new "Shop Manuals", and NRI 19″ diagonal Color TV receiver with cabinet.

6-017

More Walk Power!

New Realistic walkie-talkie with exclusive range-boost antenna system

and provision for push-to-talk mike

You know what mobile CB does for driving—think what it can do for on-foot activities like hunting, camping and hiking. If you're with friends, walkie-talkies let you spread out without losing touch. And if you're alone, two-way radio may be your *only* way of getting through for help. The Realistic TRC-200 is the perfect choice for the CBer who demands no-nonsense performance. Five watts input and a loaded telescoping antenna for maximum range. A high-low output switch saves on batteries during short-range use. With batteries and crystals for Channel 14 and provision for up to 5 more channels—just add optional-extra crystals. Ceramic filters. Adjustable squelch. Battery/RF power meter. Built-in speaker and condenser mike. Jacks for a full range of accessories. Just 99.95* for the handiest CB ever. Sold only at Radio Shack!

Provision for push-to-talk mike

Special jack lets you use optional push-to-talk dynamic mike for one-handed communications with TRC-200 out-of-the-way. Just 11.95*. 21-1172.

Exclusive range-boost antenna

Range Boost: Grip the TRC-200 and the side panels electronically couple your body to the antenna for extra signal power on Receive and Transmit.

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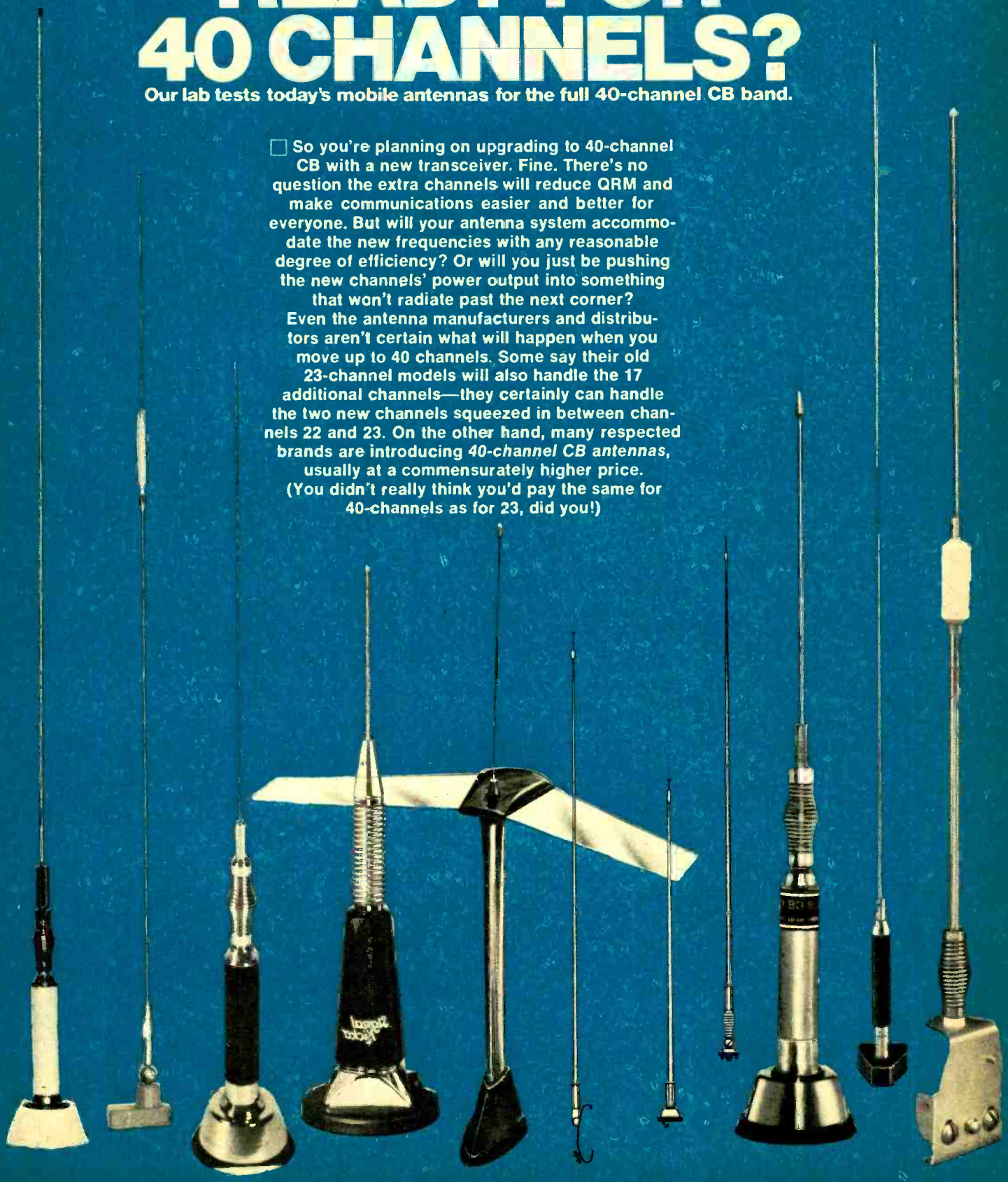
elementary Electronics
January-February '77

IS YOUR CB ANTENNA READY FOR 40 CHANNELS?

Our lab tests today's mobile antennas for the full 40-channel CB band.

☐ So you're planning on upgrading to 40-channel CB with a new transceiver. Fine. There's no question the extra channels will reduce QRM and make communications easier and better for everyone. But will your antenna system accommodate the new frequencies with any reasonable degree of efficiency? Or will you just be pushing the new channels' power output into something that won't radiate past the next corner?

Even the antenna manufacturers and distributors aren't certain what will happen when you move up to 40 channels. Some say their old 23-channel models will also handle the 17 additional channels—they certainly can handle the two new channels squeezed in between channels 22 and 23. On the other hand, many respected brands are introducing *40-channel CB antennas*, usually at a commensurately higher price. (You didn't really think you'd pay the same for 40-channels as for 23, did you!)



40-CHANNEL ANTENNAS

COMPARATIVE SWR PERFORMANCE FOR MOBILE CB ANTENNAS

Inches — Channel	1	5	11	19	25	30	40
108 Whip	1.6	1.5	1.3	1.3	1.3	1.5	1.7
108 Fiber whip, adjustable tip	1.3	1.3	1.3	1.3	1.4	1.4	1.5
44-50 adjustable top-load	1.3	1.3	1.3	1.6	1.6	1.7	1.7
76 Base-load	1.6	1.4	1.2	1.2	1.2	1.8	1.9
48 Topload	1.4	1.4	1.7	1.8	2.2	2.4	2.8
48 High-center-load, tuning tip adjustable	1.7	1.5	1.3	1.3	1.3	1.4	1.6
48 Top-load, tuning tip adjustable	2.2	2.0	1.8	1.6	1.5	1.4	1.5
42 Base-load, magnetic mount, center of roof	1.4	2.2	2.2	2.2	1.7	1.8	2.4
42-High-center load, tuning tip adjustable	1.5	1.5	1.7	1.8	2.2	2.4	2.8
42 Base-load	1.7	2.2	2.4	3.0	3.5	4.2	6.0
21 Center-load, rain gutter mount, adjustable tuning tip	2.8	3.0	3.5	4.5	5.0	7.0	8.5
23 Capacity tune "wing"	2.4	2.0	1.5	1.2	1.4	1.4	2.6
Center-load, electrical-disappearing antenna	2.4	2.0	1.6	1.2	1.3	1.4	1.8

SWR values were taken with antenna tuned either for channel 19, or other channel yeilding best value. SWRs shown are relative to 1. That is, 1.6 means 1.6:1.

Need a New Antenna? But *do* you need a new antenna for 40 channel coverage? Will a new antenna *really* reach out farther than that old stainless steel whip you've been dragging off the rear bumper through snow, salt spray, and dirt, and maybe even few fender benders for years?

The easiest way to see if an antenna will work over 40 channels is to install one on your car or truck and measure the SWR on channels spotted from number 1 through 40. Any antenna that can produce a reasonable SWR value—less than 3:1—will probably be adequate for full-40 coverage in the sense the transmitter will be able to load RF into the antenna system. At higher SWR values the transmitter generally puts only a small part of its potital energy into the transmission line.

In actual fact there are so many antenna types and brands presently available it would take months and months to test all of them for 40 channel coverage, so the editors of ELEMENTARY ELECTRONICS decided to see how "family" types perform. In this way we would only have to test two or three models of 48-inch base loaded whips to get a good idea of the representative performance of 48-inch base-loaded whip antennas as a group.

We Test a Lot of Em! We ordered, bought and borrowed samples of virtually all antenna makes and types used today on passenger cars. A few new 40-channel models were offered and they were included in the tests.

Each antenna was tested in its recommended placement on both full-size and compact cars. Position-for-position the SWR results are virtually identical for both cars so the figures in the chart can be accepted as representative of what you can expect on a family car.

When you have a lot of anything you start to notice things that usually pass unnoticed when dealing in small quantities. We had over thirty antennas, and the most striking thing we saw was the quality of construction. Some seemed designed to go to outer space and back intact, while others were pure garbage, with dissimilar metals such as aluminum and iron in contact and exposed to the elements (a sure formula for corrosion and early failure).

In one shock spring we found the shorting wire, usually heavy braid, looking like reject-quality solder "sipper," and we wouldn't give it three months, within a mile or so of salt water. Some antennas had assembly screws with slotted heads, instead of the common Allen (hex) head, and while it saves the few cents cost of a hexagonal wrench, this makes it very easy for someone to steal the antenna. One antenna was even supplied with a mounting screw specifically cut so it could be turned with a coin. We found in one instance that a magnetic-mount antenna broke off when we simply moved the car 10 feet to get a clear background for photographs—the antenna went sailing right over the hood when we put on the brake! We found hex screws too small for the job; they stripped the socket when being tightened. We found improperly-threaded trunk-lip brackets that couldn't be properly secured. We also found aluminum screws that stripped (steel should have been used), and well . . . you name the problem and at least one antenna had it.

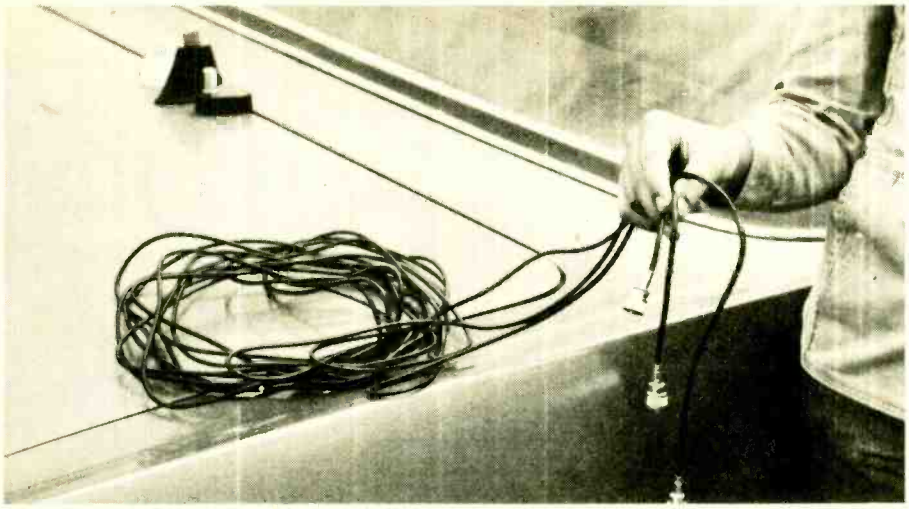
But as we said, there were some models so well made it looked like government space-shot hardware. And in particular, we were impressed that two manufacturers supplied "raincoats" for their antenna mounts—small caps to cover and protect the mount assembly when the antenna itself was removed to keep it from being stolen.

The purpose of our antenna tests was not to prove if one type or model was superior to another. All we want to know about is the performance of antennas presently available in terms of their 40-channel coverage. Since we would tune the antenna for channel 19 —the center of the 40-channel band— if antennas had a tuning adjustment, it is unfair to rate different models if we include those originally designed for channels 11 and/or 12—the center of the old 23 channel band.

How We Installed Em. All the "short" (loaded) antennas were installed in the center of the trunk lid, directly behind the rear window—the optimum most-commonly-used location for trunk-lip antennas. Magnetic mount antennas

Here our lab assistant examines a few of the more than 30 antennas we checked out.

Antennas shown on the previous page, reading from left to right, are Breaker's 10-245 gutter mount whip with center loading ($22.95), Anixter-Mark's Long Gainer base-loaded tunable ($31.75), Sparkomatic's adjustable SA-104 ($19.95), Pearce-Simpson's Convoy Kings (three models) all top-loaded with tunable tips ($28 to $35), Channel Master's Power Wing which is only 18-in. high with an 8-in. telescoping stub for fine-tuning; removes quickly for theft-foiling ($39.95), Turner's Sk-910 magnetic-mounting 46-incher ($28.00), the Royce 2-205 trunk-lip mounter which has a DC ground to minimize static buildup ($26.95), Newtronics trunk-lip mount HLM-27Z which has a matcher for AM & FM as well as CB ($31.95), and Antenna Inc.'s Protector, which is a base-loaded no-hole trunk-mounter ($28.88).



Here's how typical coaxial antenna cables look as supplied with trunk-lip-mounting whips. They just screw together, one end into the lip mount, and other end into CB set.

were placed in the center of the roof, again the usual location. Rain-gutter antennas were located directly adjacent to the center pillar on a 4-door car and full length whips were tested on the bumper mount of a compact sedan. In all cases the antennas were used with the mount and cable supplied since some cable lengths are different and we wanted to test the antenna exactly as it might be used by a CBer. Antennas that were supplied without mounts were installed in a popular, commonlly available trunk lip mount that is supplied with 18-feet of RG-58/U.

If you were to try duplicating these tests for comparison with our results you'd best make certain the vehicle's doors are closed and no car, person or antenna is nearer than ¼-wavelength (9 feet), for we discovered several antenna types are easily detuned by nearby objects. Remember this detuning effect the next time you see a CBer burning the pavement, with his antenna swaying back and forth.)

How They Stack Up. The results of the tests are shown in the chart. Keep in mind as we refer to the figures shown that while we tried to adjust the antenna for lowest SWR on channel 19, several antennas simply could not be tuned for channel 19 because their tuning devices were limited in adjustment range. Also, antennas that don't have any adjustment, such as the 48-inch top loaded whip, are factory tuned for the center of 23 channels.

Antenna models shown as center loaded have the loading coil slightly higher than the center of the antenna. The models indicated as *high center* loaded are almost, but not quite, top-loaded, with a small whip above the coil whose position is used for tuning the antenna.

If you take a close look at the chart you will notice a definite pattern, with two surprising exceptions. The most important pattern (or characteristic) is that full length whips (108-inches including shock spring) cover the greatest frequency range with the lowest SWR, with the least amount of trouble. Since their longer length also radiates more energy it's obvious the full length whip is really "king of the road".

Two Real Goodies. The new "tuned" full-length whip (fiber whip with adjustable tip) is even better, for the tuning permits the lowest values of SWR across all 40 channels.

Another new antenna that produced surprising results is the 44 to 50 inch adjustable top-loaded one. In this antenna the top-loaded coil is positioned or adjusted above the lower half and tuning is accomplished by moving the entire coil above the bottom section. This contrasts with the usual tuned, top-loading antenna where a small whip located above the coil is the tuning device.

Except for these two new designs, the antennas performed about as expected. The longer the antenna was, the wider its bandwidth, and the higher the loading coil, the wider the bandwidth. For example, a 76-inch base-loaded unit will have greater bandwidth (40 channel coverage) than a 48-inch base-loaded model, which in turn has a greater bandwidth than a 42-inch base-loaded antenna. In a similar manner, a 48-inch tunable high-center-loaded antenna has more bandwidth than a 42-inch high, center-loaded antenna.

The real surprises were two unusual antenna designs, which we did not, by just looking at them, believe could cover even 23 channels, let alone 40.

Were We Surprised! The first surprise was a high-center-loaded electric-drive whip that disappears into the trunk. Tuning this antenna was some

One of the best bumper-mounted antennas, with a springy base-loading coil. 108-in. whips tested out best.

Here noble assistant tightens mast holding "wing" antenna with a coin. When car is parked take the wing with you, or it's likely to fly away from your car fast!

e/e 40-Channel Antennas

results were worth the effort, as shown in the chart. If you need a disappearing antenna to prevent equipment ripoff the high-center-loaded type will work well. You can save time here by using the Sencore CB41 auto-null SWR meter.

The second surprise was a "wing" antenna only 23-inches high. This antenna is actually a short whip with the wing serving as a capacity load, an old trick used on many amateur's antennas. It produces a rather low SWR over quite a broad bandwidth, as shown in the chart. Just how good the capacity loading works can be seen by comparing the wing to a 42-inch base-loaded antenna that was mounted in the same location. Of course that wing is an open invitation to theft by every kid who passes by. However, it is secured by a coin-operated screw that allows instant removal for trunk storage. But remember that someone else's coin will fit just as easily as yours

Except for the small rain gutter-size antennas, and their mirror-mount cousins of the same size, which shouldn't be used even for 23 channel coverage, just about any of the larger antennas—48 inches and longer—will give adequate results for full-40 coverage. In actual fact, all antennas of this size should work, but from previous experience we know someone out there will try to make a fast buck

When it comes to other oddball designs you're on your own. Though we found these two "oddballs" worked well, other designs might not be even adequate for 23 channel coverage.

Summing Up. If we had to postulate one general rule for 40 channel antennas it's this: The longer it is and the higher the loading coil is, the better ■

☐ ELEMENTARY ELECTRONICS regularly publishes test reports on current CB transceivers. Only those models with FCC type acceptance and now on dealers shelves are included in CB Xcvr Checkout.

If you don't find the particular CB transceiver you are interested in reported on here, check your local newsstands for the 1976 CB Yearbook, which contains test reports on more than 140 different CB transceivers.

• BOWMAN CB-720

$173.95 (Bowman Astrosonix)

General Description: A 23-channel AM transceiver for mobile, PA operation. Power supply 12 VDC with negative and positive ground. Overall dimensions are 2-1/16-in. h x 5¼-in. w x 7¾-in. d. Front panel controls for Channel Selector, Volume, Squelch. Standard accessories are microphone, all crystals or PLL, mobile mount, DC power cable.

Receiver Section Test:

Input Sensitivity	1.5 μV
Adjacent Channel Rejection	49 dB
AGC Action	10 dB
Input Level for S9	60 μV

Transmitter Section Test:

RF Output	3.5 watts
Modulation to 85%	yes
Relative Sensitivity for 85% Modulation	—28 dB
Modulation Limited to 100%	no

Editorial Remarks: The CB-720 has a relative reading S-meter, internal transmitter tuning, double conversion, external and PA speaker jacks, and an S/RF output meter. ■

CIRCLE 52 ON READER SERVICE COUPON

• TEABERRY "STALKER TWO"

$429.99 (Teaberry Electronics Corp.)

General Description: A 23-channel AM/SSB transceiver for mobile, base, PA operation. Variable tuning ±1,500 Hz provided. Power supply 12 VDC with negative or positive ground and 117 VAC. Overall dimensions are 4¾-in. h x 13⅛-in. w x 10½-in. d. Front panel controls and switches for Channel Selector, Volume, Squelch, Clarifier, RF Gain, SWR Calibrate, AM/LSB/USB, PA/CB, Noise Blanker. Standard accessories are microphone, all crystals or PLL, DC power cable, AC power cord.

CIRCLE 50 ON READER SERVICE COUPON

Receiver Section Test:

Input Sensitivity	0.6 μV
Adjacent Channel Rejection	66 dB
AGC Action	13 dB
Input Level for S9	10,000 μV

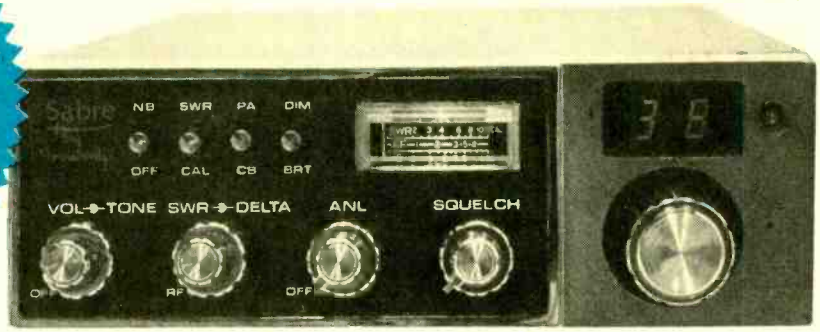
Transmitter Section Test:

RF Output	3.8 watts AM, 15 watts PEP
Modulation to 85%	yes
Relative Sensitivity for 85% Modulation	—27 dB
Modulation Limited to 100%	no

Editorial Remarks: The Stalker Two has an S-meter that reads 10 dB per S-unit, internal transmitter tuning, double conversion, external and PA speaker jacks, SWR meter, and an S/RF output meter. ■

e/e EXCLUSIVE LAB REPORT

First Look at a...



40-CHANNEL CB RIG

Our lab tests the first available prototype—the Browning Sabre-40.

EVER SINCE THE FCC announced, last summer, that the CB band would be expanded to 40 channels effective January 1, 1977, there've been a lot of questions to answer. Would it lessen the crowding on 23 channels in the big cities? How would 40-channel CB transceivers be built? Would the channel numbers be squeezed down to a gnat's eyelash to fit a 40-position selector switch? Would the transmitter's output circuit be so narrow the RF power on channel 1 would be much lower than channel 20, 30, or 40? Or would the receiver be hot as a firecracker on channel 40, near dead as a doornail on channel 1?

These suggest some of the problems we expected to find in the first models of 40-channel transceivers. There are often quickie designs that suffer many ills in first production models of much electronic equipment.

Gratifyingly this won't be the case, judging by the first 40-channel set to be tested, Browning's Sabre. It's possible to make one heck of a 40-channel transceiver first try, for the problems anticipated are non-existent in the Sabre. Since we put the Sabre through its paces on the test bench we're not going to accept any excuses for inferior 40-channel coverage. If Browning can do it right the first time there's a good chance other manufacturers will come out with sets which cover all 40 channels well, and this bodes well for the entire industry.

The Sabre Upgraded. If the photographs of the 40-channel Sabre look familiar it's because it is basically the well-respected, high-performance 23-channel Sabre, upgraded with a PLL (phase-locked loop) frequency synthesizer and additional harmonic suppression to give full 40-channel coverage with minimal TVI.

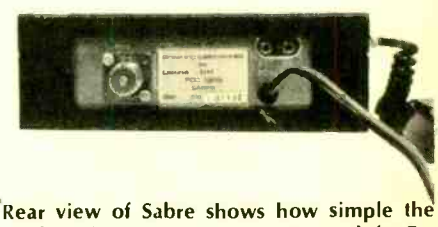
Starting with the front panel, you'll find a selector switch with an LED. channel indicator, each LED numeral a half-inch high—easily seen by the driver even if the rig is on the passenger side of the dash. Along the bottom edge of the front panel are concentric volume control and variable *Tone* control, a continuously-variable *Delta* tuning control concentric with a *Calibrate* control for a built in SWR meter, a continuously variable automatic noise limiter (ANL) control, and the usual *Squelch* control.

Located above the controls are switches for a noise blanker, SWR calibrate/read, PA/CB (permits use as a paging—PA—set) and meter lamp dimming. To the right of the switches is a combination S/RF output/SWR meter. The microphone plugs into a jack on the left (driver) side.

The rear apron has a standard coaxial connector for the antenna and jacks for PA and external speakers.

Anti-theft Features. Though provided with a standard mobile U mounting bracket, the unusual attaching screws are actually an anti-theft device. These screws have neither the standard slot or the Phillips "cross". Instead, there are two clutch indents that require a special pronged tool, which is provided with the transceiver. Each screw has a rounded cap that resists being gripped by pliers. If anyone tries to rip off this rig he's going to have one heck of a job without the special pronged screwdriver. While anything can *eventually* be removed from a dash, the Sabre

Prototype Browing Sabre with 40-channel selector set to the top of the CB band (as of January 1 and afterwards). Connections inside are made so that Channels 22 through 26 are selected in correct numerical order, although actual assignments are, in order, 22, 24, 25, 23, 26, 27 and so on.



Rear view of Sabre shows how simple the hookup is. Antenna connects at left, External/PA speaker at right of panel.

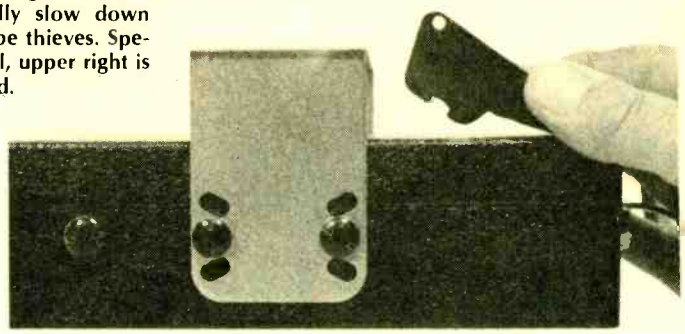
would take so long to get out without the special tool that most thieves will look for easier pickin's, or disappear when your car's burglar alarm goes off.

Performance Plus. Okay, now that we've covered appearance and operating features let's get down to the nitty gritty, the actual operating performance. Power output into a 50-ohm dummy load was 3.2 watts from channels 1 through 19, and rose to 3.3 watts by channel 40. You could say the Sabre has constant RF output across all 40 channels. A more-or-less standard microphone sensitivity of −20 dB produced better than 85% modulation on negative peaks, with full 100% modulation limiting. The modulation quality was unsually clean and crisp, providing outstanding reception even on small inexpensive *hand-helds* (walkie talkies). Everyone who received the signal from the Browning Sabre commented on the excellent modulation.

Receiver Is Tops, Too. The receiver section also proved a winner. Sensitivity for 10 dB signal plus noise-to-noise ratio (10 dB S+N/N) measured 0.42 uV on channel 1, increasing in sensitivity to 0.35 uV at channel 40. This is outstanding sensitivity, for any number of channels. Adjacent-channel rejection was better than 55 dB, and was limited by an increase in background noise rather than in interference from adjacent-channel modulation. The delta tuning control, which is continuously variable rather than two-step (it's really a *fine tuning* control), though spec'd at +1.5 kHz, measured +500/−1500 Hz—more than adequate for normal operations when compensating for the received signal being off the center channel frequency.

Speaking of center channel stability the Browning Sabre was more accurate than some of our lab-grade test equipment!

Unlike conventional crystal control where the tolerance for each channel is determined by the crystals used to generate the oscillator output for each channel, the output frequency tolerance for each channel from a PLL synthesizer is determined by the tolerance of the single PLL control crystal, and at most, one other crystal. Thus the tolerance for any particular channel is the same as for any other channel—you cannot wind up transmitting on the high side of one channel and the low side of another. From a cold start the Sabre's transmitter output frequency was within 13 Hz, well within the normal tolerance of our frequency counter. After a fifteen minute warmup the frequency tolerance was within 20 Hz, still inside the tolerance of the counter. When you consider that many transceivers have channel frequency tolerance of 400, 500 and even 800 Hz, you get some idea of the quality built into the Sabre.



Unusual configuration two locking screws will materially slow down would-be thieves. Special tool, upper right is required.

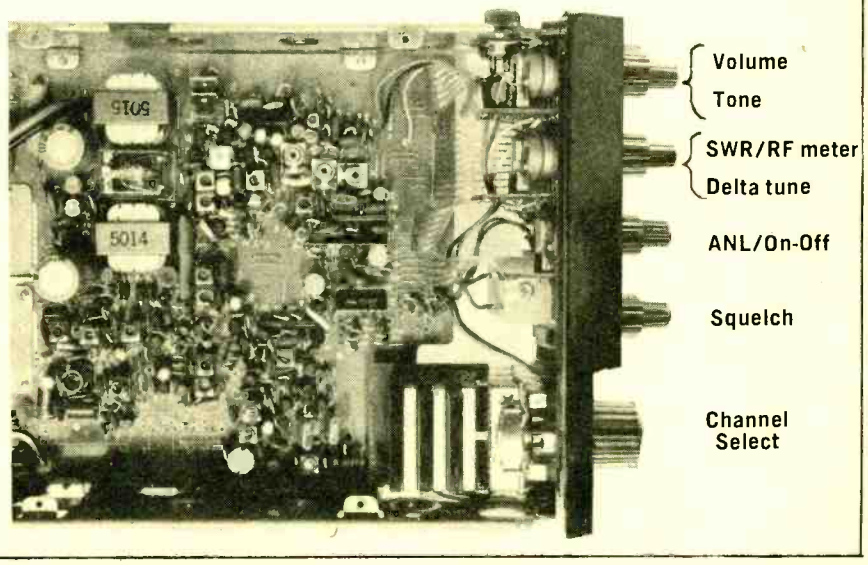
Noise Blanker and Limiter. Finally, we come to the noise blanker and noise limiter. Both worked as well as those you're likely to find in the better quality equipment. Though the noise limiter has a continuously variable adjustment —full *off* is extreme anti-clockwise, it had little variable effect—it switched in at almost full limiting level. There was no measurable variation over most of the control's range—at extreme clockwise there was a slight jump in additional limiting. This control could just as easily be a two-position switch.

The SWR meter, combined with the S/RF-output meter, works the same as it does in other transceivers. While not generally needed for day-to-day operations it's an invaluable aid when you install or adjust a mobile antenna system. And it also saves the cost of an accessory SWR meter.

Summing Up. As you can tell by the high performance characteristics of the Browning Sabre, there's no problem in getting top performance from a 40-channel AM transceiver. Whether this is also true of SSB 40 channel transceivers is something we'll have to wait to see until we complete the evaluation of a 40-channel SSB model we're checking for our next issue.

For further information on the Browning Sabre 40-channel CB transceiver, circle number 72 on the Reader Service coupon. ■

With bottom cover plate removed, this inside view of Browning's Sabre shows the 40-position channel-selector switch at the lower right of the photograph. The five control knobs at right include two dual controls (the top ones). Most of the parts are on one printed circuit board which is connected to the controls by flat, flexible, multi-wire cables (except for channel-selector switch, which is wired directly to the board).



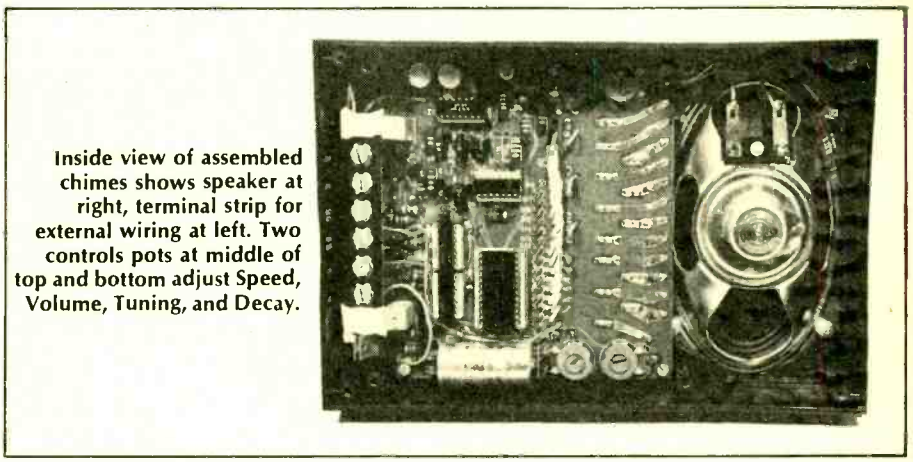
e/e checks out the...

Heath TD1089 Programmable Electronic Chimes

Easy two-evening project plays any tune you choose.

☐ Throwing a party at home, and want to make a splash with the people when they ring your bell? You can program these chimes to play Hail, Hail, the Gang's All Here, Beat Me Daddy, Eight to the Bar, or any other happy tune you choose. Children's party? You can welcome those guests with Mary Had A Little Lamb when they press the doorbell. Christmas? Your door chime plays Jungle Bells. A birthday? It's Happy Birthday. With Heathkit's TD-1089 Programmable Door Chimes you can welcome visitors to your home with sixteen notes from any song, spanning a full octave from middle C with all the sharps and flats.

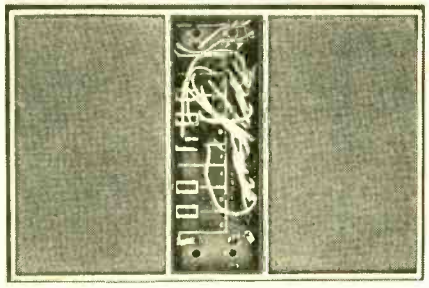
The TD-1089 is completely electronic, there are no motors, cams, or levers. Housed in a cabinet 8⅝-in. wide x 5¾-in. high x 2⅝-in. deep the TD-1089 looks like any other small door chime, but instead of solenoids and tone bars the cabinet conceals an electronic music synthesizer, front and rear door ring controls, a voltage regulator, audio amplifier and a loudspeaker. Everything needed for electronic chimes except the power transformer is built into the cabinet. The power transformer is the standard 16-volt doorbell transformer available in most hardware stores. It can be located anywhere in the home with ordinary bell wire used to connect the electronic chimes—the exact same arrangement most of us use for standard doorbells and chimes.



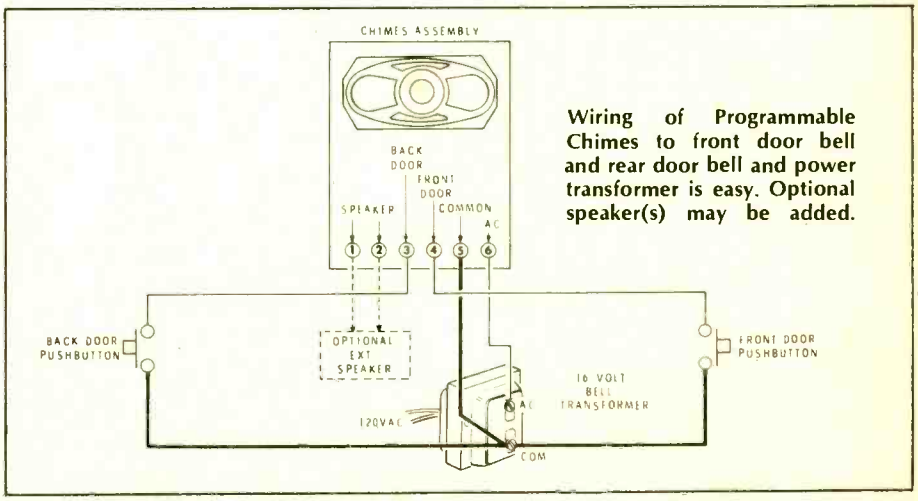
Inside view of assembled chimes shows speaker at right, terminal strip for external wiring at left. Two controls pots at middle of top and bottom adjust Speed, Volume, Tuning, and Decay.

More Sound, Too. Though the TD-1089 has a built in speaker capable of substantial volume, terminals are provided for remote or extension speakers that can be placed in remote corners of your home, down in the shop, or out in the garage.

Several user adjustments are provided: A *tuning* control to set the scale to a full octave; a *beat* control that ranges from the stately "Hymn of Thanksgiving" to "Happy Birthday"; a *decay* control that "tunes" the electronically generated sound to a chime-like sound (a slow beat requires a different setting than a rapid beat), and a *volume* control for the audio output amplifier (which affects the level of the internal



Front view of chimes with programming panel cover removed. Programming wires may be replugged anytime to change tune. For more information circle number 31 on Reader Service Coupon.



Wiring of Programmable Chimes to front door bell and rear door bell and power transformer is easy. Optional speaker(s) may be added.

e/e CHECKS HEATH CHIMES

and remote speakers).

The entire circuit—except for the speaker, is assembled on a single printed circuit board. The front of the board has the programming wires and terminals, which are accessible through a removable front panel, as shown in the photographs. Though it looks like the programming wires are a rat's nest, it is all reasonably neat and orderly while you're programming—it gets messy-looking when the wires are folded down and out of the way.

The wires that program the notes for each beat are arranged in an orderly line numbered 1 thru 16. The terminals for each note are clearly marked, for example E, F#, A# (B-flat), etc. There are three terminal posts for each note, allowing the note to be programmed for three separate beats. If you require the same note for more than three beats you can use one of three auxiliary circuits, actually an extra three terminals per auxiliary that can be connected to a note, thereby providing up to five connections for each note.

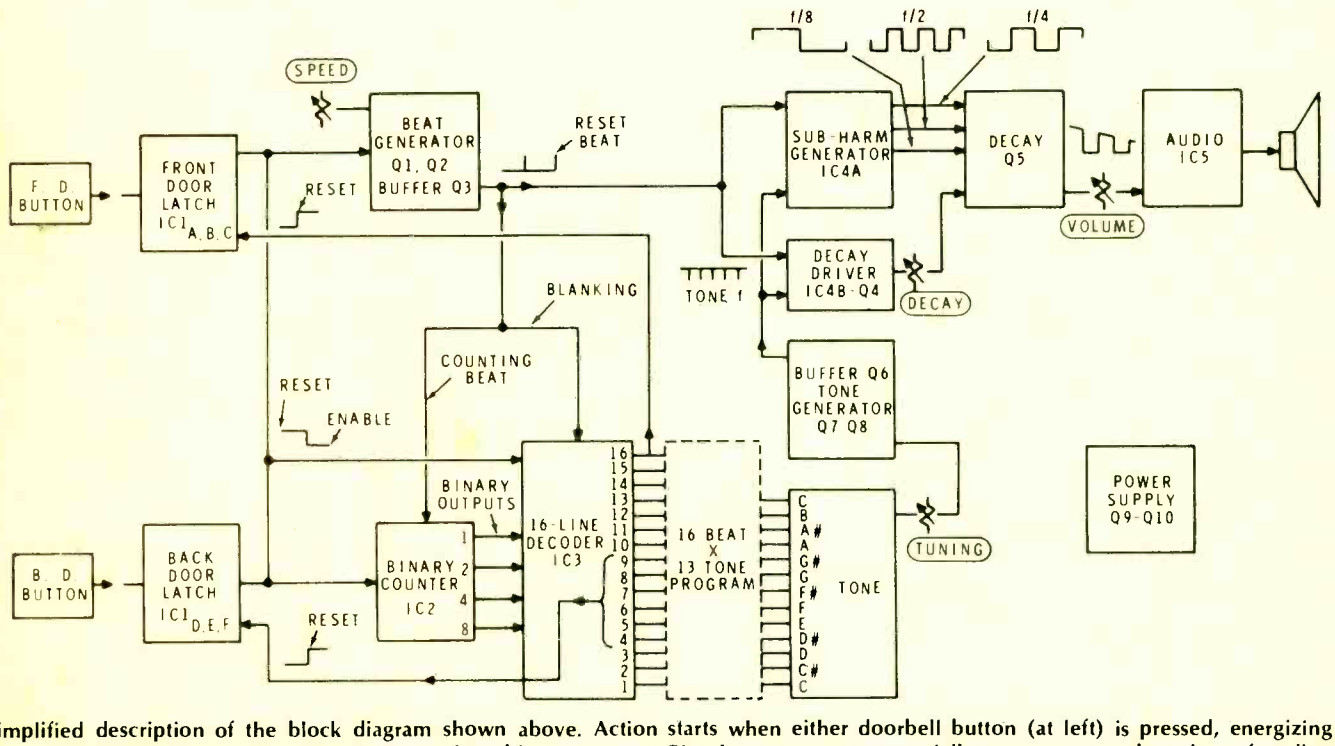
How to Hook Up. In addition to the terminal post connections for the notes and the auxiliaries there are posts labeled 4, 5, 6, 7, and 8, and a small programming wire that plugs into any of these posts. This is the programming for the rear door. When the front doorbell is pressed all sixteen beats (notes) will be played. When the rear doorbell is pressed only those notes programmed: 4, 5, 6, 7 or 8, will be played. In this way you know if the guest is at the front or rear.

Quick Test Provision. A special set of test terminals is provided so you can check the front and rear tunes without going to the doorbells. Simply touch the test wire to the F (front) terminal and the entire sixteen beat melody plays. Touch the test wire to the B (back) terminal and the programmed number of beats for the back (rear) door plays. In this manner you can easily check the programming for any melody. The 72-page instruction manual lists the correct notes and beat programming for twenty three melodies including Happy Birthday and Shave And A Haircut, Two Bits, but you can program virtually any melody that can be compressed into one octave. The manual also has detailed troubleshooting procedures in case you've done anything wrong.

Summing Up. The Heathkit Programmable Electronic Chimes, priced at $44.95 in kit form (mail order), worked as well as claimed and better than expected. Because the scale has sharps it is possible to program a complete melody, rather than a "simplified" melody as required when only natural notes are available. It is also possible to program a beat to be note-free, thereby maintaining the expected rhythm and melody. Overall, the Heathkit electronic chimes is quite a sophisticated device even though it can be built, tuned, and programmed by the average electronic hobbyist. (Assembly is more than a beginner's project". But certainly not an intermediate or advanced level.)

One word of caution, however. You cannot generally substitute the electronic chimes directly for the usual electromechanical door chimes installed by the builder because they work off three wires—a common power wire and front and rear doorbell wires. The electronic chimes, however, require four wires for fornt and rear circuits because both power transformer wires must be connected to the unit in addition to a wire from the front and rear doorbells. Be certain you can snake the additional power transformer wire to where the electronic chimes will be installed.

For additional information circle number 31 on the Reader Service coupon. ■



Simplified description of the block diagram shown above. Action starts when either doorbell button (at left) is pressed, energizing beat generators Q1 & Q2. Their output pulses drive binary counter IC2 whose output sequentially expresses numbers in a four-line (binary) code which is decoded by IC3. These signals are routed via the programmed hard-wiring into the tone generator which drives the decay driver and subharmonic generator IC4A. After level set by the volume adjust, the signal is amplified to drive the speaker(s). IC1 contains two latches, which ensure that only one pushbutton has control until the entire tune sequence is completed.

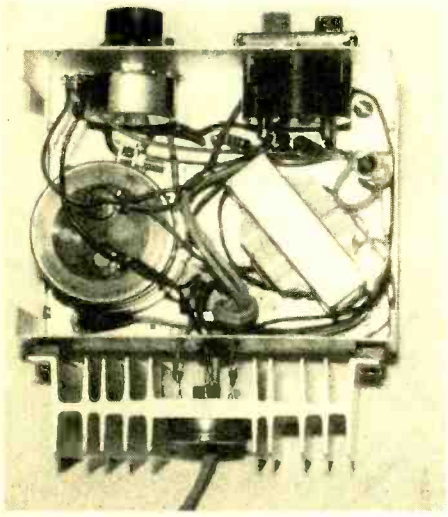
POWER UP

FOR ANTIQUE RADIOS

Collectors can power the filaments of old radios with this simple supply as well as supplying all the power for modern equipment.

by Jim Fred

☐ One of the most important things the serious antique radio collector needs if he wants to make those old radios work, is a power supply for heating the filaments of those ancient tubes. This is a low-voltage, variable output DC power supply. If you have an old enough tube manual you will find that various antique tube filaments need voltages of 1.1 to 5, as well as 14 volts DC at currents ranging from .06 to as high as 0.3 amperes. In addition to using it for operating the filaments of antique radios you can operate transistorized car radios when testing or repair them on the bench, and even charge many kinds of batteries, provided you don't try to draw much more than about 1.5 amperes of current from this supply. You might even use it for electroplating the nickel-plated binding posts, knobs, hex nuts, washers and lever-type switch handles which most antique radios built before 1928 have (such as Aeriola Jr. and Sr., and the Radiola III and IIIA).



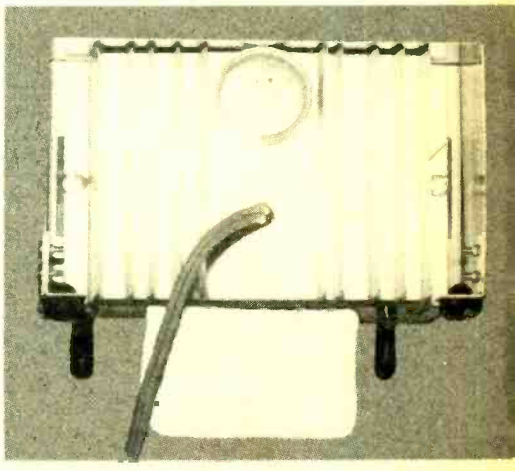
Top view of power supply shows placement of the parts. Small parts location is not critical. Keep leads short, and taut.

Now I love old tube radios, and I hate the new transistor sets, but transistors and diodes do have their proper place, and one of those is in power supplies such as this one.

This unit can supply from zero to 13 volts DC, at currents up to 1.5 amperes. This will handle the filament requirements of most sets with up to five tubes. For instance a one-tube Crosley Pup requires 3.3 volts at .063 amperes, while a six-tube set may require 5 volts at 1.5 amperes. Most pre-1928 battery sets fall within these limits.

How It Works. The transformer steps the line voltage down to 12.6 volts, which is changed into pulsating DC by the bridge rectifier. The switch is used to turn the power on and off while the pilot light indicates that the power is on. The capacitor smoothes out the pulsations and helps prevent hum in the radio whose filaments are being lighted. The potentiometer varies the voltage applied to the base of the power transistor. Varying the base voltage changes the operating characteristics of the transistor and causes the output voltage to vary.

How To Build It. This project is an ideal one for the beginning collector. There are no etched circuit boards to make, nor any critical wiring. You can make the supply as simple or as fancy as you like. If you will look at the photographs you can see that I made the cabinet from scratch, rescaled the meter, and made the dial plate. You too can add these distinctive touches to make a one-of-a-kind power supply. I do this because I enjoy designing and building from scratch and also because I don't like the garden-variety gray ham-



Rear view of power supply shows mounting of regulator transistor on massive heat sink. Long rubber feet (bottom) are optional.

mertone boxes you can buy. For those of you that don't want to spend the time I have called out easily-obtained commercial parts and sources in the parts list.

Construction. The photographs show where the parts are placed inside the cabinet. Arrange the parts you are using in the approximate positions shown and mark the mounting holes. The holes in the bottom of the box are 5/32 inch in diameter to clear 6/32 machine screws. All components are mounted with ⅜-in. long by 6/32 pan head screws and hex nuts.

The panel is similarly marked by laying the parts down and marking their location. The potentiometer specified needs a ⅜-in. hole; the switch and pilot light holes will depend on the parts you use. On the back of the box are the holes for the transistor leads, the line cord grommet, and the heat sink mounting blocks.

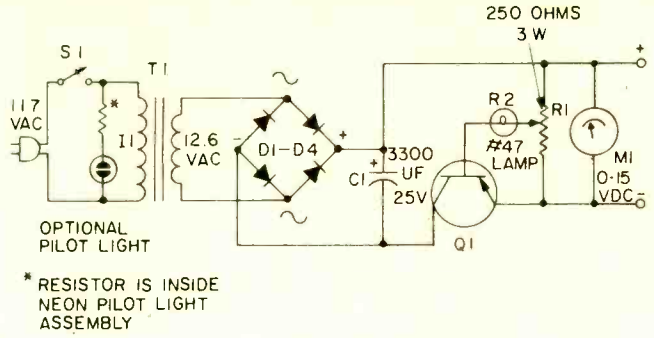
Final Assembly and Wiring. Mount all the components in the bottom of the box, and place the insulating blocks on the back of the box. Be sure the mounting screws are short enough that they do not go all the way through the blocks and short the heat sink to the aluminum box. The collector lead of the transistor connects directly to the body of the transistor and is in turn fastened to the heat sink. Use a lock-type solder lug to mount the transistor to the heat sink.

Mount the front panel components with the proper hardware. After mounting the meter lay a soft cloth on the bench so the plastic meter face will not be damaged. Insert the rubber grommet, run the line cord through it and the clearance hole. Now you are ready to wire all the parts together. Follow the schematic drawing carefully and you will have no trouble.

Testing It Out after you are sure everything is wired correctly, the transformer primary and secondary connected properly, polarity correct on the rectifier, capacitor, meter, and binding posts, you are ready to plug it in. Turn the potentiometer in a clockwise direction to turn the switch *On*. The pilot light should light. If there is no smoke turn the knob clockwise and the meter should begin to indicate. With no load the meter pointer may go off scale. You will exceed 15 volts output only if you have no load on the power supply. The meter reading should be quite linear with the rotation of the voltage control.

Caution. Because the collector of many power transistors is connected to the outside case of the transistor, you must take care to isolate the negative output (emitter, in this circuit) of the power supply from the case. That's because the heat sink, being tied to the outside of the aluminum case, is not at quite the same (negative) potential as the negative output terminal. Another way of handling this problem is to do what I did—mount the heat sink on insulators before securing it to the aluminum cabinet. Then the negative output terminal can be tied to the case, as in most DC supplies.

You now have a power supply to be proud of, and you have a useful addition to your electronic workshop. In addition to operating antique battery radios, you can operate transistorized auto radios and even charge many kinds of batteries. Just remember you are limited to 2 amperes of current. ■



PARTS LIST FOR ANTIQUE RADIO POWER SUPPLY

C1—Electrolytic capacitor, 3300 uF or more, 25 or more volts (Radio Shack 272-1021 or equiv.)

D1-4—Bridge rectifier, 2-A, 50 or more volts (Radio Shack 276-1151 or equiv.)

I1—indicator neon lamp assembly, including limiting resistor, for 117 VAC (Radio Shack 272-705 or equiv.)

M1—Panel meter, 0-15 volts DC (Allied Electronics 701-8108 or equiv.)

Q1—Power transistor, PNP, 3-amperes or more collector current (Radio Shack RS-2006 or equiv.)

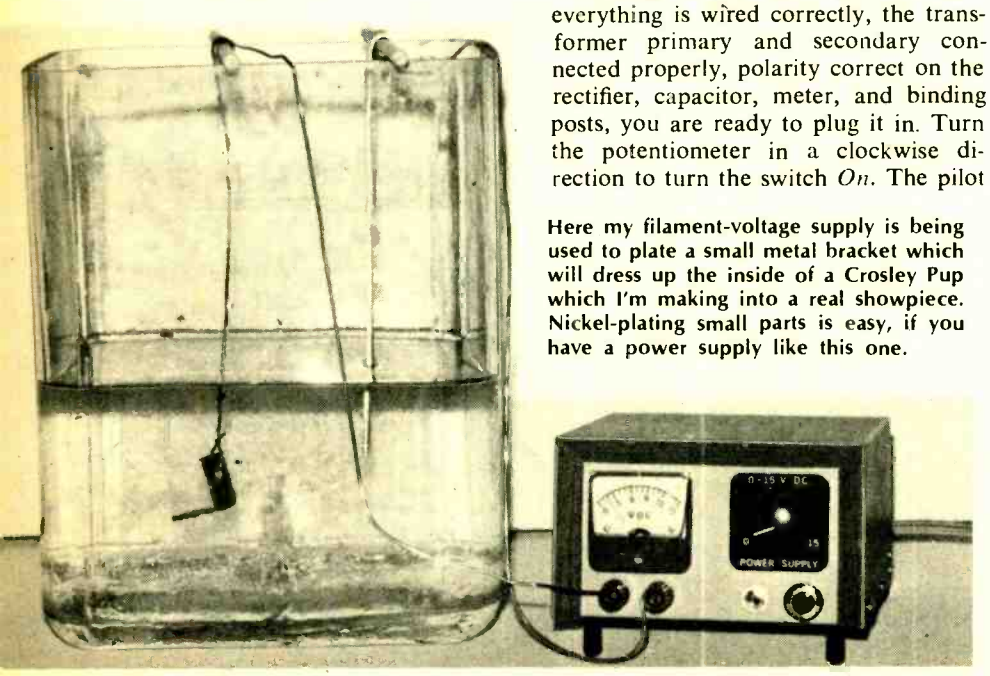
R1—Potentiometer, wire wound, 250-ohm, 3 or more watts (Allied 854-7725 or equiv.)

R2—No. 47 incandescent pilot lamp used as variable resistor, 150 mA, 6.3 V, bayonet base.

S1—AC power line switch. SPST (Radio Shack 275-602 or equiv.)

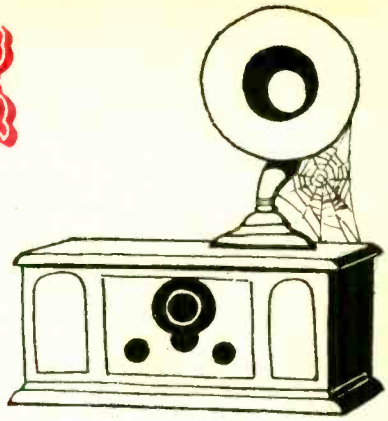
T1—Power transformer, 117 VAC to 12.6 V, 1.2 A or more (Radio Shack 273-1505 or equiv.)

Misc.—Transistor heat sink (Radio Shack 276-1361 or equiv.), binding posts (Radio Shack 274-661 or equiv.), cabinet, aluminum approx. 5-in. x 3-in. x 6-in. (Radio Shack 270-253 or equiv), socket for #47 lamp (Allied Electronics 844 R 2105 or equiv.), knob, heat sink insulators, dial plate, line cord.



Here my filament-voltage supply is being used to plate a small metal bracket which will dress up the inside of a Crosley Pup which I'm making into a real showpiece. Nickel-plating small parts is easy, if you have a power supply like this one.

ANTIQUE RADIO CORNER



by James A. Fred

☐ Hello out there in Radioland! It seems as though the old battery radios and speakers are coming out of the woodwork these days. At every antique radio meeting I attend there is a new supply. Another good thing is the number of old radio parts that are becoming available. A large number of battery sets must have been torn apart in the 30's and 40's. You will see lots of boxes of coils, condensers, (capacitors) rheostats, dials, and other parts.

Where'd The Parts Come From? Did the earlier experimenters do this to obtain parts to build one or two tube radios, or did they have other reasons for dismantling so many radios? I have a friend who told me that he used to buy 5 tube, TRF, 3 dial tuning radios for 50¢ each in the early 30's. He and his friends would take them apart, use a few components and discard the rest. I have heard this story repeated many times during the last few years. If you need a socket, rheostat, or other odd part to complete one of your radios you should go to the nearest antique radio club meeting. You will probably find the part you need there.

New Book on Scott Radios. I received my copy of "Silver Ghosts" by J. W. F. Puett and was very pleased with it. Mr. Puett publishes the Classic Radio Newsletter which contains interesting information about Scott and McMurdo Silver radios.

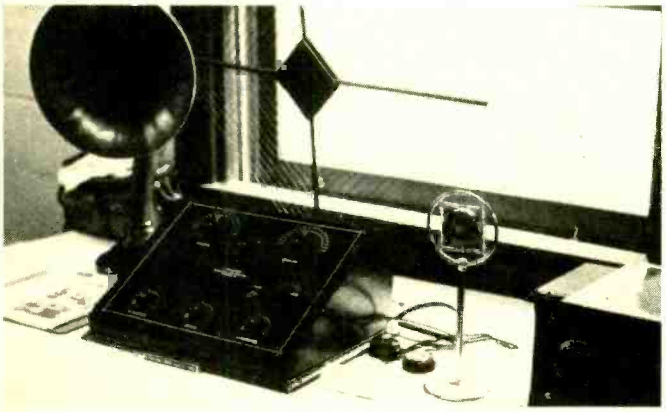
Silver Ghosts is a photo-offset printed book of 70 pages, it is 8½ by 11 inches, and has a soft cover. It consists of biographical information about E. H. Scott, many photographs of Scott radios.

E. H. Scott was born in Dunedin, New Zealand on June 1, 1887. His father and mother both were dead by the time he was fourteen years old. From then he made his own way in life. When World War I started he enlisted in the Australian-New Zealand Army Corps and went to serve in France. While there he became interested in automobiles and when the war ended he came to the United States and settled in Chicago, Illinois. During the next six years he wrote hundreds of newspaper articles on automobile repair and radio set construction.

In 1924 he started production of matched sets of IF transformers. This led to the production and sales of complete receivers. The radios he produced had superior tone, performance, and appearance. Things went well until World War II after which, discouraged by deficits and uncertain about the future of radio, Scott sold his 6000 shares in the company. Later problems with company management led to his resignation. He moved to British Columbia, Canada and passed away in 1951. The radios he designed remain as a monument to his genuis. He once said," "The fine things are always made by hand".

Silver Ghosts is a book I can recommend to all collectors of antique radios. Whether you are a beginner or a seasoned collector you will find this book informative and enjoyable. It costs $10.00 postpaid, from Puett Electronics, P.O. Box 28572, Dallas, TX 75228.

Southeastern AWA Meeting. Recently my wife and I attended the Southeastern AWA regional meet held in Winston-Salem, NC this summer. The meet was well attended and well worth driving 700 miles to get to. There was a flea market where you could buy battery and AC-power radios, speakers, tubes, and books. Displays and judging of old radios in the following categories were: Best Homemade, Oldest, Best Restored, Most Unusual, and Oldest Component. Professor Marshall Helms gave a talk on building a 100% homebrew receiver in the manner that a boy might have built one in the 1920s. A Question and Answer technical panel was conducted by James



Lyradion receiver made in Mishawka, Indiana in 1924 has directional loop antenna and horn loudspeaker.

Some of the many antique radios on display at the IHRS summer meeting at Battleground, Indiana.

e/e ANTIQUE RADIO

Fred and George Haymans. A Restoration Panel conducted by Robert McFarland and Bob Lozier illustrated many methods used to restore old radios. The meet closed with a banquet on Saturday night at which Charles Brelsford, President of the AWA, was the featured speaker.

Portland Collectors Club. Out in Portland, Oregon there is a new club for collectors of antique radios, vacuum tubes and related items. It is the Northwest Vintage Radio Society at Box 13544. Portland, OR 97213. They welcome members from anywhere in the world. If you live over 100 miles away from Portland you can join as an associate member for only $4.00 per year. You will receive the club bulletin "Call Letter", which is published and mailed monthly to all members. Associate members are invited to attend the swap meets and special meetings held throughout the year, but aren't allowed to vote on any club business.

The bulletin is very well done and is well worth the $4.00 fee.

Antique Radio Catalog. If you have an interest in British radios, tubes (valves), books or other component parts you should have a copy of the Tudor Rees Antique Wireless Catalog. It has all the above items plus many more radio parts that can be used to build or repair old radio and wireless equipment. The catalog is available by airmail if you send $2.00 to Tudor Rees, Vintage Services, 64 Broad Street, Staple Hill, Bristol BS16-5NL, England. The catalog also lists 9 series of books on the history of radio and wireless in Great Britain. There is also a new book available titled "Vintage Crystal Sets" which I will review.

Selecting Rheostats For Old Radios. A number of readers have inquired as to what size rheostat to use to replace open or burned out ones in the old radios. Here's how. To figure what size rheostat to use, it is necessary to know the battery voltage, the filament voltage, and the current drain of the tube(s) being used. Some radios used a rheostat in series with each tube filament, while other sets had one rheostat for two to five tubes.

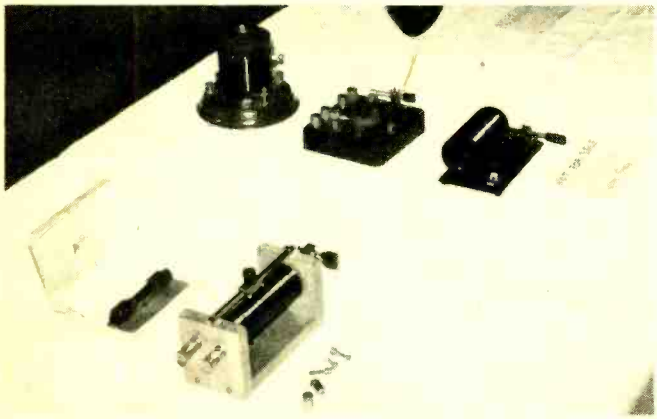
Let's take a case with one UX-201A tube, which requires 5 volts at a current of .25 amperes. This current is as high as can be economically supplied by dry cell batteries. Whether you use four 1.5 volt dry cells in series to produce 6 volts, a six-volt lantern battery, or a six-volt storage battery you will have 1 volt too much (6-5 = 1). Remember the electrical *resistance* in ohms necessary to use up the excess 1 volt is equal to the *voltage* excess divided by the *current* or 4 ohms. Now this formula is derived from Ohms Law (E equals I times R, or $R = E$ divided by I) which all collectors should be familiar with. Rheostats in the old battery sets were between 6 and 30 ohms, so in our example we would use a 6-ohm rheostat. As another example, suppose we have a WD-11 tube that requires 1.1 volt at .25 amperes. Here the size of the rheostat required is equal to 1.5 minus 1.1, divided by .25 —or 1.6 ohms. In this case we would use a 6-ohm rheostat.

Another question is whether the rheostat should be placed in the positive or negative lead to the tube filament. When 45 volts was the B battery voltage usually used on audio amplifier tubes no one used a C battery. But a C battery properly connected into the circuit will often improve the audio quality, and also reduce the amount of current drawn by the tube.

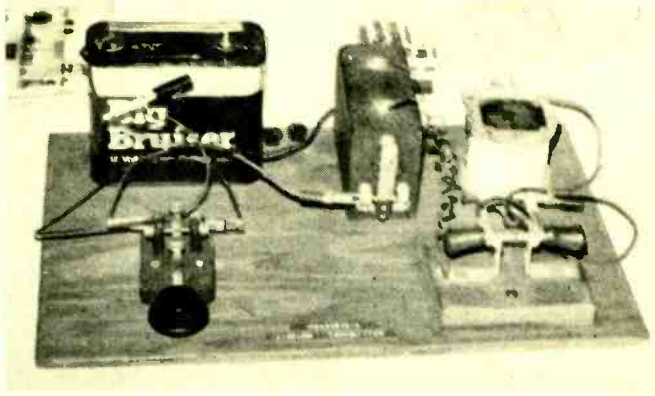
When a "C" battery isn't used it is possible to obtain a negative bias for the tube grid by connecting the rheostat in series with the negative filament lead. The negative side of the filament is taken as the voltage reference point for a vacuum tube and all voltages are measured with reference to this point. By connecting the rheostat between that point and the negative A battery terminal, this point becomes negative with respect to the reference point by an amount equal to the voltage drop across the rheostat.

Such biasing depends on the setting of the rheostat, which in turns depends on the condition of the A battery. When the battery is fully charged the drop across the rheostat will provide a proper bias. As the battery voltage drops the rheostat must be decreased in resistance to provide the proper filament voltage for the tube. This reduces the negative grid bias voltage. When we are using C batteries the trouble with placing the rheostat in the negative leg is that as the battery voltage falls and the rheostat resistance is lowered to increase the filament voltage, the value of the bias voltage is decreased. This will affect the fidelity and power output of this tube. It is much better to put the rheostat in the positive leg of the filament and then the C battery bias voltage will remain independent of the condition of the A battery, and of the setting of the rheostat. The diagram shows the proper way to place the rheostat in the positive leg of the filament.

Audio Frequency Amplifiers. It isn't wise to connect the plate of a vacuum tube directly to the grid of the following tube. That's because the plate requires a positive voltage to produce a current flow, while the grid usually requires a negative voltage to produce its variation in voltage. Amplifiers are classified according to the type of device used for connecting or coupling one tube to another. The three types



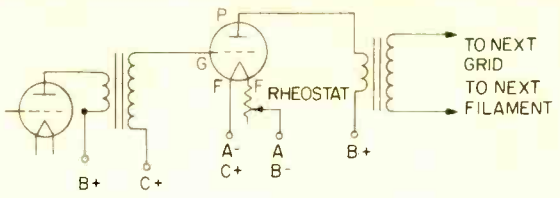
Four early crystal receivers are pictured at the Southeastern AWA Conference last summer, Winston-Salem, N.C.



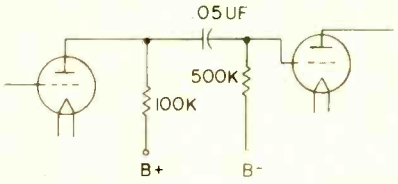
Arc transmitter using a model T (or A?) Ford spark coil. Output was pretty rough, covered a wide band of frequencies.

are: 1. Transformer coupling; 2. Resistance coupling; 3. Impedance coupling.

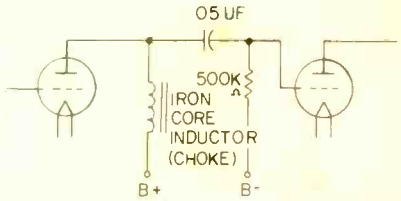
The vacuum tube acts to amplify the signal voltage. Transformers used to couple two tubes together also usually step up the signal voltage. An audio transformer is made up of two windings: one is the primary and the other the secondary. The primary is usually wound on an insulated form with the secondary insulated from it and wound on top of the secondary. An iron core is inserted into the hollow insulated form. The usual ratio of the turns of wire in the coils is 2, 3, or 6 although there are some with a ratio of 10 to 1. The primary of a stepup transformer is always the one with the smaller number of turns. Best results are obtained when the impedance of the transformer matches the circuit to which the winding is connected. The primary winding is placed in the plate circuit of the tube, with the secondary connected into the grid circuit of the following tube.



Schematic of transformer-coupling in early receiver also shows how to connect rheostat for applying exact voltage to tube filament, as well as C battery, for grid bias.



Resistance coupling method costs less than transformer coupling but it relies entirely on tubes for its amplification.



Impedance coupling is similar to resistance coupling, but uses choke (inductor) in place of the plate resistor. Provides higher gain.

Resistance Coupling. This type of coupling provides no amplification except that supplied by the tubes themselves. It has the advantage of supplying nearly flat frequency response without distortion. The variation of plate current in the plate load resistor produces across it a varying voltage drop which actuates the grid of the following tube. So that the plate voltage applied to the first tube will not be impressed on the grid of the following tube it is necessary to insert a DC blocking capacitor. The grid is kept negative by the grid resistor, or if necessary, by a C battery.

Impedance Coupling. This method uses an inductor (choke coil) instead of a resistor in the plate circuit. The inductor may be of any form provided its impedance is of a high value over the whole audio frequency range. All the amplification is provided by the vacuum tube just as it is in the resistance coupled amplifier. There is one advantage, in that the DC resistance is much lower than the plate resistance, so a lower value plate supply voltage may be used. Two stages with impedance coupling will give about the same gain as one stage of transformer coupling, but with less distortion.

Of the three above methods transformer coupling gives the most gain for the money. All the above discussion on audio-amplifier coupling methods refers to sets made before 1930. ■

THE ONE-OF-A-KIND ELECTRIC CHAIR—WITH LUXURY OPTIONS

☐ Anyone who's ever spent any amount of time in a wheelchair knows that after a while buttock circulation becomes a problem. Being confined to a wheelchair will never be a pleasure, but Fleming Dahl, a Danish inventor, has made a big step toward making wheelchair occupants more comfortable. Dahl and his partner, H. Hansen, have produced a seat which will improve blood circulation where wheelchair occupants need it most—in the seat itself.

The seat will fit into most standard wheelchairs, easy chairs, etc. It is fitted with two hundred points divided into four separate units which go up and down at intervals to be set from ten seconds to four minutes. The result is that one quarter of the seat is always free from body pressure and this helps blood circulation. Battery or AC-operated, a small engine turns inside the seat and makes the points move up and down. ■

Fleming Dahl demonstrates the special massage action of his wheelchair seat.

Dahl and Hansen take their invention apart to show its motor construction.

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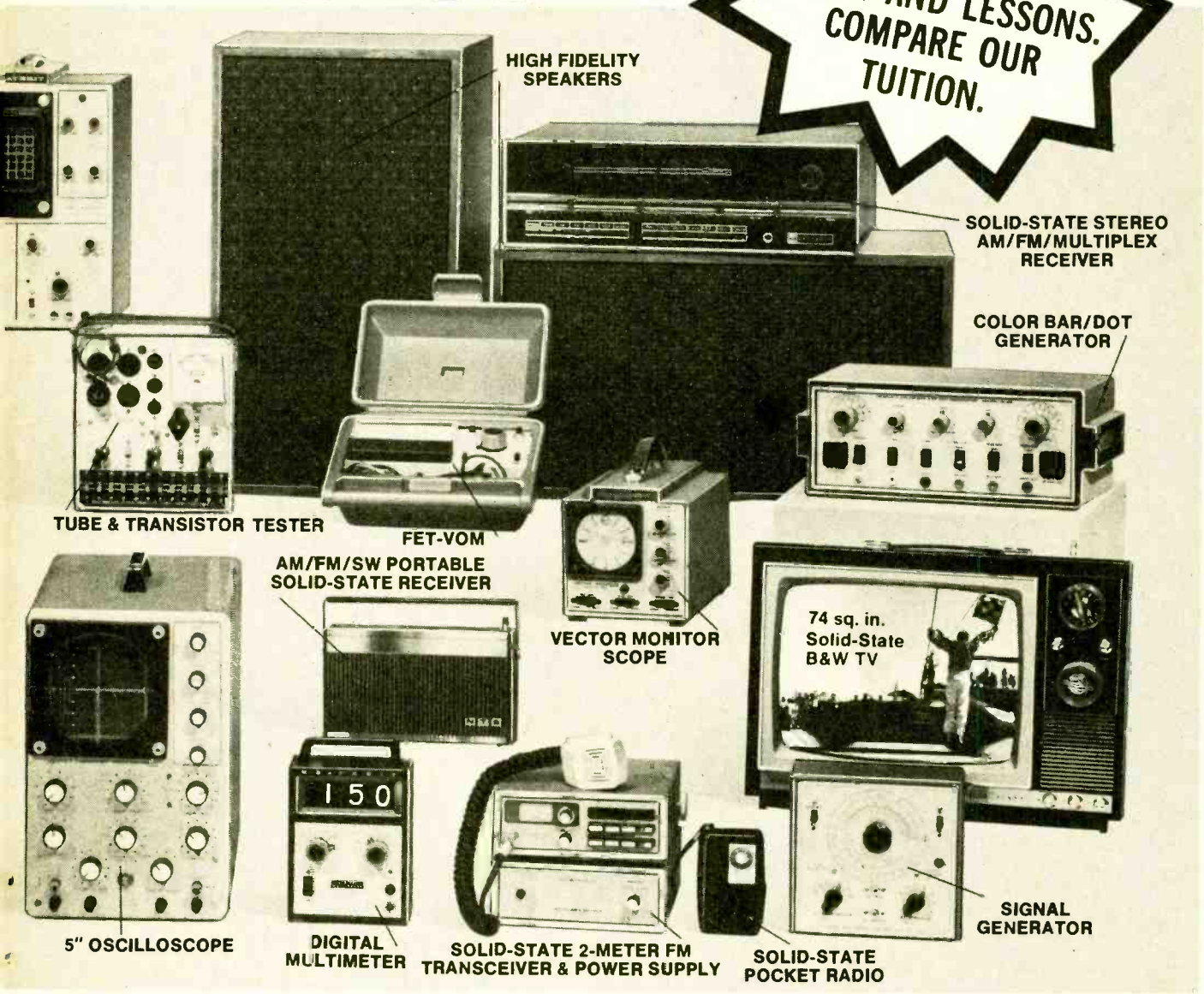

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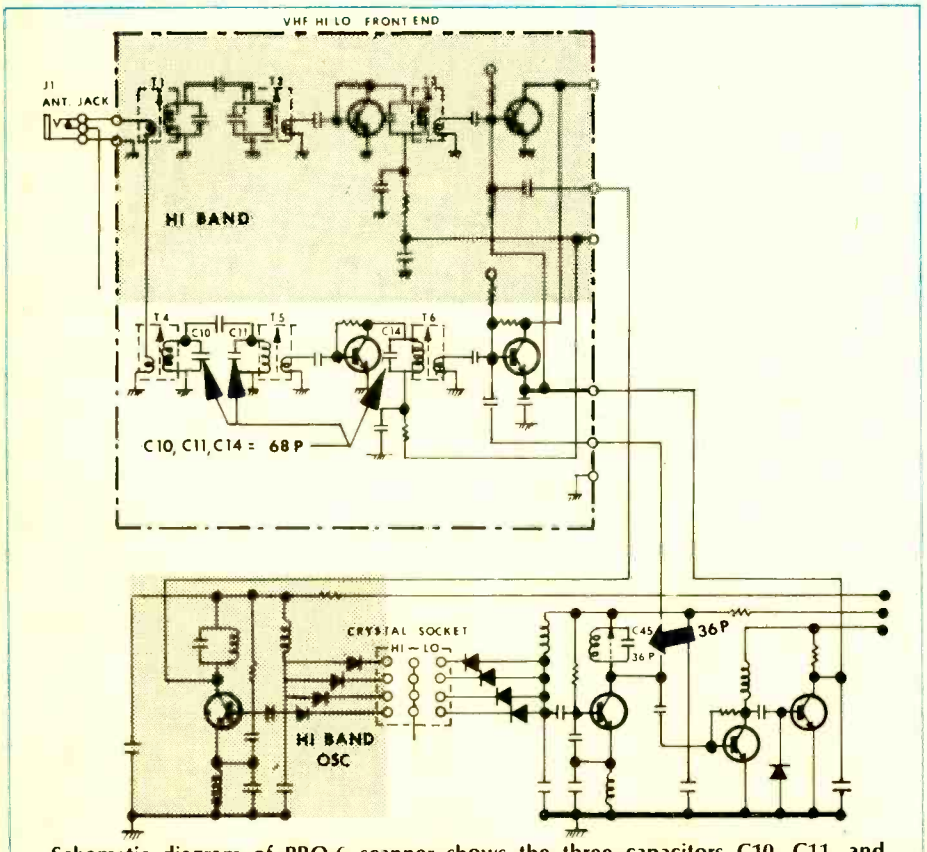
This easy conversion takes four little parts and some new

SCAN THE

☐ Now that the 18 wheelers have moved to channel 19, how can we monitor 19, and 9, and one or more "preferred" channels all at the same time? The logical answer would be to get a 4-channel scanner but every scanner I have seen has been for VHF-FM or UHF-FM, hence is incapable of receiving the CB channels. There are just two solutions to this problem—trade in your present transceiver for one with built-in scanning, or convert a VHF/Lo band scanner to the CB frequenices.

The most practical scanner for such a conversion is the Realistic PRO-6 VHF Hi-Lo Pocket Scanner. It has a low profile when placed on my base station transceiver, the price is low, it covers 30 to 50 MHz as well as 148-174 MHz, and the conversion to CB frequencies can be done by almost any CBer. Perhaps the most important reason for selecting the PRO-6 is the use of a discriminator to detect FM and the lack of limiter circuits. This because limiter circuits will clip amplitude modulation, thus preventing detection of CB signals, which are AM (amplitude modulation).



Schematic diagram of PRO-6 scanner shows the three capacitors C10, C11, and C14 which are replaced in the front end (top). One capacitor, C45, is changed in oscillator. Slight retuning of T2 through T6 is only other task required.

Figuring the Circuit Values. To make the conversion of the PRO-6 from 30 to 50 MHz to the 27 MHz region of CB frequenices, we have to lower the resonant frequenices of the RF circuits and the crystal oscillator circuit. The schematic illustrates the PRO-6 front end (RF/Mixer circuits) and the crystal oscillator for both Hi and Lo bands. Capacitors C10, C11, and C14 in the front end RF stages are 33 picofarads which resonate at the center of the 30-50 MHz band. This gives us a 40 MHz center frequency and the ideal CB center frequency would be Channel 12 or 27.105 MHz. From a Sylvania Electric Products Inc. nomograph on Inductance-Capacitance-Reactance, we calculate the new values for C10, C11, and C14 to be 69 picofarads and the inductance to be 0.5 microHenries. Now we insert these values into the formula for resonant frequency:

$$fr = \frac{1}{2\pi \sqrt{LC}}$$

where fr is in MHz,
2π is equal to 6.28,
L is equal to 5×10^{-7}, and
C is equal to 60×10^{-12}.

This figures out to a center frequency of 27.308 MHz, which is well within the range of variable inductance to tune downward to 27.105 MHz: Channel 12. 69 picofarads would be ideal (since it calculates out to 27.110 MHz) but it is not a standard capacitor value. Too, this is less than two percent variation from the standard value of 68 pF.

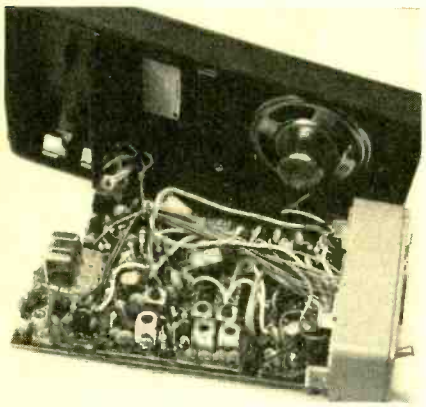
The actual conversion of the front end for 27 MHz use requires only that one replace C10, C11, and C14, plus a little retuning of T4, T5, and T6. In fact, the only problem lies in getting into the inside of the PRO-6.

First, remove the battery box and the two Phillips head screws on each side of the PRO-6's case below the battery box. Once these two screws are removed, grasp the set's case about mid-

crystals—it lets you monitor any CB channels you want with this off-the-shelf-scanner.

TOP OF 40

by James A. Gupton, Jr.



Top case removed to show crystals (left) and transformers (front, center). See the drawings for component identification.

section and apply a squeezing pressure to the sides while lightly lifting the case bottom section. Once the bottom section of the case is removed, the printed circuit board is accessible. Note the Phillips head screw in the center of the printed circuit board. Remove this screw and carefully remove the upper section of the case. Proceed carefully, for all the wires connecting to the scanner head are also connected to the board, and must not be pulled lose.

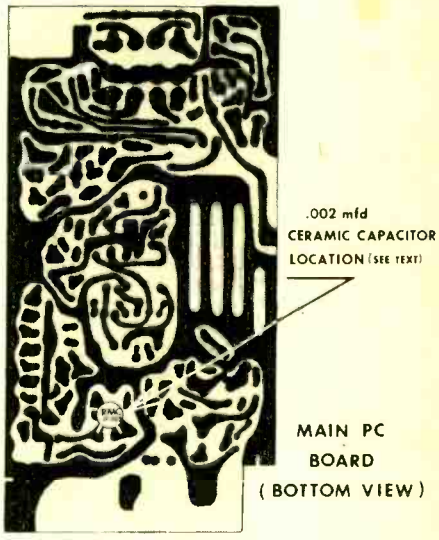
Careful Work. Once the case has been removed, we have full access to the component side of the printed board. The first thing one sees is the high density of components—there is not much room to work, and the close spacing of components requires careful work to prevent accidental shorting of leads during the solder operations. I solved this minor problem by winding a short length of No. 14 solid copper wire around the tip of my solder iron and filing a chisel solder tip on the end of the wire. This makes a long-reach solder tip that can get in between the closely mounted components without spreading solder over anything which might cause a short.

Follow the photographs and board layouts to correctly locate and identify capacitors C10, C11, and C14. You will note that C10 and C11 are located on the outside edge of the front end circuit board, and can be easily removed for replacement. C14, on the left side of T6, is difficult to remove without damaging the front end circuit board. If you have carefully removed C10 and C11 and have not damaged or shortened these capacitors leads, you can use one of these 33 pF capacitors to parallel C14 by forming a small hook on each lead and soldering these hooks to (the original) C14.

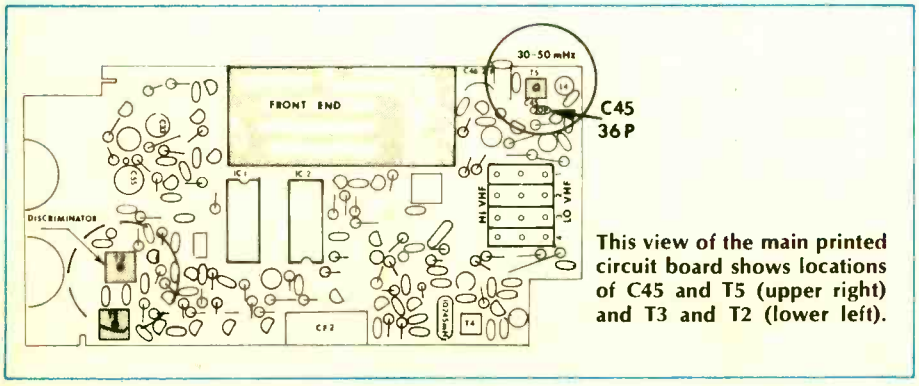
The next step is to replace crystal oscillator capacitor C45. This is a 20 pF ceramic capacitor that we will replace with a 36 picofarad silver mica capacitor. A ceramic capacitor works as well as silver mica, if that's what you happen to have on hand. Space is limited, but since the foil side of the board is readily available, C45 can be removed without difficulty.

Now the Crystals. Before the retuning can be done, we must insert the crystals into the crystal socket. The PRO-6 uses type HC crystals and they must be 10.7 MHz *higher* in frequency than the desired frequency. As an example, for Channel 12 we would order a crystal frequency of 37.805 MHz instead of 27.105 MHz. It is also advisable to separate each of your crystal frequencies by one or two channels to prevent co-channel reception. This is because the PRO-6 scanner is broader-tuned than most CB transceivers.

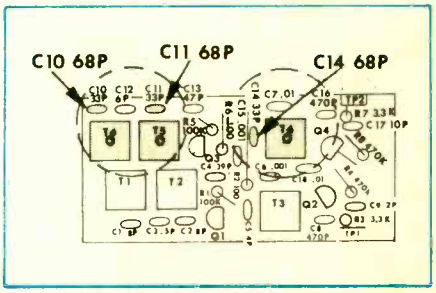
To retune the front end section, the best method uses a modulated RF generator set at 27.105 MHz and a detector probe attached to *Test Point* 2. Then T4, T5, and T6 are tuned for maximum output. The best way to peak the crystal oscillator is to inductively couple a digital frequency counter to oscillator coil T-5. However, since not many CBers have such elaborate test equipment, we must fall back on the gear we have, and use the output of our base or mobile station as a signal



Bottom view of main printed board shows location of additional .002 uF capacitor which is sometimes also required.



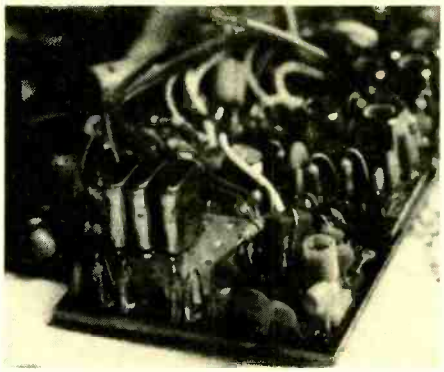
This view of the main printed circuit board shows locations of C45 and T5 (upper right) and T3 and T2 (lower left).



Front end layout shows location of the three small capacitors which are replaced along with transformers T2 through T6.

source. To do this, we prepare a dummy load connector by soldering a 5 watt-52 ohm carbon resistor to a PL-259 connector as shown in the drawing. Remove the antenna coax and replace it with the dummy load connector. Next attach a short-wire antenna (12-20 inches) to the antenna socket on the scanner and drape it near the dummy load. You may have to place the antenna inside the case for maximum signal. Now attach the PRO-6 ear plug, and activate your transmitter with some form of modulation such as a portable radio playing music. Tune T4, T5 and T6 for maximum output. For more precise tuning, connect the leads of an AC voltmeter across the speaker leads and tune for maximum output.

Discriminator Adjustment. Since the PRO-6 employs a discriminator for FM detection, the AM of CB can be detected by *slope* detection. Note the circled discriminator transformers T2 and T3 in the circuit board pictorial. Alternatingly adjust the core slugs of T3 then T2 for distortionless detection. Should you be unable to eliminate voice distortion, install a 0.002 uF. ceramic capacitor across the detection diode as shown.



Front end crystals are plugged into socket at left above. Three crystals are shown, but PRO-6 accepts up to four.

After completing the retuning, and adjusting the discriminator for AM detection, replace the top case section. Again be careful that no undue strain is applied to the circuit board leads and that the Charger/Operate AC socket is not dislodged from its position.

Replace the small Phillips head screw and attach the case bottom section. Be sure that the case ends engage with the scanning head and Charge/Operate AC socket before you permit the locking tabs to snap into place. Replace the two long Phillips head screws and the battery box. Your converted PRO-6 scanner is now ready to scan the desired CB frequencies. To use your base antenna, simply solder the short scanner antenna lead to the *Receive* section of the receive/transmit relay.

40-Channel CB Frequencies	
MHz	MHz
26.965	27.235 **(24)**
26.975	27.245 **(25)**
26.985	
27.005	
27.015	27.255 **(23)**
27.025	
27.035	
27.055	27.265 **(26)**
27.065 **(9)**	27.275
27.075	27.285
27.085	27.295
27.105	27.305
27.115	27.315
27.125	27.325
27.135	27.335
27.155	27.345
27.165	27.355
27.175	27.365
27.185 **(19)**	27.375
27.205	27.385
27.215	27.395
27.225 **(22)**	27.405

The Realistic PRO-6 pocketable Scanner for VHF-Hi/Lo, which covers the 30-50 and the 148-174 MHz bands, is Radio Shack number 20-171, and

(Continued on page 93)

EASY WAY TO RECORD

To record shortwave or other broadcasts just plug a telephone pick-up coil into a cassette recorder, then attach the pick-up to the headset.

☐ Have you ever wanted to record shortwave broadcasts, the code practice sessions that are transmitted daily by W1AW while you are studying for your ham license or maybe you wanted to capture the action of the local VHF police band?

If you use headphones for listening there is a very easy way to record these broadcasts. Use the type of telephone pick-up coil that has a suction cup on it. These pick-ups are designed to record telephone conversations when placed on a telephone's earpiece but they work equally well when placed on a pair of earphones.

I used an Arista model 321 telephone pick-up coil but similar pick-ups are available from Radio Shack (part no. 44-533, $1.49), and others, including Lafayette and Calectro.

Have fun with your new gadget. Recording short wave broadcasts and other transmissions you tune in on can add a lot to the pleasure of your listening. If you're not sure of a station's identity or something else that's said, just play back the tape until you've got it. You can also impress your friends by letting them hear that rare one from Mongolia you logged last night after digging for it for the past year or so.

Listening to recordings is one of the best ways to learn the code, and, if you or a friend have a receiver that can receive code, you can have an almost unlimited supply of practice material by recording the regular code practice transmissions from W1AW, headquarters station of the American Radio Relay League, Newington, Connecticut. W1AW transmits on a number of frequencies so you should be able to hear it on at least one regardless of what part of the U.S. or Canada you live in. The complete W1AW code practice schedule appears in the League's official journal, QST, and is also available on request from the Communications Department, ARRL, 225 Main Street, Newington, Connecticut 06111. ■

e/e checks out the...

Interfab Pong-IV Video Game Kit

Preassembled printed circuit board with 43 ICs needs only soldering

VIDEO GAMES ARE POPPING UP everywhere; amusement centers, theater lobbies, cocktail lounges and even on jetliners. For 25¢ a game you can pit your skill against any opponent, with complex electronic wizardry acting as referee. These games offer various formats, from space-ships firing "laser beams" to cars racing through a maze of electronic walls. Still among the most popular video games are the ones that simulate ping-pong or tennis.

Although several companies now market ready-made units that connect to your TV set to convert the screen into an electronic playground, you may prefer the satisfaction of putting one together yourself, saving some money, and getting a more versatile game, as well as learning a lot in the process.

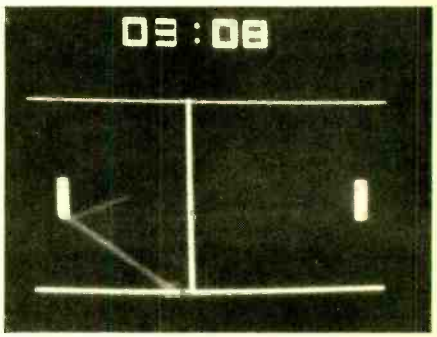
The Interfab Corporation's *Pong IV* video game comes in kit form and has some features not found in other video games. In addition, it's the least expensive kit seen to date.

Features. Set up for two players, with a separate control box for each, *Pong IV* includes an AC power supply, so no batteries are needed. It plays two games—just flip a switch to go from tennis to handball, with the entire court shown on the TV screen. Digital numbers appear above the court throughout the game to keep score. A pushbutton switch allows you to start a new game at any time. Ball speed is random, sometimes fast, sometimes slow. The ball bounces from the court walls and the players' paddles at random angles. A control is provided to change paddle size—large paddles for beginners, smaller and smaller paddles as the players become better at the game. Also, the paddles can be moved horizontally, as well as up and down on the court, so you can play close to the net for a real challenging game. Sound is built into the main cabinet. A small speaker beeps each time the ball contacts a wall or paddle, and emits a raucous Bronx cheer whenever a player misses a ball. A special feature is that either or both players can be set on automatic, with the computer in control. Thus you can play against the machine, or even watch the computer play against itself!

Pong IV Kits. *Pong IV* is available in three kit forms: Standard, Pre-Soldered, and Completely Assembled. The *Pong IV-D* standard kit contains everything but solder and glue; even predrilled control boxes and main cabinet, nuts, screws, spacers, washers and wire. To make for easy assembly all the 18 diodes, 4 transistors, 42 capacitors, 93 resistors and 43 Integrated Circuits (ICs) are already mounted on the single 2-sided printed circuit board (PCB)!

Pong-IV kits with all parts spread out. Printed circuit board has all resistors, capacitors transistors and ICs already in place. Needs only soldering.

For further information circle no. 73 on the Reader Service coupon.



Pong-IV puts this picture on your TV screen. Left player has just returned ball, to bounce off sidewall (photo bottom).

The parts are held in position by a plastic blisterpack covering on top of the board, with the board bottom open for soldering. It would take at least two extra hours—probably more—for you to identify and stuff the printed circuit board yourself, with the possibility of getting the parts inserted in the board improperly. After soldering the components into the board you connect wires to the external controls, install them in the cabinet supplied, and that's it, you're done! Interfab supplies an assembly manual, which includes a number of voltage checks you should make before applying the power. They also include a goodly number of troubleshooting steps, with symptoms and corrective steps.

The Pong IV-C pre-soldered kit takes construction one step further. The entire printed circuit board is furnished soldered, and with continuity checked out. Since there are over 900 solder joints on this board many people will be willing to pay the extra $10 charged for this—especially since bad soldering is the biggest cause of problems.

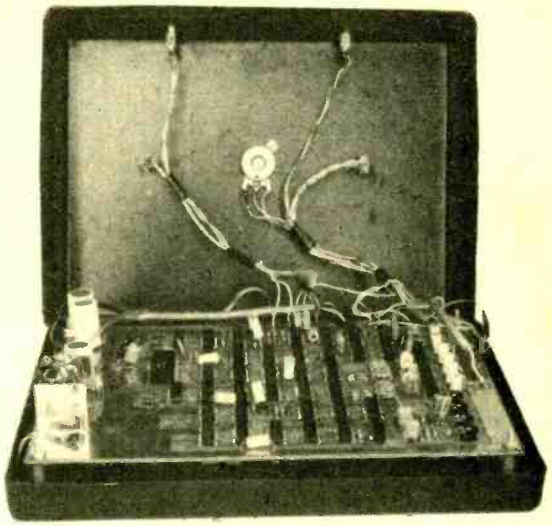
Semi-kit Version. The PONG IV-B Completely Assembled Kit is soldered, cabled, tuned for proper horizontal and vertical oscillator frequencies, and checked out. You only need to mount the switches and potentiometers in their proper locations in the main case and

control boxes, which have pre-drilled holes.

Building the Pong IV-D. We built a *Pong IV-D* standard kit just to see how tough it would be. It took about 8 hours, proceeding very slowly and carefully, using a small-tipped 25-watt soldering iron. This is *not* a beginner's kit, since it requires a lot of very careful soldering, and some wire cabling. The instructions, while not elaborate, are adequate. Even though Interfab has carefully stuffed the printed circuit board, it's a good idea to verify that all the ICs are inserted properly. We found one IC pin bent under instead of projecting through the board, and another IC had one whole row of pins not inserted into the PCB holes. Examine the underside of the printed circuit board with a magnifying glass before soldering to see that all IC pins are projecting through their holes.

Further Assembly. After soldering and clipping excess wires from all the discrete components (resistors and capacitors) remove the blisterpack covering from the top of the board and check to see that all parts are firmly soldered to the board. Using two screws and nuts provided, ground the LM309K regulator IC. Add diode D3 from R25 to D16, as shown in the assembly drawing Interfab furnishes with the kit, and add the jumpers specified in the instructions.

Mount the potentiometers, two in each control box, and one in the main case top. You may have to enlarge the holes slightly with a file or reamer. The control knobs supplied push very hard onto the smooth shafts—this is intentional, so that the knobs will slip on the shaft if turned too hard against the control, rather than destroying the stop! Following the wiring diagram and using the 6-conductor cable provided, wire the controls, noting each wire color on the wiring diagram for later reference. Now temporarily set the control boxes aside.



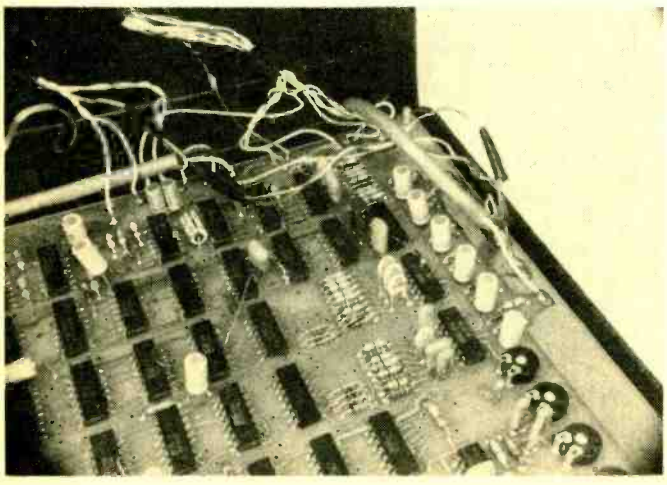
Wired kit with top lifted shows connections from board to the control and switches in top cover. Not shown here are the two players' manual controls.

Mechanical Assembly. Next, glue the speaker in the bottom of the main cabinet, above the small holes that form the speaker grille. Mount the printed circuit board, component side up, into the cabinet bottom using the long screws, spacers and nuts. Solder the speaker wires to the terminals on the board shown in the assembly drawing. The wiring diagram also shows you all the wiring between controls, switches and the board. Carefully wire between the circuit board and the various switches and controls, including the control boxes. If you get wires connected to the wrong *terminal* on a switch or control, they can be reversed later on, when you test the game, but don't connect the wires to the wrong switch or control. Cable wires that follow similar paths together by weaving the wires before soldering, or by bundling them together with cord or tape, to improve the appearance.

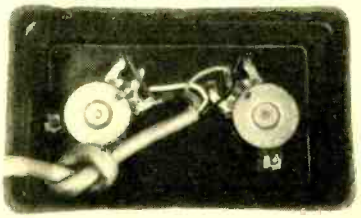
Connecting to Your TV. Until recently *Pong IV* was sold with a self-contained UHF transmitter built right on the printed board. This converted the video output of *Pong IV* to a modulated UHF signal between Channels 72 and 82. By simply connecting the *Pong IV* UHF output leads to the UHF terminals of your TV, you could tune in the *Pong IV* picture with your TV's UHF tuner, at the high end of the band. However, the FCC has been vigorously enforce its regulations regarding Class 1 TV Devices, requiring FCC type-approval—a long and expensive path for a small manufacturer. Interfab has therefore discontinued providing the UHF parts with the kit. The PCB is etched, however, for the addition of the UHF transmitter should you desire to add it. Included with Interfab's instructions is a circuit and parts list, and the description of how to build a simple UHF transmitter from a 2N5770 transistor, 4 resistors, 2 capacitors and a piece of brass or copper. This transmitter's 5 milliwatt low-power signal broadcasts on approximately 860 MHz, where no commercial TV signals currently broadcast, and thus will not create any interference.

Preassembled UHF Transmitter. As an alternative to building the UHF transmitter described above you can buy a PXV-2A transistorized modulated oscillator kit for $8.50 postpaid from ATV Research, 13th and Broad-

(Continued on page 93)

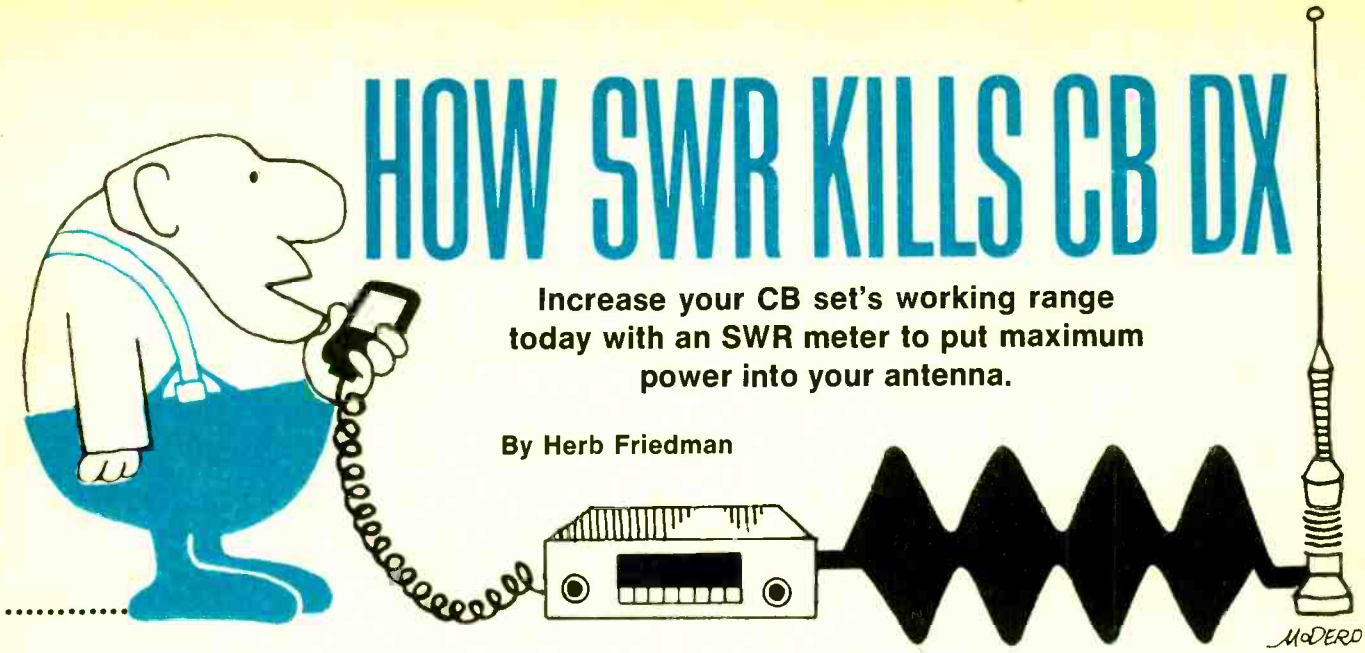


Closeup of printed circuit board shows some of the 43 ICs and many resistors which come already in position. Upper left is top cover with control and switches.



Manual control seen from bottom to show wiring from the two potentiometers.

HOW SWR KILLS CB DX



Increase your CB set's working range today with an SWR meter to put maximum power into your antenna.

By Herb Friedman

ALTHOUGH MOST CBers are familiar with the term SWR, which means *standing wave ratio,* very few actually know how SWR affects a CB station's overall performance. In some cases SWR is absolutely meaningless to the CBer, having little or no effect on the station's signal. In other cases SWR can reduce a CB station's effective output to almost zero.

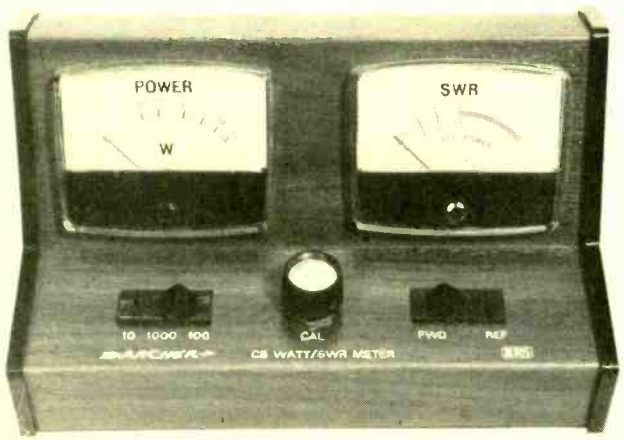
SWR is the *ratio* of the transmission line *impedance* to the antenna *impedance,* at resonance (the operating frequency). An SWR (ratio) is written "2:1", which can be described in words as "2 to 1." For example, if the transmission line impedance is 50 ohms and the antenna impedance is 100 ohms the SWR is equal to 100/50, or 2:1. It is not 50/100 or 0.5:1. Putting it another way, if the transmission line impedance is 50 ohms the antenna impedance can be either 25 or 100 ohms for a 2:1 SWR.

The SWR figure is important because the antenna does not accept all the power delivered by the transmission line when the antenna impedance differs from that of the line, and the SWR tells how much power is turned back by the line/antenna mismatch instead of being radiated by the antenna. The power that is turned back is called *reflected* power, and it is used up as heat dissipated in the transmission line and in the transmitter's output circuit. The Table shows the percentage of power reflected back for typical SWR values. Note that at an SWR of 3:1 there's 25 percent of the power at the output end of the transmission line (the antenna end) reflected back, instead of radiated out into the air from the antenna. In addition, there's always a natural loss of power in the line before the power gets to the antenna. Thus the SWR indicates a loss from the already-lowered (by line loss) output.

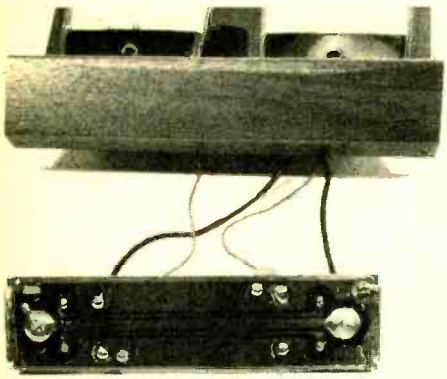
You will not be surprised to know that it's pretty difficult to measure the actual antenna impedance when the antenna is mounted on its mast or tower. Fortunately, when the reflected power flows back down the line the phase difference of current and voltage meeting the forward power sets up voltage and current *standing waves* on the line. By measuring the minimum and maximum values of these current or voltage standing waves we determine the ratio of forward-to-reflected power, which is the SWR of the antenna system. Since voltage is easier to measure than current the typical CB SWR meter indicates forward and reflected power through a voltage measurement, so the indicated SWR is actually *VSWR*—meaning SWR determind through a voltage measurement. All in-line CB SWR meters are really VSWR meters—the terms (*SWR* and *VSWR* being interchangeable.

Using the SWR Meter. In commercial installations, SWR is generally determined by measuring the forward and reverse power and then calculating the SWR. A much easier way to find the SWR is to use a meter that can be adjusted to indicate full scale on the forward power regardless of the actual level of the forward power. The reverse power is then indicated as a proportion of the full-scale reading. If the reverse power was 25 percent of the forward power the meter would always indicate the same reading regardless of the actual forward power as long as the meter was always calibrated to indicate full scale on the forward power. And this is the way most CB SWR meters work. They connect in series with the transmission line and sense the forward and reverse power. The user, by adjusting a *calibrate* control, sets the meter to indicate full scale on the forward power. When the meter is switched to read reverse power the scale calibration is directly in SWR; and some scales are calibrated to indicate both the SWR and the percent reflected power. Since the SWR meter senses *voltage* it absorbs very little, almost no RF energy. Thus it can be left permanently in the transmission line circuit, giving a continuous indication of the antenna system's SWR.

Some of the latest service shop SWR test meters have automatic full-scale



Radio Shack's combination power-SWR meter is in-line instrument capable of checking most transmitters up to 1000 watts (on amateur radio rigs).



Middle foil of printed circuit is the center conductor; on either side of it are the forward and reverse power sensors.

calibration, so the meter reads out directly in SWR without the need to first calibrate the meter for the forward power.

How SWR Meters Work. Regardless of whether forward calibration is manual or automatic, SWR meters used for CB all use the same type of inductive forward-reverse power sensor shown in the schematic. Wires positioned on each side of a coaxial center conductor sense the forward and reverse RF energy in terms of standing wave ratio. The RF energy is rectified and filtered to a DC voltage which is proportional to the RF energy. The meter then uses the DC to indicate the SWR value.

In modern CB SWR meters it has become common practice to use a small printed circuit board for the RF sensor of SWR meters. The coax center conductor and the forward and reverse sensing wires are etched from copper on a printed circuit board, as shown in the photograph. Pictured here is a Radio Shack combination SWR and output power meter. The output power meter consists of the forward power sensor with an internal calibration control (not accessible to the user) and a scale calibrated in watts rather than SWR. A selector switch allows the CBer to set the scale calibration for 10, 100, or 1000 watts. Obviously, the 10 watt-scale is fine for CB, but since a power-SWR meter can be used for other services in addition to CB in the range of 3 to 30 MHz the additional calibrations (100 and 1000 watts) allow the meter to be used for these other applications without internal modification.

One photograph shows the RF forward-reverse power sensor. Flipping the unit over lets you see the attached coaxial connectors, which are shown in detail in the next photograph. When the whole thing is assembled all the CBer sees is a panel with RF connectors labeled *Antenna* and *Transmitter*. No damage will occur if the connections made to the antenna and the set are reversed. The meter will simply read backwards. That is, the forward power will be indicated when the meter is set for reverse power, and vice versa.

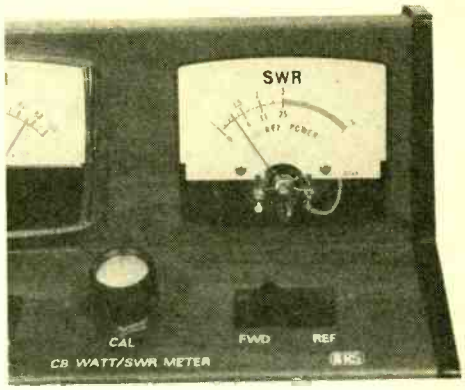
What Typical Values Mean. The closeup photograph of the SWR meter scale illustrates the typical *SWR/Percent Reverse Power* calibration common to most SWR meters used for CB. The top scale shows SWR values—note that there is no calibration above 3:1 because anything greater than 3:1 is simply not acceptable. If values near 3:1 are found the antenna system should be tuned or repaired, or an antenna matcher should be used.

The bottom scale represents *Percent Reverse Power*. It shows that an SWR of 3:1 means 25 percent of the power is reflected back from the antenna. An SWR of 1.5:1 means that only 4 percent of the power arriving at the antenna is reflected.

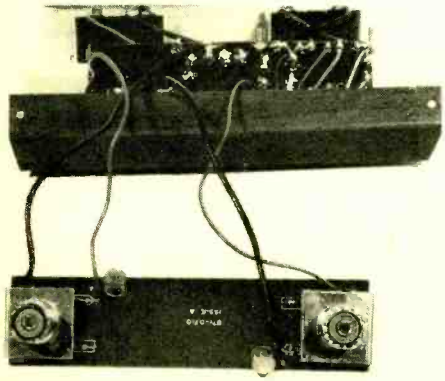
Useful CB Test Instrument. One of the latest CB service test instruments is the Sencore CB41 Automatic Performance Tester. It indicates power output. SWR. and percent modulation. Note that there is no forward power calibration control. This is because it is automatically calibrated when the *SWR Test Switch* is depressed. Since the meter is intended for use in service shops, its SWR scale is calibrated green, yellow and red to indicate good, passable and defective conditions, Of course it also has the usual SWR number markings.

In addition to the normal reflected power loss one must remember that SWR increases all other antenna system losses. Further, the SWR reading is rarely accurate on long transmission lines because of the inevitable line losses. Starting with the SWR multiplier effect; if the normal line loss is say, 3 dB per 100 feet of coax transmission line, a moderately high SWR will add 1 dB additional loss. Further, the same loss is added to the return power loss so that an SWR meter working into 100 feet of cable sees a lower-than-actual return power, and therefore indicates a lower-than-actual reflected power. Normally the SWR indication is lower, to

(Continued on page 88)

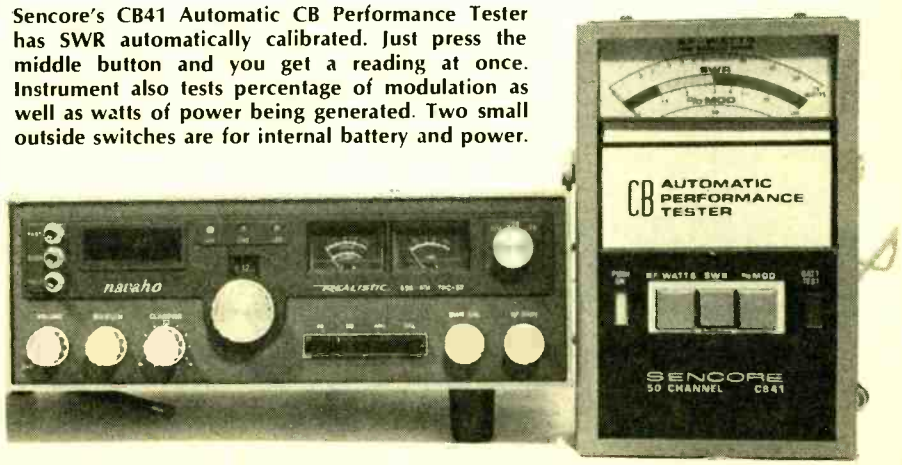


Detailed view of SWR meter face shows relation between SWR and percent of power returned. Markings show 25% of power is lost at 3:1 SWR.



Here's the reverse (rear) of the sensor boad, showing the coaxial cable connectors for input and output.

Sencore's CB41 Automatic CB Performance Tester has SWR automatically calibrated. Just press the middle button and you get a reading at once. Instrument also tests percentage of modulation as well as watts of power being generated. Two small outside switches are for internal battery and power.



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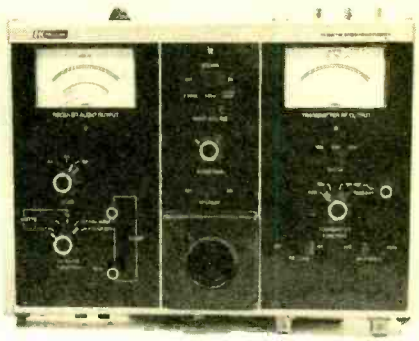
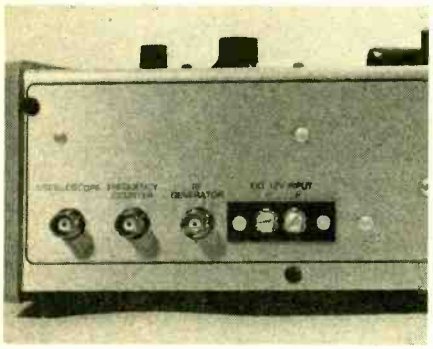
B&K CB Servicemaster



CIRCLE 74 ON READER SERVICE COUPON

☐ In addition to outstripping the ability of set manufacturers to keep up with the demand for CB sets in recent months, the number of CB sets sold has run far ahead of the number of service technicians and shops needed to keep them all working properly. Further, there isn't enough specialized transmitter test equipment to go around, even if there were enough technicians with the needed knowledge to fix CB sets correctly. In many parts of the country—particularly in the larger cities—a routine equipment check is almost impossible to get, and a real service job can take four weeks or more just to get your transmitter onto the test bench.

Perhaps the primary cause for such



Basic (auxiliary) test instruments are connected through jacks on this narrow (bottom) panel. Optional 12-volt power connects to terminal strip at right.

poor CB service is that shop equipment used to test and service radio, TV and audio equipment has neither the capability nor the accuracy required for CB service work. For example, while you need to known beyond any doubt that your CB transceiver can receive signals down into the microvolt region, the ordinary radio works on *hundreds* of microvolts of received signal. Thus the ordinary signal generator used to test a home radio set usually has more signal leaking out of its cabinet than a CB set needs to operate.

But as with other things, when there's enough of a need, someone will make the equipment available. In this case the need has been filled by B&K's *CB Servicemaster*, a multi-function, high-performance test instrument specifically designed for CB transceivers. In addition, it's also intended to be used by the average technician or electronic hobbyist. In fact, with just a few minutes of training—or an hour or so with a notably thorough and extensive instruction manual—just about anyone can check a CB installation through a complete checkout with this unit.

It Works Anywhere. The 1040 CB Servicemaster is normally powered by the AC line but rear panel connection allows it to be powered by any 12-volt battery.

If you look at the photographs you'll see the front panel is clearly separated (by white lines) into three separate working sections. The right section tests the transmitter and provides an average or peak (for SSB) power output meter with full-scale ranges of 10, 50 and 100 watts, and an SWR meter. All power measurements can be made into the internal 50 ohm/50 watt (continuous power rated) dummy load, or thru-line into the antenna system. Panel switches determine the choice of dummy load or thru-line antenna connection, average or peak power, and meter range.

The center of the instrument is an audio tone section complete with microphone coupler—a small speaker and a soft surround into which the microphone under it is pressed for "isolated" coupling to the speaker. Either 1000 Hz (AM test), or a two-tone (500 and 2400 Hz) SSB test signal can be fed into the speaker for testing a transceiver's modulator starting at the microphone input. A gain control allows tone level adjustment from full *Off* to much more than needed for any modulation tests. The speaker and its level control can also be switched in to serve as a transceiver monitor when the transceiver is connected through its remote speaker output to the Servicemaster for receiver tests.

The third, audio, section is used for receiver tests. It contains speaker substitute loads of 4, 8 and 16 ohms, a meter calibrated in audio watts and dB for signal-to-noise, and sensitivity checks, and a distortion meter set for 1000 Hz. By feeding the transceiver with a 1000 Hz modulated signal from a signal generator you can measure the output power and receiver distortion.

You've probably noticed we haven't mentioned percent-modulation measurements, nor explained how to avoid a rat's nest of interconnecting wires. Well, those two aspects are the real beauty of the CB Servicemaster.

You probably know it takes a laboratory-grade oscilloscope to observe a 27-MHz signal—a very expensive 'scope to be sure. The typical service 'scope goes up to about 4-5 MHz, while most hobbyist 'scopes generally poop out at 1 MHz. Yet precise modulation measurements require observation of the modulated RF signal on a 'scope. While you might be able to measure percent modulation of a sinewave test tone on a specially-calibrated meter, there is no CB modulation meter that can accurately measure speech waveform.

Use Any Old Oscilloscope. But B&K makes 'scope measurements possible even if you have only an old third-hand general-purpose unit. Here's how

Connections to the test set are simple. They're all made on the narrow (top) panel shown above. External RF load is dummy load, not the antenna.

its done. Inside the Servicemaster is a 26 MHz oscillator whose output is beat with a sample of the transceiver's 27 MHz signal in a diode mixer. One of the mixer's output signals is the difference between 26 and 27 MHz, which is approximately 1 MHz depending on the particular CB frequency to which the transmitter is tuned. This 1 MHz output has all the modulation characteristics of the original 27 MHz signal. If the 1 MHz is fed to any 'scope with response to at least 1 MHz you will see an accurate representation of the modulated RF—the same representation you'd see on a multi-thousand dollar lab-grade 'scope. (This alone is a major breakthrough in CB test gear and B&K deserves a hand for making it available at a moderate price.)

And as for the usual rats' nest of wires? It just doesn't exist. B&K has come up with something unique along this line. On the back are three BNC connectors labeled *RF Generator, Frequency Counter* and *Oscilloscope*. These are "permanently" connected through patch cords to the indicated instruments, though a counter is needed only if you want to check the transmitter's frequency tolerance (for one or more channels). On the front of the test set are two coaxial jacks labeled *Transceiver* and *Ext RF Load* (like an antenna for SWR tests). There are also banana jacks for *Receiver Audio* and *Audio Output*. *Audio Output* is the oscillator signal from the audio tone section and isn't generally needed for checks and adjustments.

Modulation check is made by pressing mike into the cushioned coupler ring. Unit provides 1000Hz tone for amplitude modulation check, and two frequencies, 500 Hz and 2400 Hz for making Single Sideband measurements.

How To Test CB Sets. To check out a rig all you do is connect the transceiver's antenna output to the test set's *Transceiver* jack, and a cable from the transceiver's *External Speaker* (or *PA Speaker*) jack to the test set's *Receiver Audio* jacks. That's the whole bit—just two connections from the transceiver.

To test the CB set's receiver section you simply feed the signal generator's output, which automatically goes through the test set to the transceiver, then back to the audio test section and the oscilloscope, for viewing the receiver audio.

When you key the transmitter the signal generator is automatically disconnected (inside the test set) so RF doesn't pound into the generator, the test set's transmit section is connected to the CB set, and the oscilloscope connection is automatically switched.

That's it. Just key the transmitter and all circuit change switching is taken care of, yet it takes only two connections from the transceiver.

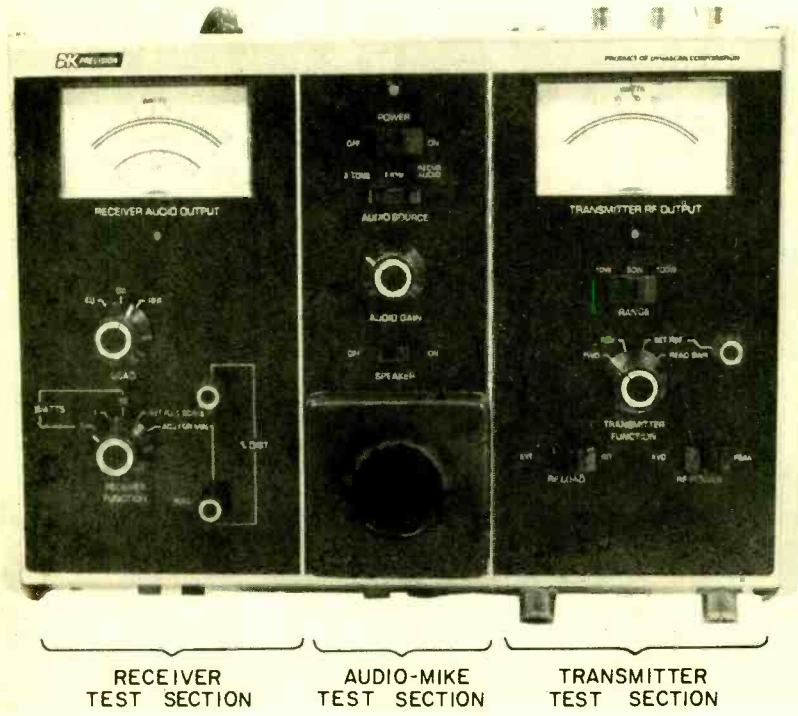
How Accurate Is It? Surprisingly, the measurement accuracy of the B&K CB Servicemaster was about as good as the laboratory-grade instruments we normally use to check out CB gear. The power-output measurements were within 0.25 watt of our lab power meter readings, which is better than you'll ever need, or be able to estimate from a meter scale. The audio power-output readings were within five percent accuracy, as was the distortion-measurement accuracy.

With two minor exceptions the precision of the CB Servicemaster is well beyond what is needed for service-grade tests and measurements, and it equals or approaches the precision of lab-grade equipment in all respects.

In fact, it exceeded the specifications shown in the manual substantially as regards oscillator distortion. The manual shows THD (total harmonic distortion) at 3 percent or lower, and says that two percent is typical. Our unit, however, tested even better than that, showing oscillator THD at just 1½ per cent.

Summing Up. The B&K CB Servicemaster, priced at $250, is the most outstanding CB test and service instrument we've seen. We expect that B&K will be coming out before long with companion units such as a output signal generator for the 1040 Servicemaster. But with or without companion equipment the Servicemaster runs through most CB tests in a matter of minutes with the least possible fuss and bother. It's an ideal instrument for any CB instrument for any CB installation or service shop, and for the larger CB clubs and REACT emergency teams.

For more information circle No. 74 on the Reader Service coupon. ■



Main panel is divided into three separate sections. Middle section tests CB set's microphone and modulation. Mike is held against cushioned coupler ring around small speaker.

EXPERIMENTING ON 2 MEGAHERTZ

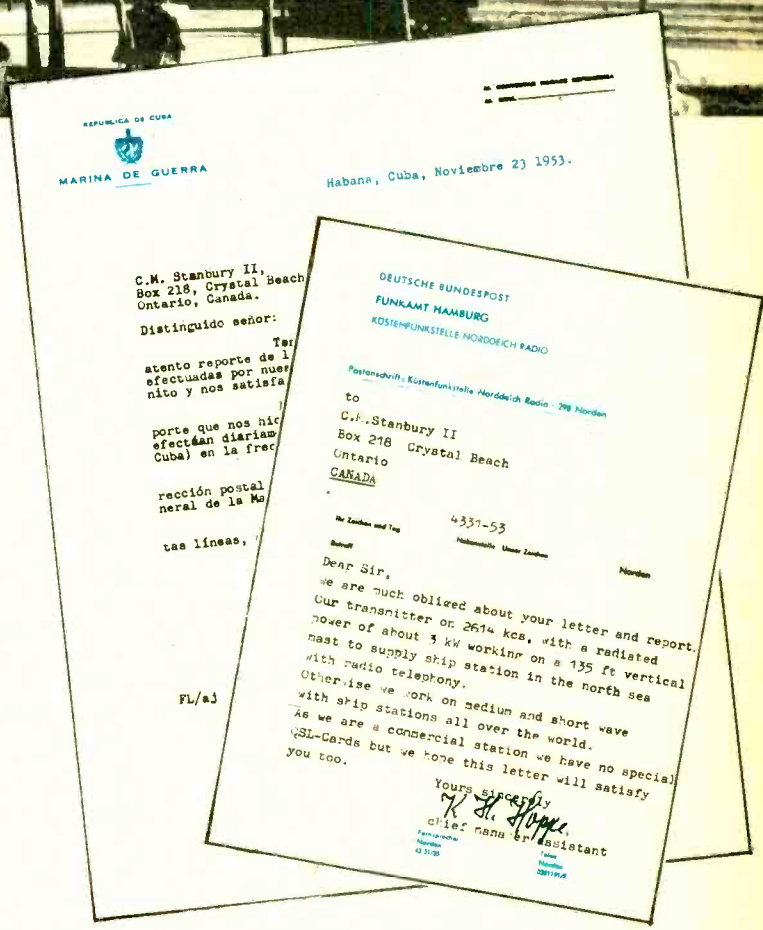
by C.M. Stanburg, II

Here are some simple reception checks that can open up the door to new DXing.

☐ The frequency range between 2000 and 3000 kHz is a subject of ongoing debate and fascination amongst DXers and SWLs. The question is, "Should reception here be classified as Medium Wave (the same as the standard AM broadcast band) or as shortwave?" Officially it is defined as Medium Wave but hard-and-fast definitions are too arbitrary to settle this debate, and the real answer lies somewhere between the opposing points of view. Here are five experiments which the reader can carry out with his own receiver which will shed some light on the subject. All the stations discussed, incidentally, just happen to also be fine DX catches.

Latin America. When one talks of comparing 2 MHz with shortwave, one means of course a comparison with the lower shortwave bands; 90, 60 and 49 Meters. No SWL would ever suggest a similarity between 2 MHz reception and that on frequencies above 7 MHz. Also, there is no night of the year during which Latin American signals cannot be heard on every band below 7 MHz down to and including the standard AM Broadcast Band (the "BCB" as it is called by veteran DXers). The factor which primarily determines the amount of LA (Latin American) DX above the equator on each band is interference from upper and mid-latitude stations. It is this relative level of interference you'll be comparing with 2 MHz when checking out Latin American DX.

It should also be remembered that interference and the number of Latin American broadcast signals, both, are always low on 2 MHz. Interference consists mostly of radio-



REPUBLICA DE CUBA
MARINA DE GUERRA

Habana, Cuba, Noviembre 23 1953.

C.M. Stanbury II,
Box 218, Crystal Beach
Ontario, Canada.

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Postanschrift: Küstenfunkstelle Norddeich Radio, 298 Norden

to
C.M. Stanbury II
Box 218 Crystal Beach
Ontario
CANADA

4337-53

Norden

Dear Sir,

We are much obliged about your letter and report.
Our transmitter on 2614 kcs, with a radiated
power of about 3 kW working on a 135 ft vertical
mast to supply ship station in the north sea
with radio telephony.
Otherwise we work on medium and short wave
with ship stations all over the world.
As we are a connercial station we have no special
QSL-cards but we hope this letter will satisfy
you too.

Yours sincerely
K. H. Hoppe
chief manager assistant

Many overseas and Latin American broadcast stations are so unused to receiving reception reports from North America that they don't have regular QSL cards and respond with personally-written letters. Shown here are two such acknowledgements received by the author, one from Cuba, and one from Germany.

e/e EXPERIMENTS ON 2 MHZ

teletype, CW and similar transmssions as well as those coast stations and ships still engaging in voice communications between 2000 and 2850 kHz. Included in the latter is the primary Cuban ship-to-ship and ship-to-shore channel, 2760 kHz. This frequency can be used in making Latin American comparisons.

Most widely heard of the *legal* Latin American 2 MHz broadcast signals is (TGDF) *La Voz de Atitlan,* a missionary station in Guatemala transmitting programs in Spanish and various Indian languages on 2390 kHz. A similar Guatemalan station is (TGBA) *Radio Maya de Barillas,* on 2360. A Mexican educational station, (XEJN) *Radio Huayacocotla,* has also been heard irregularly Saturday evenings on TGDF's frequency. In addition, there is a variety of illegal LA broadcast signals on 2 MHz. These are harmonics of standard AM transmitters. A different crop of BCB harmonics seems to turn up every few months, but one that's been there year after year is YNQ (*El Lider*) at Managua, Nicaragua on 2200 kHz.

THE 2 MHz LOG

kHz	Station	Notes
2200	"El Lider" (YNQ), Managua, Nicaragua	BCB harmonic
2310	China	Home service, exact location unknown.
2336	Rhodesian Broadcasting Corp.	Status uncertain
2360	Radio Maya de Barillas, Huechuetenango, Guatemala	
2390	La Voz de Atitlan, Santiago, Guatemala	
2390	Radio Huayacocotla, Mexico	Irregular
2425	Rhodesia Broadcasting Corp.	Status uncertain
2446	O.R.T.F., Reunion Islands	
2614	Norddeich Radio W. Germany	Coast station
2760	Cuba & International Waters	Cuban coast stations & ships
2830	Schenveningen Radio, near Rotterdam, Netherlands	Coast station
2850	Pyongyang North Korea	
2889	Shannon Aeradio, Eire	
2980	Prague Aeradio, Chechoslovakia	
2980	Paris Aeradio, France	

Radio stations in Mexico broadcast programs much of the time to reach the great mass of people who often can barely afford a radio. Scales which measure produce sold in this market square in Oaxaca are likely older than the radio stations. (Photographs courtesy of Mexican Department of Tourism)

Okay, with these basics in mind, you are ready to conduct the first, relatively simple, experiment. Whenever Cuban signals are heard on 2760 kHz, and/or one or more of the broadcast stations listed above, immediately check and determine (1) whether LA shortwave reception has improved, and (2) if Latin American BCB reception has improved. To be scientific about it, keep a list of every night when *two* or more 2 MHz LA signals could be heard (count Cubans on 2760 as one station) and for each night note whether *improved* LA reception spilled over into the frequencies above and below 2 MHz.

Transatlantic. There are no conventional broadcast stations in Europe on 2 MHz. However certain aeradios and coast stations have regularly-scheduled weather broadcasts which serve our purpose almost as well. These include *Shannon Aeradio* (Eire) on 2889 kHz on the hour and half hour, *Prague Aeradio* at 15 and 45 minutes past the hour on 2980 kHz and *Paris Aeradio* on the same frequency at 25 and 55 minutes past the hour, *Shenveningen Radio* (near Rotterdam, Netherlands) at 1800 EST on 2830 kHz, and *Norddeich Radio* (West Germany) on 2614 kHz at 1615 EST.

If any of the above are logged, you should spend the rest of that evening (1) checking reception of European aeradios on 5533 (Shannon) and 5557 kHz (Paris & Prague), and (2) monitoring signal strengths of the European BCB regulars (West Germany on 1586, France on 1554 etc.—see the article "Secrets of Split Frequency DX" page 46, September–October, 1976. In describing each of these experiments it is assumed that the reader DXes often enough on the BCB to know what reception he can normally expect from his receiver, antenna and location.

The Pyongyang Phenomenon. Up until now all the comparisons suggested have been of a very general nature. But if you live in the western U.S. or Western Canada some very exact observations can be made. The first involves *Radio Pyongyang* (North Korea) home service transmissions on 6290, 2850 and 655 kHz. The 6290 outlet is a commonly reported logging in western NA but it may surprise many SWLs to learn that the other two frequencies are also often heard during early AM hours, beginning about 0200-0300 PST.

The questions are: (1) on what percentage of good 2850 nights is 6290 reception also improved? (2) on what percentage of good 2850 nights is 655 comparatively better? (3) which percentage is higher? A similar and equally interesting series of tests can be conducted using Radio Peking's home service transmitter on 3450 kHz, a home service outlet on 2310 kHz (location unknown but probably in central China), and the station on 1040 kHz which carries a mixture of Radio Peking's foreign and home service transmissions.

More Far East. If, instead of 1040 we substitute Radio Peking's Russian language powerhouse on 1525 kHz (in the central Asian province of Urumchi), then this Chinese trio may be

(Continued on page 87)

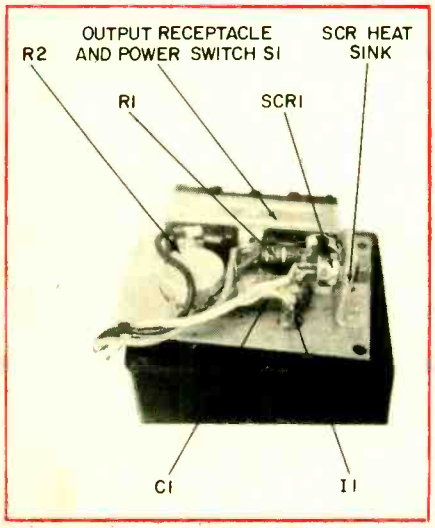
BUILD SELECT-A-SPEED MOTOR CONTROL

Beginner's project that provides choice of speeds for electric drill and other AC devices.

by the Electronic Assembly Class
Central High School, Bridgeport, CT

☐ We have all become conditioned to expect rapid transportation via fast cars, streamlined trains and supersonic jets. We've learned to expect instant . . . cash, credit, headache and stomach relief, rebates, replays and foods. No wonder we seldom think of speed in terms of anything less than maximum. 'Twould seem practically un-American.

However, those of us who have to work with non-ferrous metals, with plastics, or hard woods, find it important to get intermediate ranges of speed (rpm) with portable electric drilling equipment. The Select-A-Speed motor controls described here accomplish this goal. The smaller model continuously varies the rpm of portable ¼-inch electric drill motors, and the larger unit provides incremental speed changes using a switching arrangement, a feature not previously seen on a control of this kind.



View inside speed control which is continuously variable. Note SCR heat sink.

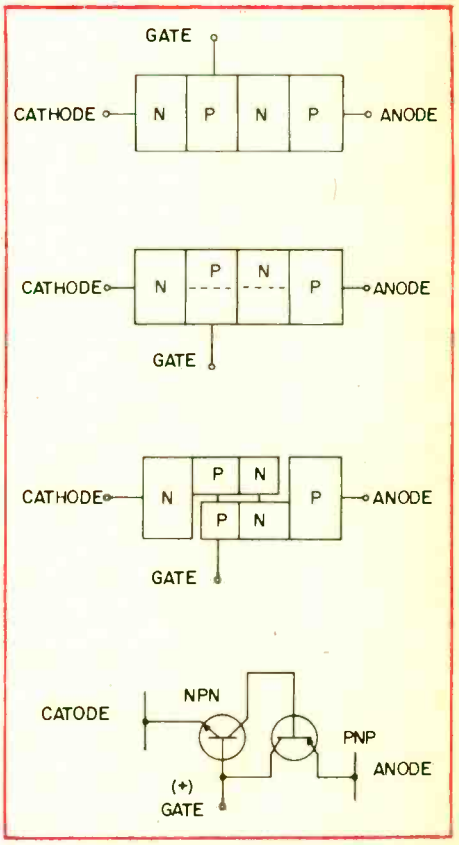
How It Works. The heart of these units, a silicon controlled rectifier (SCR) is a four-layer device whose construction is shown in the diagram. Alternate half-cycles provide the forward bias to cause the conduction, which occurs when the gate is properly triggered. The RC time constant, provided by the resistance and the capacitance controls the rate of charge of C1. Here's how the circuit acts.

C1 will discharge through I1 when the charge on C1 is equal to the ionizing potential of I1, thus providing the gate with a signal. Once triggered, conduction is sustained until the negative half-cycle reverse-biases the SCR at which time conduction ceases until the cycle is repeated. As more resistance is introduced the RC time constant is increased. The resulting increased phase shift further delays the time at which the gate is triggered. This causes the SCR to conduct for less time, and the available load power is thus diminished.

Can Control Many Devices. This versatile unit also functions well as a temperature-control device for pencil-type soldering irons, and also regulates the intensity of conventional desk lamps as well as photo-floods.

In addition it works well to control the speed of electric sewing machines and other small motor-driven hand tools. However, you *must not* try to use it to control devices which have transformers in them, such as soldering guns (pencils are OK), high intensity lights, etc. Of course it won't work at all with fluorescent lights, because lower voltage won't be sufficient to work the starter.

Any number of switch positions may be incorporated. One prototype of ours had ten. Whether you opt for three,



Silicon-controlled rectifier is a four-layered device. Simplification is shown at top. Gate voltage cuts off current between cathode (left) and anode (right). At bottom is a schematic diagram showing the SCR acts as though it were two transistors, an NPN and a PNP, together. Positive voltage on gate (of NPN) causes that "transistor" to conduct.

four . . . or ten, the option merits consideration. Having this choice eliminates sharpening drill bits so frequently as would be required without speed selection. Utilizing too high a speed for a given material is similar to "running in place" . . . neither gets you anyplace; both are dulling! Operating at speeds less than those recommended tends to cause breakage and invite physical harm to one's person.

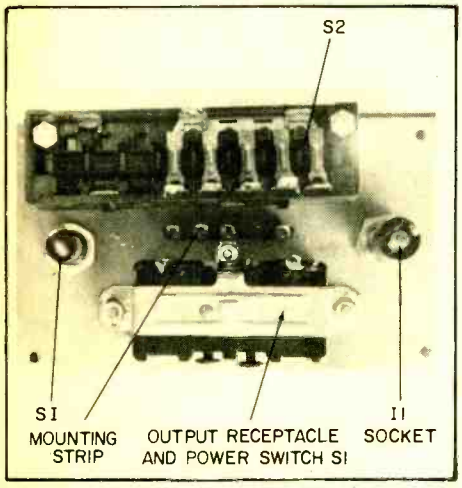
The resistors may be of any wattage and their ohmic resistance figured on the basis of the speeds most useful to you. We actually found the resistor values for optimum operation by using a resistance substitution box.

Parts placement is not critical. The controlling SCR should definitely be heat-sinked. Be sure that the SCR is electrically insulated from the sink or chassis. It is necessary to use silicone grease to insure proper heat transfer. Don't exceed the wattage rating of the SCR!

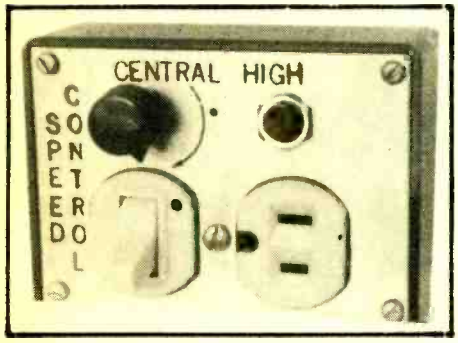
All switches used in our prototype models were bought through a source of surplus supplies. Each was modified to meet our particular needs. Incidentally, we noted no appreciable difference in speed between conditions of load and no load.

A photograph of the waveforms was taken across the load with the SCR as the controlling device. The SCR was apparently conducting during 90 degrees.

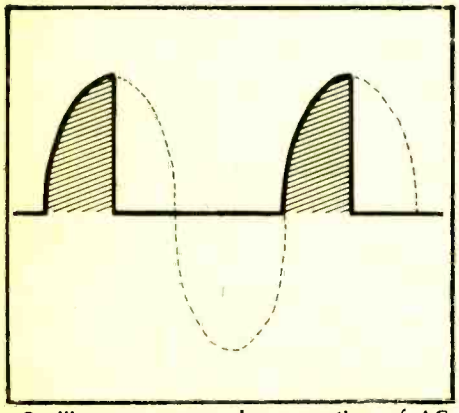
The industrial electronics class of the Career Education Department of Bridgeport Central High School worked on this project. Special credit is due Anthony D'Andrea, Torcato Caldas, Brad Hechler, and Chris Shamiss. Class instructor, under whose supervision this project was completed, is Edward M. Allen. ■



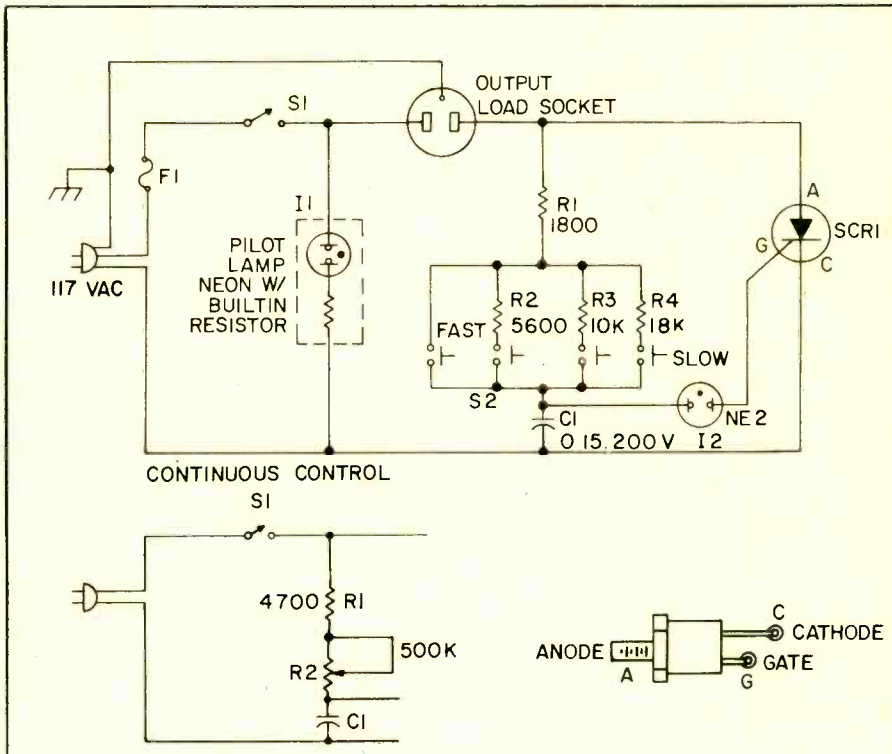
View inside 4-speed control shows push-button switch at top. Similar to fan controls.



Variable-speed unit uses potentiometer for smooth, continuous control.



Oscilloscope screen shows portion of AC sine wave during which SCR permits current to flow (cross-hatched parts).

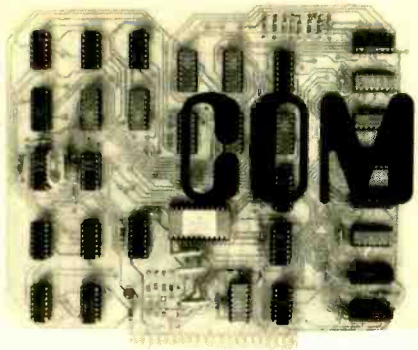


PARTS LIST FOR 4-SPEED CONTROL

C1—0.1 to 0.2-uF, 200-V DC (or better) capacitor (Radio Shack 272-1058 or equiv.)
I1—Indicator light, neon, with resistor built into holder, 117 VAC (Radio Shack 272-1501 or 272-703 or equiv.)
J1—Outlet socket and toggle switch, duplex unit, 117 VAC (from electrical or hardware store).
Q1—Silicon-controlled rectifier, 200 VDC or better, 8A (Motorola HEP-R1243 or equiv.)
R1—1800 ohm, ¼- or ½-watt resistor (Radio Shack 272-000 or equiv.)
R2—5,600-ohm, ¼- or ½-watt resistor (Radio Shack 272-000 or equiv.)
R3—10,000-ohm, ¼- or ½-watt resistor (Radio Shack 272-000 or equiv.)
R4—18,000 or 20,000-ohm, ¼- or ½-watt resistor (Radio Shack 272-000 or equiv.)
S1—part of J1, above
S2—4-position pushbutton switch, heavy duty electrical (10A or better). From electrical or hardware store (similar to switches used on large fans, blenders, etc.)
Misc.—Aluminum utility box, 6-in. x 3- or 4-in. x 2-in. or more (Radio Shack 270-252 or equiv.)

PARTS LIST FOR CONTINUOUSLY-VARIABLE CONTROL

Substitute the following parts in the 4-speed control list above:
R1—4700-ohm, ¼- or ½-watt resistor (Radio Shack 272-000 or equiv.)
R2—50,000-ohm potentiometer, linear taper (Radio Shack 271-1716 or equiv.)
Note: omit **R3**, **R4**, and **S2**.



COMPUTER READOUT

by Norman Myers, Computers Editor

e/e VISITS A COMPUTER SHOW

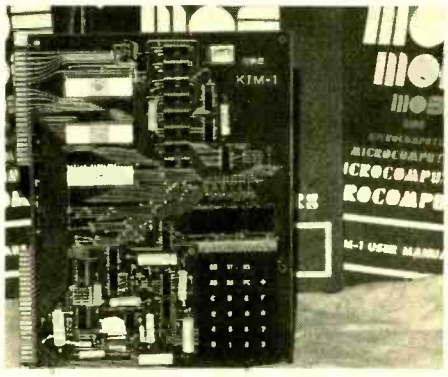
☐ Last time around we introduced a mighty-midget called Microtutor. We saw how that RCA pocket-sized computer can control external electronic devices and we wrote a computer program for it called *Secret Password* that allowed an imaginary bank vault to open only when the proper combination of letters and numbers was punched into the computer. This time we have a firsthand review of the fabulous microcomputer fair for hobbyists held in Atlantic City recently. In addition, we'll take a good, hard look at one of the most popular microcomputers at the fair—the KIM-1 by MOS Technology. The KIM-1 is unusual not only because it is a fully operational computer on a 9-in. by 10-in. printed circuit board, but also because the price is relatively low and it has good expansion capability.

Computer Show. Two big crowd pleasers appeared in Atlantic City recently. One was the Miss America Pageant, the other was the Personal Computing '76 Fair. These two attractions had several points in common. Both showed attractive young females, both showed the latest equipment models and demonstrations of talent, and both attracted lots of attention. The Personal Computing '76 Fair was the first national computer show for hobbyists, and it drew about 5,000 people during the two days it lasted. Sponsored by the Southern Counties Amateur Radio Association of New Jersey, the Fair was quite successful, with over 100 exhibitors showing computers and related products. You may ask why an amateur radio group would be interested in microprocessors and the like. The answer helps show how microprocessors and microcomputers are proliferating into more and more areas.

There are several reasons why radio amateurs are interested in microcomputers. One reason is that hams are, like you and me, electronic hobbyists who want to use electronics in powerful ways at little cost. Certainly microprocessors are powerful, and some of them are exceptionally inexpensive—as low as $10 in some cases! Another reason is that there is a real challenge in combining the technology of computers and amateur radio. (Ed. note: as we go to press a journal devoted to small computers has come across my desk, and over half the issue —six articles—is devoted to computer-ham interface.) Another reason for radio amateurs' interest is that there's such a challenge in combining the two technologies.

One product getting lots of attention these days, for example, is a Morse code keyboard. You type on the keyboard (just like typewriter keyboard) and Morse code, or an encrypted code goes out on the amateur radio airways —as fast as you can type. At the receiving end another microprocessor decodes the dots and dashes to generate words on a TV screen.

Another example; imagine a small CB walkie-talkie with a small keyboard with numbers 0-9. Pressing a button generates a tone which is relayed to a centrally-located microcomputer. The microcomputer takes the number you pressed on the keyboard and decodes it (via a memory look-up) into a phone number. The microcomputer, through a telephone connection, then connects your walkie-talkie to the telephone of the person you called. If you want to change the keyed code that connects you to your friend's telephone, you only have to change the digits in the memory of the microcomputer.



MOS Technology's KIM-1 microcomputer is complete on one board except for the power supply. Readout display is six 7-segment digits above the keyboard. KIM-1 assembled is $245.

The possibilities for using radio-controlled devices becomes almost boundless with microprocessors. Model airplanes, boats, trains, and cars, can carry small microprocessor-oriented devices that respond in intelligent ways to radio signals from the operator, as well as to traffic conditions, other vehicles, and so on.

Changes Ahead. The most outstanding message at most booths of the Fair was that, although inexpensive hobby computer equipment that does incredible things is available right now, much more is coming. The hobbyist as well as the commercial or industrial designer will see plenty of improvements, both in hardware and in software. Hardware changes ahead will bring more memory, faster cycle times, and for less money. There'll also be instructions that can be accepted by the microprocessor units, and really good, small input/output devices. The latter will probably be small cathode-ray-tube displays, small keyboards, and clever printers. An example of such a printer, and a sign of things to come is Southwest Technical Products Corp's PR-40 printer. It's about the size of a small bread toaster yet it just flies across the four-inch-wide paper as it prints letters and numbers with a dot matrix.

Software improvements of the future will not only let you write programs easier, but also use more pre-written, or canned, programs that are simply read into your shoebox-sized computer via an ordinary cassette player.

Star Trek Video Game. One of the most popular (and fun) programs currently available is a TV space-war game called *Star Trek*, and it was in use at the Fair. Mr. Spock's spaceship, the Enterprise, is the champion of

(Continued on page 74)

CB NEW PRODUCTS

e/e puts together in one neat package some of the newest CB rigs, antennas and accessories for you to use in CB contacts this year!

New Carry Bag for CB

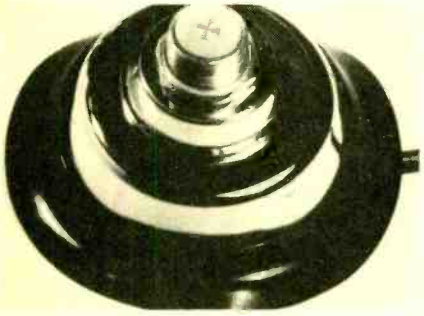
CB Sacks of Alexandria, Virginia, has introduced a new carrying case for citizens band radios to facilitate the CBers taking their rigs with them when they leave their vehicles . . . to avoid radio rip-offs. The new case, called the CB Sack, features a dual layer, heavy vinyl exterior and fully padded, shock resistant interior. Rigid top supports prevent

CIRCLE 57 ON READER SERVICE COUPON

gapping while the CB radio is being carried. The case also features an extra-long waterproof zipper, and a separate inside microphone compartment. CB Sack fits almost all CB units, and is manufactured to military specifications. Its non-stretch web strap adjusts for hand or shoulder carrying. The entire unit is a rich dark blue. CB Sacks are available for $10.95 (postpaid) from CB Sacks, 8807 Linton Lane, Alexandria, VA 22308.

Waterproof CB Antenna Mount

The Antenna Specialists Co. has announced an exclusive new waterproof antenna mount that will soon be incorporated into many of



CIRCLE 55 ON READER SERVICE COUPON

the Company's mobile CB antennas. It allows the CB user to eliminate potential short out or rust problems encountered at car washes by making it easy for him to remove the coil and whip assembly without damage or coil detuning difficulties. The new mount also makes it possible for the CBer to remove his antenna for protection from vandals and thieves. The dramatic product innovation makes use of a rugged spring pin and a sealed contact assembly which prevents the entry of water and other unwanted substances. For further information, contact The Antenna Specialists Co., 12435 Euclid Avenue, Cleveland, OH 44106.

Shakespeare Has Two

The Shakespeare GBS/3 AC Power Converter is all you need to turn your mobile CB unit into a base station transceiver. Compact and easily installed, the GBS/3 is designed to convert conventional 110-115 volts AC to 11-15 volts DC. The same operating voltage found in most automobiles. Now you can enjoy CB communications in your home without the added cost of a base station transceiver. Sells for $19.95. The Shakespeare GBS/5 extension speaker makes a dramatic difference in your CB reception. Voices come through clean and clear. Easy to understand. Natural, not garbled. You get outstanding clarity across the entire voice range, with less static and interference. Mounted in a

CIRCLE 53 ON READER SERVICE COUPON

rugged cabinet, the GBS/5 comes complete with positioning brackets and 10-ft. of cable. Ideal for four wheelers, 18-wheelers and vans. Perfect for boats, campers or any vehicle where normal reception is less than optimum. The GBS/5 sells for $14.50. For more information, write to Shakespeare Company, Electronics Group, 2805 Millwood Avenue, Columbia, SC 29250.

CB Headset

Telex's new lightweight CB headset, Model CB-88, features a noise-cancelling power microphone that delivers clear, crisp voice transmission even in a moving vehicle where wind, traffic, and engine noise normally interfere with sound quality. The mike has a variable-gain amplifier and is mounted on a pivoting boom so that it can be positioned close to the lips and moved aside when not in use. A push-to-talk switch has a clip for convenient attachment to shirt or blouse. The headset, weighing less than three ounces, closely follows the design of pilots' headsets, of which Telex is a leading manufacturer. !ncoming signals are carried direct-

CIRCLE 51 ON READER SERVICE COUPON

ly to the ear by means of a soft eartip, allowing even weak signals to come in clearly. The unit can be used with either the left or right ear, and—if desired—can be worn without the headband. An adapter is furnished which allows the ear-piece to be clipped to the user's eyeglasses. This also allows the CBer to monitor the radio in private without disturbing passengers. Price is below $70. Detailed information may be obtained by writing Telex Communications, Inc., 9600 Aldrich Avenue So., Minneapolis, MN 55420.

The Long Gainer

Anixter-Mark introduces The Long Gainer—a new tunable CB base loaded stainless steel antenna that can be easily adjusted to cover all channels across the band. Just a simple turn of the frequency adjustment screw brings in the desired channel clearly on any one of the 40 available. The smart-looking Long Gainer has a long lasting stainless steel whip and deluxe mount with coaxial cable designed for easy snap-on installation. No drilling is required, because it mounts easily to the trunk lip. A genuine PL-259 coaxial connector that insures long life is also included. Maximum height is 60-in. Sells for $31.75. For more information, write to Anixter Bros., Inc., 4711 Golf Rd., One Concourse Plaza, Skokie, IL 60076. **CIRCLE 49 READER SERVICE COUPON**

e/e CB NEW PRODUCTS

2-Way Pocket CB

A 2-way citizen's band transceiver so small it fits into pocket or purse is being offered by KingsPoint Corp., Jersey City, New Jersey. Known as the CB-150, the unit, which weighs only 5.5 oz. and measures 5½-in. x 2-in. x 1-in. is powered by a low cost 9-volt battery

CIRCLE 61 ON READER SERVICE COUPON

which by virtue of a power shut-off feature lasts for weeks and weeks. Changing crystals is made easy by a convenient slide-open compartment which lets one snap out and snap in alternate channel crystals. Ideal for security guards, fishermen, campers, hikers, motorists, home owners, coaches, etc., KingsPoint's CB-150 retails for under $40. For complete details write KingsPoint Corp., 106 Harbor Drive, Jersey City, NJ 07305.

Magnetic Mount CB Antenna

Circle No. 54 On Reader Service Card

A new mobile CB antenna that can be mounted easily and instantly on flat metal surfaces without drilling holes or marring paint is now in production at JFD. The new model 10-MM can be removed quickly despite its magnetic grip when the radio is not in use. This helps deter theft by removing entirely from view the antenna which signifies presence of a CB radio. Other 10-MM features include: a precision-wound permanently sealed copper wire base loading coil that provides a typical VSWR of less than 1.3 to 1 for optimum transmission and reception of CB frequencies; corrosion-proof, high strength 37-in. solid stainless steel radiator whip; heavy duty stainless steel shock spring; heavy gauge ABS cup that can never rust, corrode or stain; chromed brass screw machined parts; tough high electric nylon insulation for low loss performance; and 18-ft. 95% copper-shielded RG58/U coaxial cable sweep-tested to assure maximum signal transfer, with factory-assembled PL259 connector. Suggested list is $33.00. For all the facts, write to JFD Electronics Corp., Pine Tree Road, Oxford, NC 27565.

Hump-Mount Speaker

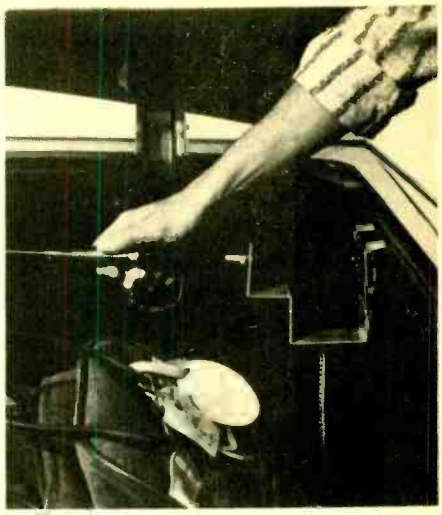
Superior sound and security have been designed into Acoustic Fiber Sound Systems, Inc.'s new Kricket Kamel external speaker. While CB enthusiasts know the safest place for a transceiver is in the trunk when they are not in their vehicles, many simply do not want to contend with the nuisance of unscrewing a bunch of screws every time they leave their vehicles unattended. That's why the base of the AFS/Kricket Kamel speaker unit contains hole patterns to accommodate bracket mounts for most transceivers and microphones. Now for the first time speaker transceiver and microphone can be combined into a single unit that simply rests on the transmission hump of an automobile van or truck. Specially designed "teeth" in the speaker base hold the unit firmly in place while driving. So, installation problems are totally eliminated as well. To

Circle No. 58 On Reader Service Card

remove the AFS/Kricket Kamel speaker/transceiver unit, simply unplug the antenna and power leads, lift the entire unit off the floor and place it in the trunk. It's that simple. To provide maximum clarity and intelligibility across the entire voice range, the 3½-in. waterproof speaker is housed in AFS enclosure. Cross-laminated tubular fiberboard controls the sound, deadens static. Annoying reverberations are eliminated and the result is a clear, clean, brilliant sound. For more data and info on other CB products, write to Acoustic Fiber Sound Systems, Inc., 7399 Knue Road, Suite 116, Indianapolis, IN 46219.

Tuk-A-Way Antenna Mount

A steel antenna mount which stops radio antenna theft has just been introduced by Tuk-A-Way. Sold as an accessory for citizens band radio, mobile radio and car telephone users, Tuk-A-Way installs easily on the trunk lip of most car models, and provides complete antenna concealment inside the trunk when not in use. It accepts antennas designed for either roof or trunk mounting. Tuk-A-Way offers three essential benefits for car radio and telephone users: the added protection against theft; the convenience which allows use of automatic car washes and covered parking facilities; and the elimination of paint chipping and scratching or permanent holes in the roof or trunk by use of a clamp for installation. Tuk-A-Way is constructed of 12-gauge, cold-rolled steel, and is coated with zinc chromate. The hinge is of stainless steel, and is spot-welded to the clamp to provide positive ground con-



Circle No. 56 On Reader Service Card

tact. Suggested retail price for Tuk-A-Way is $15.95. For more information, contact the Deep South Marketing Corporation, 2828 Telephone Road, Houston, TX 77023.

CB Jewelry

Because of the many requests Regal Lapidaries, Inc. had been getting from countries other than the U.S.: Brazil, Columbia, Italy, Israel, Argentina, Mexico, Canada, Panama, etc., because CB was going international, Regal felt that there was a need for a slogan and symbol that would be readily recognizeable to CBer's all over the world. "Good Buddy" is the expression used by U.S. CBers so that's where it seemed to be the logical place to start. "Good Buddy" is an expression of sodality—it is a term identified with a special group or movement. Buddy therefore means Sodality which in turn stands for fellowship, comradeship, association. "Sodalis" is its direct Latin equivalent—Latin being the basics for French, Spanish, Portu-

Circle No. 60 On Reader Service Card

guese, Italian and a partial root of the English language too. "Bonus" is Latin for good, and thus was conceived the perfect international slogan—"Bonus Sodalis"—incorporating a language readily familiar to most everyone and embracing the idea of "Good Buddy." Regal now offers five new items bearing the "Bonus Sodalis" slogan and symbol. The new products include a man's and woman's ring which will be cast in solid bronze, 14 Kt. gold electroplated and then antiqued to allow the detail to be clearly visible. The other three items are: a pendant, key chain and belt buckle which are handsomely struck in solid bronze. All items are of highest quality—and yet will be priced so that every "Bonus Sodalis" can afford one. Get all the facts and prices direct from Regal Lapidaries, Inc. 420 Madison Ave., N.Y. 10017. ■

e/e COMPUTER READOUT

(Continued from page 69)

justice in this game against the Klingon. Rockets, or phasors, can be fired by the space-ships on the TV screen, and the ships can maneuver, refuel, and change their flight characteristics in this sophisticated game. There are so many variables that can be changed in this game that a manual is provided, called the Starfleet Technical Manual.

Just walking from one booth to another at the Fair was like walking through a candy store. Every processor, computer, printer, TV game, keyboard, and module was interesting and tempting. Digital Equipment Corporation (DEC) even had a model railroad layout controlled by their LSI-11 computer. The train could start, stop, wait, and change direction along a multi-switched path, all under computer command.

More New Micros. Motorola announced that they will have a low-cost microcomputer kit available soon. It will have keyboard input, a six-digit LED output, memory, and teletype interface capability. The unit will be based on the Motorola 6800 microprocessor, a quite powerful device. Price will be around $200. For more information on the KIM-1 microcomputer circle number 75 on the Reader Service coupon.

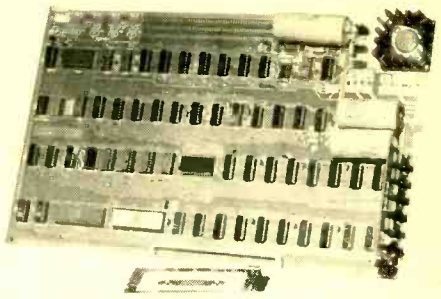
In a similar move, EBKA Industries in Oklahoma showed a brand-new kit, the 6502 Familiarizer, which was humming away. The 6502 contains a printed circuit board 9-in. by 12-in. and a keyboard, two-digit LED display, 1024 *bytes* (8 *bits* to a *byte*) of RAM (random access memory), and 256 bytes permanently stored in a PROM (programmable read only memory). The program is put in the PROM before the kit is shipped, allowing the Familiarizer to automatically perform some pretty handy functions. The digits on the LED display, for example, move to the left as the keyboard buttons are pressed and then the digits are automatically shifted into the RAM.

The basic kit sells for $229, and there are other boards that can be added to turn the unit into a more powerful computer. You can add more RAM, or you can add a PROM board which is programmable from the instructions you enter on the basic board. With this PROM your program will always be there, even when you turn the power off then on again—which is not true for RAMS. In addition a cassette tape recorder can be connected to the Familiarizer to store programs for later play back.

The Apple Computer. The Apple Computer Company showed their Apple computer, priced at $666.66. This is a bit expensive for beginning hobbyists, but it offers a lot. A keyboard and a TV monitor connect directly to the Apple. A program, Apple Basic, is available on a cassette tape that allows the user to write programs in an easy-to-understand language. Further, Apple Basic finds bugs (worms) in your program and prints out error messages telling just what is wrong.

More Hardware. Another company, Wave Mate, was showing their Jupiter II computer, designed to control industrial equipment like wire-wrapping machines and milling machines. And MITS, makers of the Altair computer discussed in July/August, 1976 in this column, was there with a large display of equipment and computer programs. Finally, National Semiconductor, the company that sends you a computer kit in a ring binder notebook, was showing their SC/MP (pronounced "Scamp") computer. One SC/MP was operating a TV screen while another responded to one's teletype inputs.

There was a great deal to see—much too much to describe further, but this should give you an idea of what you missed if you weren't at the Computer Fair this year. There'll be another hobby Computer Fair next year, and we'll keep you posted on this interesting event well ahead of time.

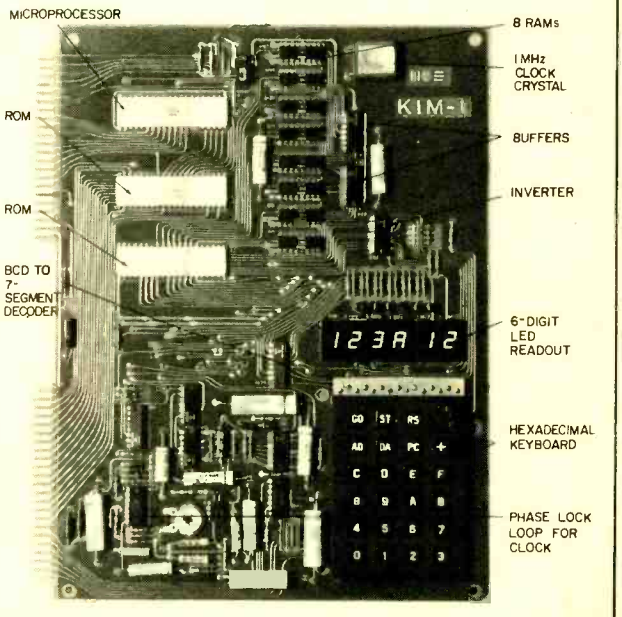


Apple Computer's computer, The Apple, works with external keyboard and TV monitor, and also accepts programs from cassette tapes. Priced at $666.

KIM-1, a Bargain Microcomputer. MOS Technology in Norristown, Pennsylvania, has named its popular microcomputer the KIM-1. It comes already assembled on a 9-in. by 10-in. printed circuit board, and has everything you need to make it work except a 5-volt power supply. The board carries the microprocessor chip, memory, input/output control chips, a keyboard for writing programs and entering data, and a six-digit LED display. The display can show the address and contents of any memory location you select. The unit comes with three manuals:

1. The User's Manual, which gives an overview of the design of the microcomputer and how to use it.
2. The Hardware Manual, which explains each of the chips and various hardware interfaces that can be used.

(Continued on page 92)



The KIM-1 computer by MOS technology is complete on one large board which contains all circuitry, as well as the readout digits and the keyboard (lower right).

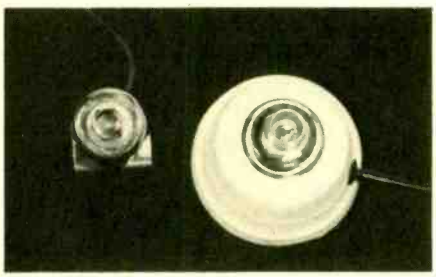
Kathi's CB Carousel

by Kathi Martin, KGK3916

☐ Everyone, including the TV broadcasters, has suddenly become aware of TVI (TV receiver interference) and it matters not that the worst TVI is caused by sewing machines, office appliances, oil burners, defective flourescent lights, doorbell transformers, etc., each and every one of them blames TVI on CB. It's hard to find a single newspaper or newsmagazine that has not had at least one article blaming CBers for every form of TVI including a totally blank picture (usually caused when someone accidentally pulls the power cord out of the outlet).

Unfortunately, people down at the FCC also read the nonsense ground out by these fast-buck writers and worse, sometimes they actually believe it.

Somehow, all the TVI and RFI (radio frequency interference) generated by high-power transmitters in the land mobile service never get mentioned. We hear of CB signals received over church PA systems but no one remembers the name of the church. We hear of CB signal received on medical equipment, but no one remembers the hospital. How come the *flea's whisper* CB transmitters (3-4 watts) get picked up by everything including grandma's tooth fillings, but the high-power police transmitters (50-250 watts) never get picked up? How come we never read how an FM broadcast transmitter wipes out hi-fi systems for blocks and blocks? The reason is police, fire, government and broadcast interference doesn't make good copy. Picking on the CBer is more fun, and more lucrative.



Most mobile mounts for CB antennas are one of these two kinds. Left is single feed (also called single-ended) and right is coaxial feed. Note close similarity to standard PL-259 coaxial connector.

The Truth of the Matter. In fact the radio amateurs and the ARRL squashed much of the TVI some 20 years ago, also establishing that a substantial amount of TVI was due to improper TV receiver front end design (most TV sets still don't have a high pass filter on the antenna input.) When there is much CB TVI it is generally caused by an illegal linear amplifier, or someone trying to receive TV signals well outside the secondary service area of the transmitter—deep fringe. Anything, even a sewing machine with a universal motor will cause TVI on a deep fringe TV receiver. But we CBers make better copy than some unknown sewing machine, and those deep fringe viewers are counted into a TV station's audience when computing advertising rates, so you can figure why the owners of those Marconi goldmines get upset when one single listener, way out in the boonies, can't receive Mary Hartman, Mary Hartman.

More Nonsense. Another bit of garbage emanates from those worried about upcoming skip jamming the Citizens Band. Ever notice how the worriers are non CBers—they couldn't tell a skip signal from a walkie-talkie down the block. What has happened is they have latched onto another *zinger* to throw at CB. How come they don't recall how the last sunspot peak caused TV reception interference: there were times Philadelphia was completely wiping out channel 2 in New York City. Where was CBS with its interference complaints then? Considering CBS' complaints about NBC programming we can probably expect CBS to request the FCC close down all of Philadelphia broadcasting (to play it 100% safe) when the skip's in.

The end result of the publicity created by carpetbagging writers, journalists,

Base loading coil is tapped (near bottom) to provide match to 50-ohm transmission line. Top of coil connects to antenna, while other end connects to ground. Many coils are not tapped.

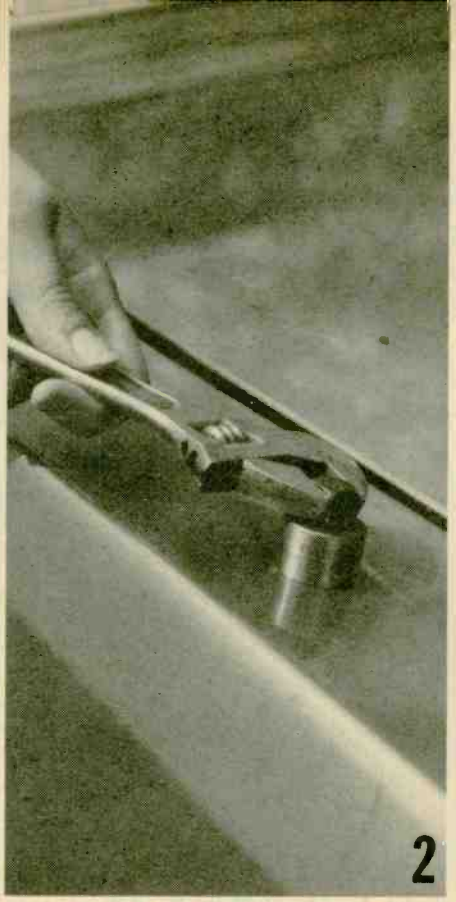
and the TV broadcasters is that the FCC requires so much harmonic suppression in the new transmitters that the CBers will be paying roughly the cost of a decent antenna, for TVI filtering we don't need, and which most likely won't have any effect on local TV sets.

40-Channel Antenna Tests. Moving along to a more interesting and valuable subject, I had the good fortune to show up in the middle of tests being run by Herb Friedman and the engineering crew from Tridac Labs Division on antennas for 40 channels. They were testing and examing just about every type of mobile antenna and mounting device. I saw expensive mounts from well known manufacturers with internal parts that had virtually dissolved after exposure to ordinary weathering over several months, mobile brackets that simply fell apart after a few weeks of use, brackets with incorrect hardware, antennas with unsoldered matching coils, non spring pressure contact terminals, and *weatherproof* (?) coil forms filled to the brim with water. But bad as all this might sound, these defects represent a minuscle percentage of the antenna hardware presently on the market. On balance, most of the stuff was darn good; problems appear when one of the better manufacturers cuts quality in order to be competitive with *schlock* made to resemble the quality components.

Universal Antenna Rule. As far as mobile antennas are concerned, Herb's tests once again confirm his universal rule for CB mobile antennas: the long-

(Continued on page 88)


1

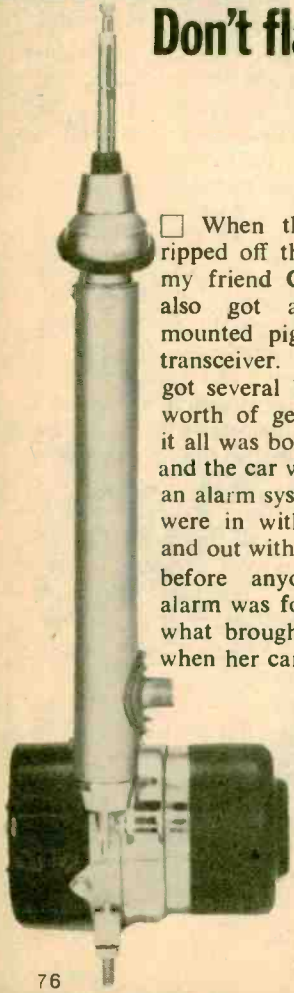

2


3

ANTI-RIP-OFF CB ANTENNA

Don't flag your CB rig with a CB antenna! Foil thieves with the Tenna CBE-10 electric-driven antenna that disappears!

by Herb Friedman



☐ When the local hoods ripped off the CB rig from my friend Celia's car they also got a tape player mounted piggyback on the transceiver. All in all they got several hundred dollars worth of gear even though it all was bolted to the dash and the car was protected by an alarm system. The hoods were in with a coathanger and out with the gear before before anyone knew the alarm was for real. Wonder what brought this on Celia when her car was in a parking lot along with several hundred other cars? An antenna sticking up above the rooftops — a beacon announcing to one and all, "Hey, there's some expensive equipment in this heap."

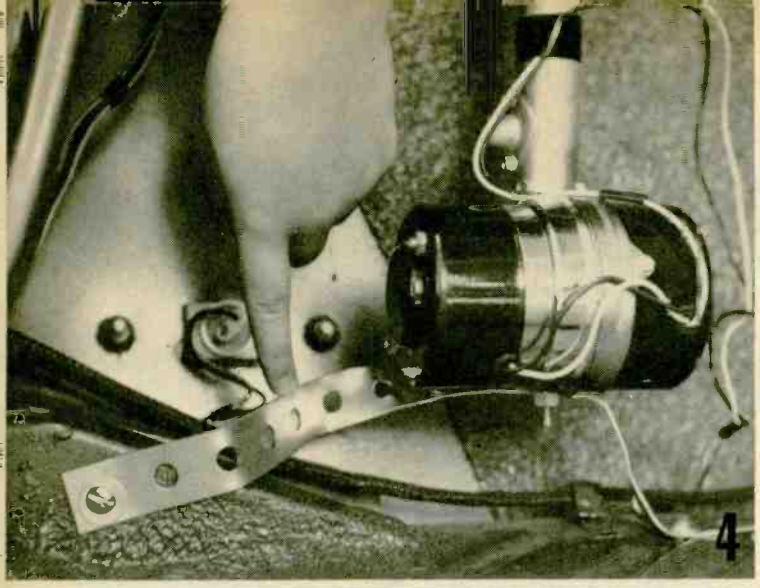
So when Celia came to me asking how to avoid having her new rig ripped off I suggested a Tenna CBE-10 electric antenna—a CB antenna that disappears from sight when not being used.

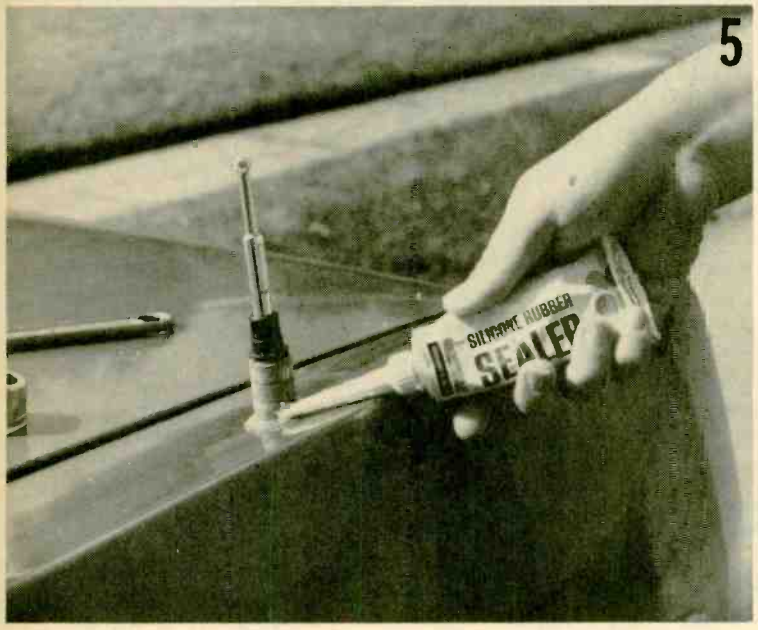
Here's How It Works. At the base of of the antenna is a small electric motor that drives an elevator assembly. When the antenna is switched off the motor telescopes the antenna down inside the vehicle with only a small stub sticking out, just like the concealed antennas Tenna makes for GM, Chrysler and Ford cars. When the antenna is switched On the motor drives the center-loaded antenna up and out. When the antenna reaches full height the power is automatically removed from the motor.

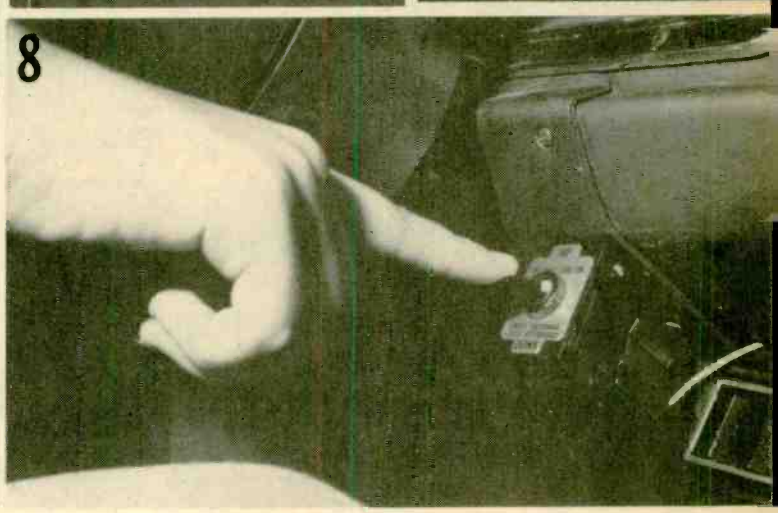
To insure the rig isn't keyed to transmit while the antenna is down, which might damage some early solid-state transmitters, the Tenna CBE-10 has a special wiring circuit that applies the power to the CB transceiver. Turn the antenna switch to *Up*, meaning antenna extended, and power is applied to the CB rig. Turn the control switch to *Down* and the power to the set is turned off while the antenna does its disappearing act.

Take careful note that the Tenna CBE-10 resembles several other motor driven CB antennas but the Tenna has one really big advantage: it is center loaded and the loading coil disappears into the car. The copies of the Tenna model have base loading coils and the coils remain outside when the antenna is lowered, almost shouting out "Hey, I'm a CB antenna!" And the external base coil provides a nice handgrip for vandals. The Tenna CBE-10, however, leaves little sticking out of the car with almost nothing for a vandal to grab on to.

The Tenna CBE-10 is supplied with a coaxial cable with connectors on both ends (PL-259 standard coaxial type at the transceiver end), control wire har-







Photos at left (on facing page) shows antenna along with coaxial cable and control wire harness prior to installation. Photo 2 shows how easy it is to cut hole in car fender for mounting antenna. Tool is Greenlee punch, available at hardware or electronic supply stores for a couple of dollars. Just drill 1/4-in. hole with your electric drill, put punch in place and tighten with adjustable wrench. The punch will soon cut a nice clean hole for antenna mount. Photo 3 shows how antenna is tuned for minimum SWR on channel 12 (if you're on 23) or channel 19 (if on 40). Photo 4 shows how bottom end of power-driven antenna is held in place with metal strap (supplied). Sealing installation with silicone plastic keeps it waterproof. In photo 6, above, Celia shows how high antenna extends. In 7 she's following it down with her finger while I depress the switch inside car. You can see it installed under the dash in picture 8.

ness with a factory-installed connector for the back of the supplied control switch, a sturdy metal switch mounting bracket, and installation hardware.

Where To Put It. The pictures show how Celia's CBE-10 was installed on her car. One note of caution, however, before you get into your installation. The antenna can fit inside the front fender of some "full size' cars, but you simply might not have the dexterity required to complete the installation in a front fender. A better location is on the rear deck. And Tenna recommends two locations, one right behind the rear window where trunk lip antennas are usually installed. There is generally not enough room, however, in intermediate and compact cars for this mounting location. For smaller size cars I suggest the rear fender location used on Celia's '73 Valiant. Note that some modern cars such as the Volare and Aspen have no room at all for a trunk-mounting antenna of any type other than a lip, or rain-channel mount. Make certain you can install a Tenna CBE-10 in your car before you purchase the unit.

The photographs show how easy it is to install the Tenna CBE-10. You run the (supplied) coax from the front to rear using the same wiring channel or rear-seat channel you'd use for any other antenna, and don't forget to run the wiring cable for the motor along with the coax. Then follow the steps as they are shown in the photographs above on this page and the facing page

Adjusting Antenna. After the installation is complete the antenna must be adjusted for minimum SWR. A special set of wrenches is provided for making this adjustment. You will have no problem as long as you connect the power wire to a circuit controlled by the ignition switch, because the tuning adjustment must be made with the antenna partially retracted, and you can only stop the retraction by turning off the main power. (Once the antenna's control switch is set to "down" the an-

(Continued on page 93)

CB Buzzin' Bee

BY CHRISTINE BEGOLE, KFC3553

☐ You got KFC3553 Buzzin Bee sending all you bodacious letter-writers a big ten-four and all the good numbers. Mercy sakes alive, though, what's happened to all my shutterbug buddies? Bees need photos to keep on buzzin! Keep the news coming in, and don't forget that as far as I'm concerned a picture is worth a thousand words.

Carrot Top Calling Beer Belly

Those of you who watch the tube know that CB radio has made its debut on television. When Ann Romano's daughter, Julie, disappears on the weekly series *One Day at a Time* (CBS), Ann (Bonnie Franklin), Barbara

(Valerie Bertinelli), and their building super (Pat Harrington) take to the airwaves and use CB to find the missing runaway. Catch it on the re-runs if you missed it on the first time around.

For All You Border-Crossers

Traveling outside of the U.S. with CB can be tricky. Here's the scoop on what to do *before* you hit the road.

A while ago. I got a communiqué from my good buddy A. Grimm Richardson in the Panama Canal Zone. He had some advice for CBers heading south of the border: "Don't even think about crossing the border, any border, with your CB, without first checking out the laws of that country. They'll fine, con-fine, and confiscate, as old Grandpap with the superheterodyne atop Signal Hill used to say of the Bears who found a still in use long after Prohibition. You won't want to feed the wall-to-wall Latin American Bears, as it runs into big green stamps for possession, when you haven't even had your ears on." Thanks for the tip, Grimm; things are now even more restricted than when you sent your letter to me.

Nowadays, visitors with CB rigs in their vehicles can't even get into Mexico. Mexico used to issue temporary operating permits to licensed U.S. CBers, but now, presumably because of enforcement problems, CB use by Americans is totally banned in Mexico. Units which somehow get across the border undiscovered by border officials risk both confiscation and stiff fines later on, so all in all, if you're going to Mexico, leave that radiddio at home!

Canada, on the other hand, is more friendly—if you make sure to plan ahead. You can operate your rig in Canada if you get authorization from the Canadian Department of Communications before you get to the border. All you do to get authorization is write to the DOC office that is nearest to the place that you plan to enter Canada. Ask them for an application to register your CB station. When the application arrives, fill it out, and zoom it back to the DOC, allowing at least six weeks for mailing and processing delays.

When you head for the border take your U.S. license, your Canadian authorization, your gear, and you'll be set to chat with your northern CB buddies. Need address for the appropriate DOC office? Check our listings on this page.

ATLANTIC REGION
Regional Director
Department of Communications
7th floor
Terminal Plaza Building
P.O. Box 1290
1222 Main Street
MONCTON, N.B.
Canada E1C 8P9

QUEBEC REGION
Regional Director
Department of Communications
20th floor
2085 Union Street
MONTREAL, Que.
Canada H3A 2C3

ONTARIO REGION
Regional Director
Department of Communications
8th floor
55 St. Clair Avenue East
TORONTO, Ont.
Canada M4T 1M2

CENTRAL REGION
Regional Director
Department of Communications
2300-One Lombard Place
WINNIPEG, Man.
Canada R3B 2Z8

PACIFIC REGION
Regional Director
Department of Communications
325 Granville Street, Room 300
VANCOUVER, B.C.
Canada V6C 1S5

One Way to Slow Down Theft

All of us worry about our mobile rigs being stolen while we're not looking. One solution to CB theft is to carry your rig with you wherever you go. If you can't be bothered with one more thing to tote around, another al-

ternative is to invest in an in-dash unit, which will at least slow CB thieves down. One unit, which to my knowledge is the smallest in-dash unit available, is the Royce Model 1-614. It's a combination 23-channel transceiver and AM/FM radio, including such features as an automatic noise eliminator, a fully variable squelch control, and an RF gain switch which doubles as a local-distant switch when the unit is used as an FM radio. Take a look at this unit and others like it next time you're in the neighborhood of your CB dealer.

A Close Call In Alabama

Rollin Moseley wrote me recently and sent along a story of a fellow Alabaman who learned the hard way why it's important to announce your name and location before you start transmitting advice:

"Be sure everyone knows who you are and to whom you are talking," urges Hugh E. Wilson Jr. of Opelika, Alabama, after a frightening experience recently. That's good advice, as his story reveals.

Wilson was riding along a country road in South Alabama with a truck following rather close behind—the driver obviously wanted to pass. Coming to a reasonably straight stretch, Wilson picked up his mike on channel 19 and helpfully announced, "Come on by, Good Buddy. You can pass me now."

No sooner had the truck passed when Wilson heard the following, quite scary, conversation: "Gracious alive, man! I liked to have had a head-on collision with that 18-wheeler."

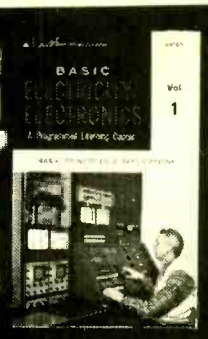
Another voice joined in: "I was eyeballing it. You're lucky to be alive."

"Why did you tell me to come on

(Continued on page 94)

e/e BASIC COURSE IN ELECTRICITY & ELECTRONICS

RECOMMENDED THEORY FOR ALL CB OPERATORS



This series is based on BASIC ELECTRICITY/ELECTRONICS, Vol. 4, published by HOWARD W. SAMS & CO., INC.

HOW OSCILLOSCOPES WORK

WHAT YOU WILL LEARN. When you have finished reading this article you will have learned what the parts of an oscilloscope are and, how they display electrical signals on the screen of the cathode-ray tube. You will also have learned how the various individual control circuits in the oscilloscope process the signal and generate control signals to make it appear on the CRT screen in a meaningful way. You will be able to draw a block diagram of the parts of an oscilloscope, and you will understand how simplified versions of actual oscilloscope control circuits work.

CONTROL CIRCUITS

Although the cathode-ray tube is a versatile device, it cannot operate without control circuits. Naturally, the type of control circuits required depends on the purpose of the equipment in which the CRT is used.

There are may different types of oscilloscopes. They vary in purpose and cost from relatively simple test instruments to highly accurate laboratory models. However, all have two things in common; they must have some type of CRT, and they must have a group of control circuits to feed a waveform to the CRT. All test oscilloscopes can be divided into the basic sections shown below.

FRONT PANEL CONTROLS

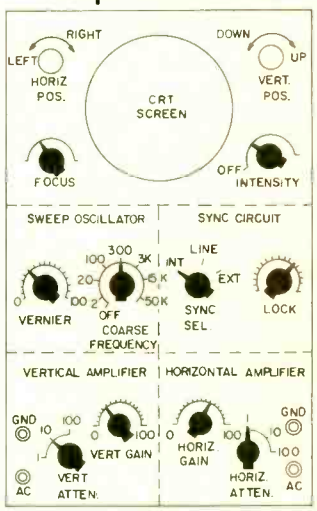
There are about 12 front-panel controls on most popular models, which adjust the oscilloscope circuits for proper operation. The type and number of controls vary with the purpose of the **scope** (an accepted name for oscilloscope). This article discusses these controls, and how the circuits they control operate.

All of the circuits in the block diagram are controlled from the front panel. (The power-supply switch is on the intensity control.) The four controls surrounding the screen regulate voltages being fed to the CRT. The four areas in the lower half of the panel have titles similar to those in the block diagram.

POWER SUPPLY

Power-supply requirements for oscilloscopes vary considerably. Some cathode-ray tubes such as those

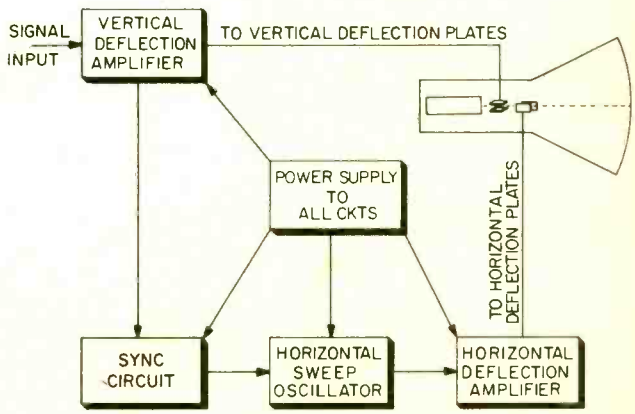
Scope Front Panel



in TV sets, require accelerating (second anode) voltages as high as 15 to 30KV (15,000 to 30,000V). The type used with most general-purpose scopes on the other hand, use 2 to 3KV. Most power supplies employ a transformer, half- or full-wave rectifiers, filters, a load resistance, and, often also include voltage regulation.

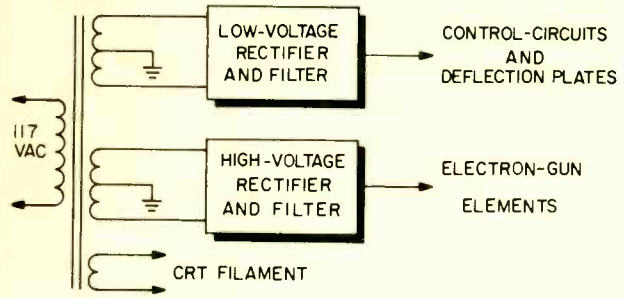
Most test scopes have both high-voltage and low-voltage power-supply sections fed by a single transformer. The high-voltage, low-current section takes care of the electron-gun requirements. Voltage needs

Main Circuits and Signal Paths

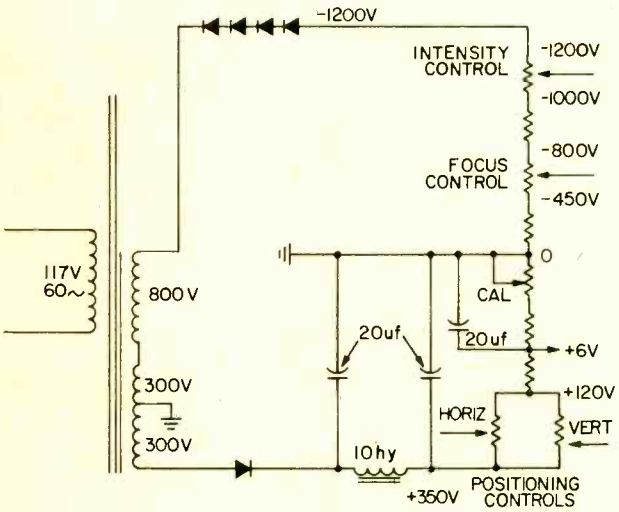


for the remainder of the circuits are supplied by the low-voltage section. This section provides potentials of 40 to 80V. A third winding on the transformer provides voltage and current for the CRT filament.

Block Diagram Power Supply



Power Supply Internal Circuit



QUESTIONS

Q1. To which element of the cathode-ray tube is the *Intensity* control connected?

Q2. To which element of the CRT is the *Focus* control connected?

ANSWERS

A1. The **Intensity** control is connected to the **control grid** of the CRT.

A2. The **Focus** control is connected to the **first anode.**

CRT Controls

In the circuit below, the second anode (accelerator) is near ground potential. To obtain the high accelerating potential required, the other electron-gun elements are operated at negative potentials. The control grid often operates near 1,200V negative, 90 to 100V more negative than the cathode. The first anode (focusing) can be maintained between —800 and —900V. These voltages are typical but vary among instruments.

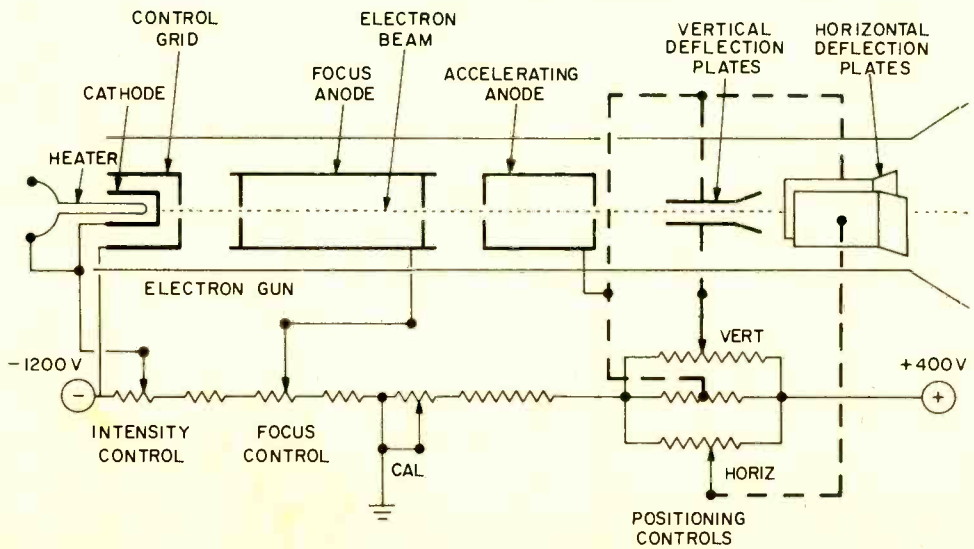
Deflection-Plate Controls

The method of adjusting the deflection-plate voltage shown in the diagram is only one of several possible ways.

In addition to centering the beam vertically on the screen, there are times when it is desirable to move the entire waveform up or down. **Vert Pos** (vertical positioning) is a front-panel control that permits this. A circuit used to vary the potentials on the plates for positioning purposes is shown on the opposite page. Voltage from the last stage of the amplifier, varying in the same way as the original waveform, is impressed across R1. C2 returns the AC signal to ground and blocks the DC from ground.

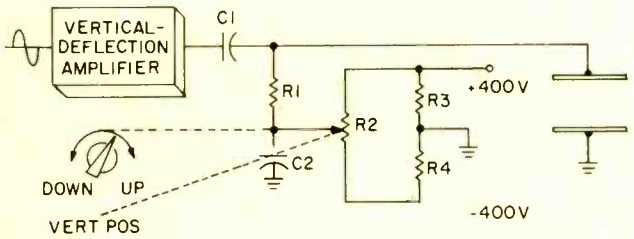
When R2 **(Vert Pos** control) is centered, there is no difference of potential between the two plates. When the arm is moved down, the lower plate becomes

Power Supply Connections to Cathode-Ray Tube Elements



more positive than the upper plate, and the electron beam moves downward. When the arm is moved up, the upper plate becomes more positive. If there is a waveform being applied across R1, the difference of potential from this positioning network is added to or subtracted from it. This arrangement makes it possible to shift the entire waveform up or down on the CRT screen.

Vertical Positioning Circuit



QUESTIONS

Q3. If one deflection plate is at +124V and the other is +18V, in which direction will the electron beam bend?

Q4. Why are the deflection plates of a CRT bent outward at the end?

ANSWERS

A3. The electron beam will bend **toward the +124V plate.**

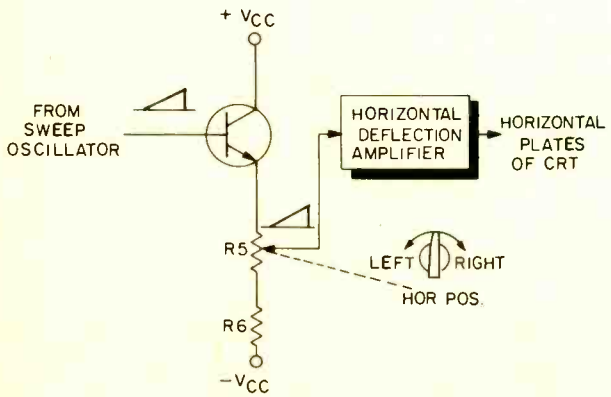
A4. The ends of the plates are bent to **allow larger angles of electron-beam deflection** than would be permitted by straight plates.

Horizontal Positioning

One type of horizontal-positioning circuit used in the deflection system is shown below.

The positioning transistor operates as an emitter follower. Its input signal is a sawtooth sweep voltage from the sweep-oscillator circuit. The sizes of the resistors are such that the center position of R5 **(Hor Pos** control) is at zero (ground) potential. The horizontal-deflection amplifier is made up of two transistors operating in push-pull. Each transistor controls the potential on one of the plates. With the arm of R5 at ground potential and no sawtooth signal present, the collector currents in the amplifier transistor are identical, so difference in voltage exists between the deflection plates. When the arm is moved up (more positive) or down (more negative) the collector currents are no longer equal. The potential on one amplifier collector is then more positive or less positive than the other. In this manner the beam can be moved left or right. Vertical positioning is done similarly.

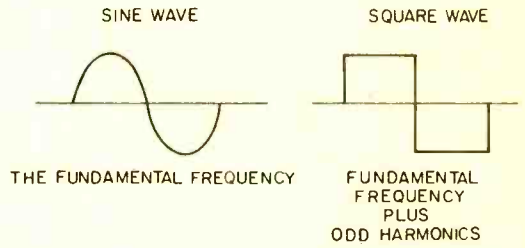
Horizontal Positioning



Vertical Amplifier

Since the vertical amplifier receives the waveform to be observed, its input impedance should be very high to prevent loading of the external circuit from which the waveform is obtained and the resultant distortion of the signal. The amplifiers of most scopes have input impedances of several megohms. Some other requirements for good vertical amplifiers are listed below.

Frequency Response—Frequency response is a measure of the ability of an amplifier to pass the frequency components of a waveform. A pure sine wave, as you know, has only one frequency component—the fundamental.



A square wave, however, consists of the fundamental sine wave plus many odd-numbered **harmonics.** A harmonic is a sine wave having a frequency that is a whole-number multiple of the fundamental frequency. A perfect square wave has an infinite number of odd-numbered harmonics. Its tops and bottoms are perfectly flat, and the rise and decay of its sides occur in zero time. Since there must be some time to allow voltages to rise and fall, there is no practical circuit that can produce a perfect square wave. However, a conventional square wave contains several hundred odd-numbered harmonics.

A good general-purpose scope should have a frequency response extending up to 5 MHz. For practical maintenance work, a scope should be able to pass the tenth odd harmonic of a square wave. Since this is 21 times the fundamental frequency, a good 5-MHz scope will be able to display square waves having a fundamental frequency as high as 100 kHz.

QUESTIONS

Q5. What makes a square wave different from a sine wave?

ANSWERS

A5. A sine wave is made up of a single fundamental frequency; a square wave consists of the **fundamental plus many odd harmonics** of the fundamental.

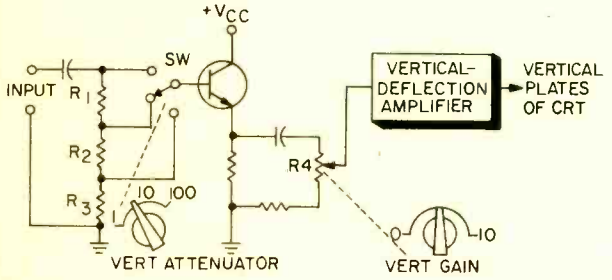
Gain—The gain of a vertical amplifier determines how well a small signal can be expanded for observation on the screen. If the CRT, for example, has a deflection factor of 0.8V per inch and no means of amplication, a waveform having 0.2V amplitude would be very difficult to examine. However, if an amplifier were used, all large signals would be amplified so much they would extend off the screen. Therefore, instead of having several channels of amplification (each with its set of linear, good frequency-response amplifiers), a method must be used to attenuate (reduce) waveform amplitudes before they arrive at the amplifying stage.

The diagram below shows the method commonly used for attenuation. The **Vert Atten** (vertical attenuator) switch has three positions, 1, 10, and 100, which are factors of attenuation. The attenuation equals unity in position one; there is no attenuation of signal. This corresponds with the top tap of the switch in the schematic. The full voltage of the input is fed to the grid of the cathode follower. Attenuation equals 1/10 in position 10. R_1, R_2, and R_3 are selected so that 1/10 of the input voltage will arrive at the grid. Position 100 provides an attenuation of 1/100.

Since attenuation values between these broad settings may be desired, a finer attenuation control is provided. This is the **Vert Gain** (vertical gain) control. As you can see, it selects a voltage from R, the emitter resistance, and applies this voltage to the vertical amplifier. Through the use of the **Vert Atten** and **Vert Gain** controls, the vertical size of the waveform can be regulated on the screen.

The vertical-deflection amplifier stage in a good scope is usually a push-pull amplifier having a constant gain and a frequency response up to 5 MHz. The output of the amplifier is fed to the vertical-deflection plates.

Vertical Attenuation and Gain



QUESTIONS

Q6. Constant gain refers to the ability of an amplifier to equally amplify all signals within its capability. Why is this necessary in an oscilloscope?

Q7. Is this frequency response of a scope a good measure of its quality?

Q8. In the schematic above would the switch be connected to the tap at the bottom of R_2 or the top of R_1 if the Vert Atten were set at 100?

ANSWERS

A6. Constant gain is required so **all waveforms,** regardless of their amplitude (within the voltage range of the amplifier), **are amplified the same amount.** Variations in gain would make the presentations inaccurate.

A7. Yes, frequency response is a good measure of the capability of a scope. A scope with good frequency response will reproduce waveforms over a wider frequency range more faithfully (with less distortion) than a scope with a poorer frequency response. A scope with good frequency response responds more quickly to the rapid changes of narrow pulses and steep wave slopes.

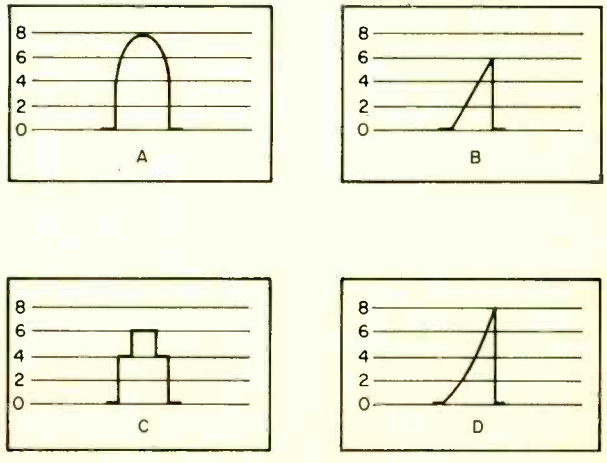
A8. The switch would be connected to the **bottom tap,** thus providing the grid with a less negative voltage than at the other two taps.

Other Vertical-Amplifier Requirements

Inputs to the Scope—The illustration of the front panel of the oscilloscope shows GND and AC connections for the vertical-deflection amplifier. Test leads with probes attached are inserted into these connections for test purposes. On some oscilloscopes there is a third jack that is marked DC. This provides the possibility of observing a DC voltage or a waveform that varies its amplitude at a very slow rate. The DC connection feeds the signal directly to a DC amplifier and then to the deflection plates. The normal vertical amplifiers cause distortion of very low-frequency signals.

Y-Axis Amplifier—On some scopes the vertical-deflection amplifier is called a **Y-axis amplifier** The Y axis corresponds to the Y coordinate (up-and-down reference line) on a graph Since a scope presents a graph of amplitude (plotted on the Y axis) and time (plotted on the X axis), these terms are sometimes used

Drawings for Question 9



instead of vertical and horizontal.

If the vertical amplifier and its associated circuits are properly designed according to the requirements you have just studied, the amplitude of a waveform will be faithfully reproduced on the screen.

An amplifier is required to increase signal voltages so that the full size of the screen can be used. It is easier and more accurate to study an enlarged reproduction of a waveform. Large waveforms can be attenuated to 1/10 or 1/100 of the amplified size, and any waveform can be made larger or smaller by varying the amplifier gain.

QUESTIONS

Q9. Assume your oscilloscope had only a CRT, vertical deflection amplifier, and the right type of power supply. Draw a picture of each of the above waveforms, showing how they might appear on the screen.

Q10. What are the two characteristics of a waveform an oscilloscope is able to reproduce?

Q11. ..... is plotted on the X axis, and ..... is plotted on the Y axis.

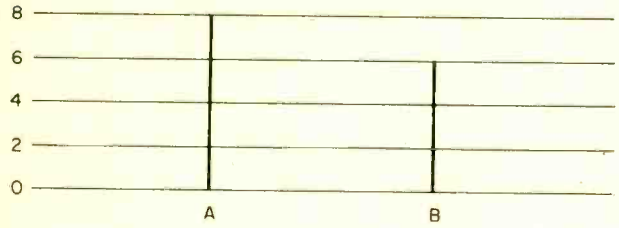
Q12. Why is a DC jack included on some oscilloscopes?

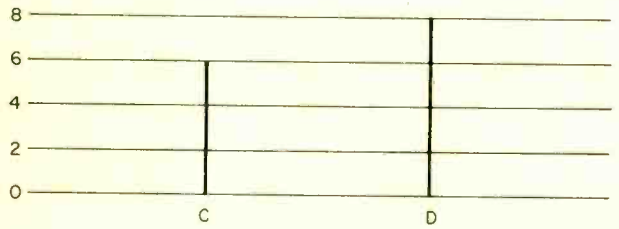
Q13. What other vertical-amplifier inputs are used in an oscilloscope?

ANSWERS

A9. Your drawing should look something like:

Drawings for Answer 9





A10. The two waveform characteristics an oscilloscope can reproduce are **amplitude** and **time.**

A11. Time is plotted on the X axis, and **amplitude** is plotted on the Y axis.

A12. The DC jack is used to **observe a DC voltage or a waveform that varies in amplitude at a low rate.**

A13. AC and **GND** (ground) connections are the other two inputs.

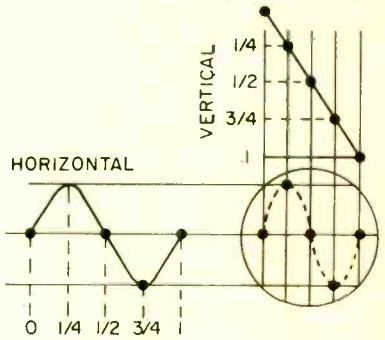
Horizontal Time Base

As you can see in Answer 9, a scope with only a vertical-deflection amplifier in its control circuits will present only a vertical line; the horizontal dimension missing.

Time as a Reference—Since waveforms change their amplitude in accordance with time, it becomes a useful means of measurement for the horizontal direction on the screen.

Look at the drawing below. If the two waveforms

Rate of Change

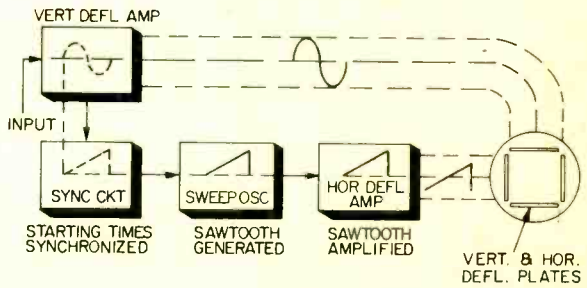


span the same period of time, each could be divided into corresponding increments (small intervals) of time. If a sawtooth waveform were applied to the horizontal plates and a sine wave applied to the vertical plates, the former would move it up or down in corresponding increments of time. Notice how the vertical and horizontal deflections combine at each instant of time to produce the waveform.

Characteristics of a Sawtooth Wave

You have probably identified the necessary characteristics of a sawtooth waveform. Voltage must rise uniformly to be constantly proportional to time. It must

Vert. and Horiz. Deflection



be capable of starting its rise at the same instant the waveform to be observed starts. The time duration of the sawtooth waveform must be equal to that of the other waveform if one complete cycle is to be observed. The sawtooth must decay quickly to zero so that both waveforms can complete their cycles at the same time.

QUESTIONS

Q14. The ..... waveform moves the electron beam from side to side, and the ..... waveform moves the beam up and down.

Q15. What part of the control circuits of a scope produces all the characteristics of the sawtooth waveform?

ANSWERS

A14. The **sawtooth** waveform moves the electron beam from side to side, and the **sinusoidal** waveform moves the beam up and down.

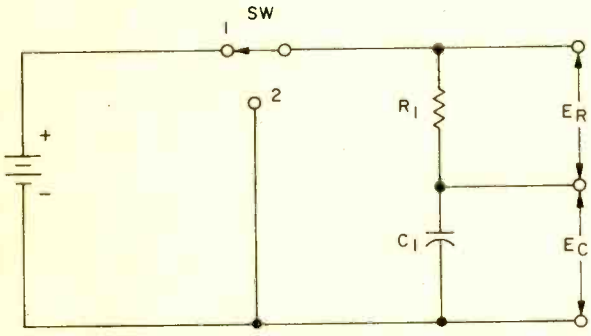
A15. The horizontal-deflection circuits produce all the characteristics of the sawtooth waveform.

Sweep-Oscillator Circuits

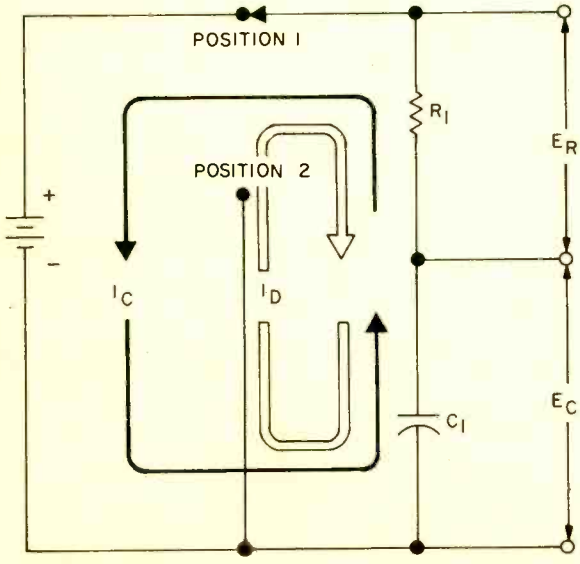
The sawtooth waveform is generated by the sweep oscillator. Sweep refers to the steady rise of sawtooth voltage that moves the waveform horizontally across the screen in a desired period of time. An oscillator is a circuit capable of repeating the waveform it generates at some specific freguency.

A basic RC circuit is shown below. The circuit contains a resistor and a capacitor in series with a battery.

Simple RC Circuit



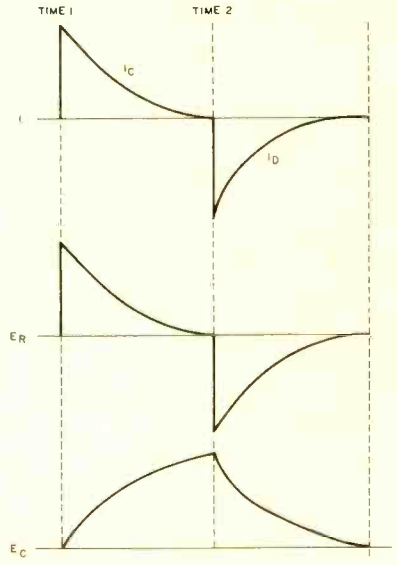
Charging Action of RC Circuit



A switch for disconnecting the battery and placing a short circuit across R_1 and C_1 is also connected in this circuit.

At the instant the switch is placed in position 1, Ic (the charging current) rises to maximum, and Er rises to the value of the battery voltage. Since C_1 charges up (Ec) at an exponential rate, Ic and Er decrease at the same rate. At the end of the period of time (determined by the values of R_1 and C_1) the capacitor will reach its maximum charge. Current will stop flowing, and Er will become 0. At Time 2, when the switch is in position 2, the capacitor begins to discharge. Id (discharge current) is maximum negative (reverses direction), and Er is also maximum in the negative direction. The discharge decreases exponentially until all values reach 0. Ee resembles the sawtooth, but its rise is not linear.

Charge and Discharge Sawtooth Waveforms



QUESTIONS

Q16. Refer to the drawing captioned "Simple RC Circuit." At the instant the switch is placed in position 1, is Er equal to, gerater than, or less than Ec?

Q17. Assume C_1 has been charged. At the instant the the switch is placed in position 2, is Er equal to, greater than, or less than Ec?

ANSWERS

A16. Er is greater than Ec at the instant the switch is closed. Er is at maximum voltage, and Ec is at zero.

A17. Er is less than Ec at the instant the switch is placed in position 2. When C_1 is fully charged, there will be zero volts across the resistor, and the voltage across C_1 will be at its maximum.

TIME BASE (SWEEP) OSCILLATORS

To provide a linear time base, the electron beam

must be deflected horizontally from left to right at a uniform speed. To accomplish this a sawtooth waveform of voltage is applied to the horizontal deflection plates. A sawtooth waveform is generated by an oscillator that regulates the charge and rapid discharge of a condenser and is generally referred to as the **sweep generator.** The sawtooth waveform must have the following properties:

Linear (Straight Line) Sweep
Rapid Retrace
Adjustable Frequency
Easy to Synchronize

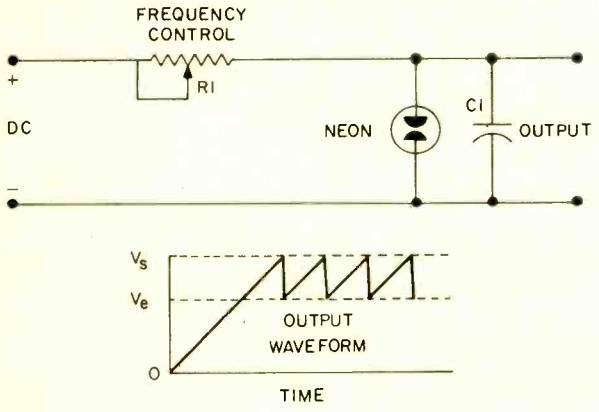
There are several types of sawtooth generators in use including a simple oscillator using a neon bulb to more efficient transistor multivibrators. A simple sawtooth oscillator using a neon bulb is shown below which serves as an excellent introduction to relaxation oscillators.

A neon bulb is limited to two states; it is either fully conducting with a low internal resistance, or it is non-conducting. Conduction results when the voltage applied to the bulb is sufficient to ionize the gas molecules, and is non-conducting when the applied voltage drops to a certain value. For example, a particular neon bulb may require a striking potential of 90 volts and an extinction potential of 60 volts.

Neon Bulb Relaxation Oscillator

1. When a DC potential that is greater than the striking potential of the neon bulb is applied to the circuit shown capacitor C_1 starts to charge through series resistance R_1.

Neon Bulb Sawtooth Generator



2. When the voltage across the condenser equals the striking potential of the bulb, the neon gas will ionize and conduct.

3. The neon bulb connected across the charged condenser provides a low resistance path and the condenser discharges rapidly.

4. During the discharge the potential across the condenser will drop to the extinction voltage of the bulb causing the neon gas to deionize and cease conducting.

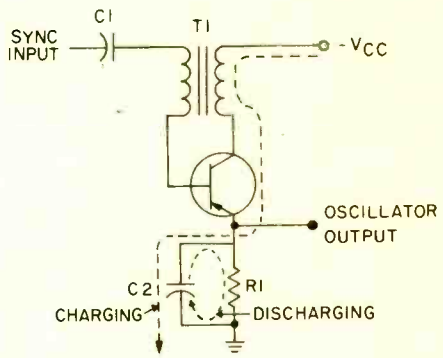
5. After the neon bulb is extinguished, the condenser will start to recharge immediately. Since the discharge is very rapid, the frequency of the charge and discharge cycle is determined by the RC time constant of the series resistance R_1 and condenser C_1.

Most oscilloscopes use more complex circuits for the horizontal sweep oscillator. Typical of these is the simplified transistor multivibrator discussed below.

Simplified Typical Time Base Sweep Oscillator

The operation of a blocking oscillator (which is one of many oscillators which could be used as a time-base sweep oscillator) may be explained as follows. Assume that when the circuit is turned on there is current flowing through the transistor from the collector down through the emitter, and then through resistor R1 to ground. At the same time current will flow into the top plate of capacitor C2, charging it up to equal the potential difference between the top and bottom of resistor R1.

Blocking Oscillator Sawtooth Generator



While the current flows through the transistor is increasing there will be an expanding magnetic field generated around the winding (secondary) of transformer T1, which will in turn generate a current in the other (primary) winding of T1. This current will create a positive signal at the base of the transistor which will, after a brief period, cause the transistor to cut off, stopping the flow of current between the collector and the emitter.

When the transistor is cut off C2 will discharge through R1 to equalize the charge on the two plates of C2. When the current stops flowing in the transistor the magnetic fields generated in the two windings of the transformer will collapse, and the signal now presented to the base of the transistor will go negative. This will cause current to start flowing again through the transistor collector into the emitter, and again current will flow through R1 to ground, and simultaneously into the top plate of capacitor C2, charging it up again.

The signal across resistor R1 will provide an output which is the desired sweep signal.

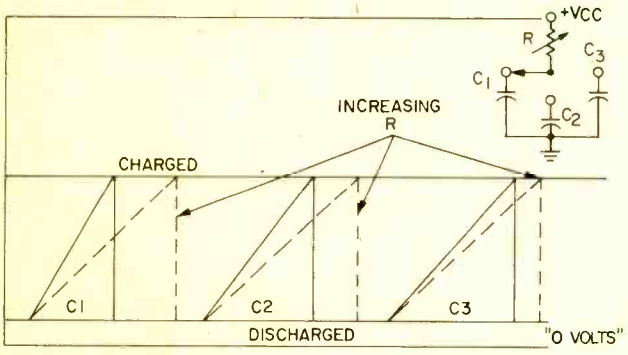
This is how the sweep oscillator operates when it runs "free," with its frequency (as well as output signal waveshape) dependent largely on the values used of C2 and R1. If it is desired to synchronize the frequency of the sweep oscillator with the waveshape (signal) being displayed, a small signal from the displayed

waveform is fed to the sweep oscillator through coupling capacitor C1.

By incorporating a switch with several different capacitors in place of C2 the frequency of the sweep (the time base) can readily be changed.

Since the frequencies, or time durations, of waveforms are not all the same, a sawtooth waveform with only a single rise time is not suitable. The most frequent method for varying the length of the sawtooth waveform is to change the values of the RC charging circuit.

Charge and Discharge Sawtooth Waveforms



By changing capacitors in the RC circuit, the RC time constant can be increased in coarse increments, as shown by the solid lines in the figure above. C1 has a smaller capacitance than C2, which is smaller than C3. If R remains the same, a larger capacitance will take longer to charge than a smaller one. Consequently, the rise time of the sawtooth waveform generated by the capacitor would increase. If R were a variable resistor, fine variations of the basic sawtooth waveform for each value of C could be controlled. This is shown above in dashed lines.

Controlling Sawtooth Frequency and Timing

Two controls for the **sweep-oscillator** (sawtooth-generator) circuit are on the front panel of the scope. **Coarse Frequency** selects one of seven capacitors (in this case) in the circuit. Numbers on the switch specify the frequency (cps) of the sawtooth. **Vernier** makes the fine setting of R6 to obtain frequencies between coarse settings. To place a 60-cycle waveform on the screen, for example, **Coarse Frequency** is set on 20 and the **Vernier** is adjusted until a single cycle is presented.

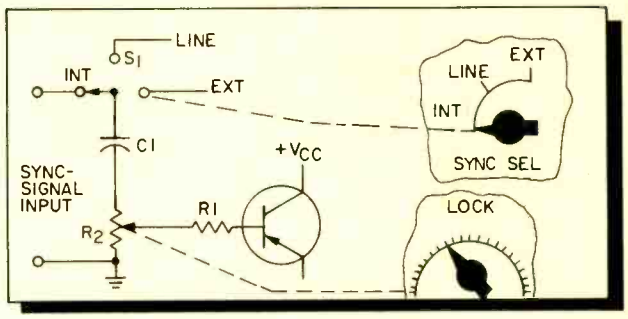
Sync Circuits

You may have noted the three-position switch (S1) the front panel for selecting the sync.

The purpose of the sync circuit is to cause the sawtooth waveform to remain in **synchronization** with the waveform to be placed on the screen. That is, both waveforms must start at the same time. The origin of the waveform to which the sawtooth is to be synchronized determines the setting of the **Sync Sel** (sync-selector) switch on the front panel. **Ext** (external) is the setting used when the sync signal is to be obtained from an external circuit or source. **Line** obtains the sync signal from the oscilloscope power line. **Int** (internal) samples the waveform in the vertical-deflection amplifier channel.

The **Lock** control varies the amplitude of the signal appearing on the grid. The control is necessary since sync signals vary widely in amplitude. A steady, uniform sync can be obtained by adjusting for proper

Horizontal Sync Circuit Controls



ionization variation with the **Lock** control.

QUESTIONS

Q18. Explain the three settings on the Sync Sel switch.

ANSWERS

A18. The three settings are **Int (samples the internal signal** in the vertical-deflection circuit); **Ext** (used when the sync signal is to be obtained **from an external source); Line** (used when the sync signal is obtained from the scope **power line).**

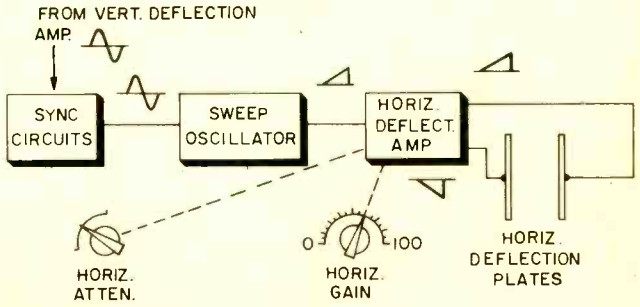
Horizontal Channels

The sync circuit, sweep oscillator, and horizontal-deflection amplifier make up the horizontal channel.

The **sync circuit** sends a sample of the observed waveform to the **sweep oscillator** for synchronization with the generated sawtooth wave. The sawtooth is then amplified by the **horizontal-deflection amplifier** and applied to the horizontal plates.

Vertical and horizontal amplifiers are similar and perform identical functions. Each has a gain control to develop the desired size of the pattern. Each also has an attenuation control to decrease the amplitude of large waveforms so that they will be retained within the area of the screen. The **Hor Atten** control is used when an external waveform is to be applied to the

Horizontal Channel



horizontal-deflection plates through the amplifier. AC and ground jacks are available on the front panel for this purpose. When a waveform is to be applied directly to the horizontal-deflection plates, the sweep oscillator is disconnected from the horizontal amplifier and neither is used for the scope display.

WHAT YOU HAVE LEARNED

1. An oscilloscope contains two basic sections—the CRT and control circuitry. The CRT is designed to place a controllable beam of electrons on the face of the tube. The circuitry controls the movement of the beam.
2. 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. If a waveform is applied to the scope, the plates deflect the beam according to the amplitude and time characteristics of the waveform. The screen is made of fluorescent materials that give off light when struck by fast-moving electrons. The picture seen on the screen is formed by the illumination of these materials.
3. The control circuitry has two channels—vertical and horizontal. A constant-gain amplifier places the waveform to be measured on the vertical-deflection plates of the CRT. The beam follows the differences of potential between the two plates and, therefore, the amplitude of the waveform.
4. The horizontal channel contains a sync circuit, a sweep oscillator, and an amplifier similar to that used in the vertical channel. The sync circuit obtains a synchronizing signal from the vertical amplifier, power line of the scope, or external source. The sync signal is applied to the sweep oscillator to synchronize its frequency in phase with the waveform in the vertical channel. The shape of the sawtooth is such that when it is amplified, it will be the precise time base required to place one, two, three, or more waveforms on the screen at one time. The horizontal channel can be used for bringing an external signal into the scope.
5. Controls are available to adjust the position of a waveform up and down or left and right on the screen.
6. Intensity and focus controls vary the brightness and sharpness of the picture.
7. Sync-circuit controls are two in number. The sync-selector switch is used for selecting the correct sync signal. A lock control stabilizes the screen presentation.
8. To obtain the correct time base for a wide selection of input frequencies, a coarse-frequency switch and a vernier control are used. The coarse-frequency switch selects the approximate frequency setting; the vernier permits making fine adjustments to obtain a stable waveform.
9. Controls for the vertical and horizontal amplifiers are identical. In this section of the front panel, jacks (or posts) are located to which test leads are connected. These jacks enable external signals to be brought into the amplifier sections.

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. @ $25.50. For information on the complete set, write the publisher at 4300 West 62nd St., Indianapolis, Ind. 46268.

Experiments on 2MHz

(Continued from page 66)

used during late fall and winter for experiments in eastern North America between approximately 1730 and 1900 EST. This sort of eastern NA reception from Asia in that time period during the last few years has been an especially hot topic in DX circles. If nothing else, it has shown that the average shortwave listener, as contrasted to the average BCB DXer, has only the sketchiest understanding of radio.

When the Orient is heard in eastern NA at that time of the day, veteran SWLs tend to refer to it as long path reception—via the south pole. Yet for distant reception to occur on either the BCB or 2 MHz, the great circle path between transmitter and receiver must be entirely in darkness or something close to it. And this is only slightly less true for distant reception on 3 and 4 MHz. Thus reception of our Chinese trio can only be via the north pole (large portions of the long path in daylight), and this opening ("window") to the Orient would theoretically begin at North American sunset and end at Asian sunrise. In practice, the window is probably open a little longer.

It is interesting to note that the station which touched off all this DX discussion, the first 2 MHz Oriental station to be logged at sunset EST, was Pyongyang on 2850 kHz. In view of this, the experimenter might ask, why not make eastern NA comparisons of Pyongyang on 2850 and 655 as west coast DXers can? Well, anytime the reader hears 2850 he should certainly try for Pyongyang on 655 kHz. The difficulty is that this EST sunset/Korean sunrise window is open for such a relatively short time that both frequencies would have to peak almost simultaneously, probably within 15 minutes of 1700 EST. Even when the same location can be heard at opposite ends of the BCB, for example, Portugal on 655 and 1578 kHz, it is seldom that both frequencies will peak within a few minutes of each other. Further, there is a lot more interference is eastern North America around 655 (WSM on 650 and WNBC on 660) than around 2850 kHz.

Pilot Stations. When we suggest you use 2850 to know when to challenge the interference around 655, we are using Pyongyang's 2850 kHz transmitter as a pilot signal. On most days that you hear 2850 around sunset you will not hear 655 but you will *never* log 655 unless you can hear 2850. Even more interesting, pilot station experiments can be performed in the area of trans-equatorial reception. For example, if you can hear ORTF's broadcast station in the Reunion Islands (Indian Ocean, not too far from the African coast) on 2446 kHz at 2130 EST (1830 PST) S/On, you should then try for Radio Zambia's 818 kHz when it signs on around 2200 EST. ■

SWR Kills CB DX

(Continued from page 62)

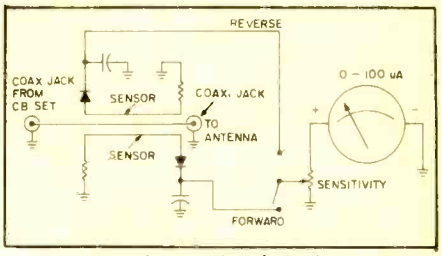
begin with, because of line loss.

To understand this, assume the SWR meter is connected at the input of about 100 feet of RG-58/U, which has a line loss of 3 dB per 100 feet. Also assume the SWR is 2:1, meaning 11 percent of the power is reflected back from the antenna. If we feed 4 watts into the line only 2 watts will get to the antenna end of the line because of the 3-dB loss .11 percent, or 0.2 watts, will be reflected by the antenna/line mismatch. But now, in traveling back down the line the 0.2 watt reflected power is also attenuated 3 dB so only 0.1 watt arrives at the meter. The meter sees only 2.5% reflected power—it knows nothing about line losses, so it indicates less than the actual 2:1 VSWR.

Comparison of SWR with Reflected Power (from antenna back)

SWR	Percent of power reflected
1:1*	0.00%
1.1:1	0.22%
1.2:1	0.82%
1.5:1	4.00%
2:1	11.40%
2.5:1	18.00%
3:1	25.00%

*Not attainable



Sensor picks up tiny bit of power via capacitance to drive SWR meter.

So you see, though an SWR meter is an important part of every CB installation, you still must keep in mind that it can be fooled, not only by normal line losses but by standing wave impedance variations (which we have not discussed). Nevertheless, and in spite of these errors the SWR meter is the CBer's most reliable, low-cost indicator of the condition of the antenna system, as well as of the match between the transmission line, and the antenna.

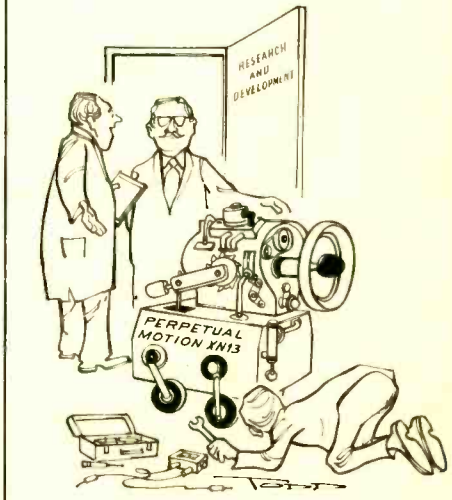
Kathi's CB Carousel

(Continued from page 75)

er the antenna the stronger the received signal. It doesn't matter where the antenna is located—for any location, the longer the better. Of unusual interest, full length whips (108") mounted low down on a bumper mount have essentially the same radiated energy as a 48" whip mounted on the trunk lip. The same full length whip mounted higher up the side of the fender on a body mount so little car metal is opposite the base of the antenna) delivers a more-powerful signal than any shortened whip mounted anywhere on a car.

Also, electrically-loaded antennas with single feed (center conductor only, not coax shield and center conductor to a base-matching coil) have radiation resistance about 5 to 30 ohms and should be connected to the transmitter through a coaxial cable ¼ wavelength long (6 feet) or an odd multiple, to insure a proper transmitter match. Only when the transmitter is matched to about a 50 ohm load does the transmitter deliver its rated output. When the antenna's radiation resistance is matched to 50 ohms through a tapped loading coil or some other matching device the coax can be any length, or preferably a half wavelength (12 feet) or its multiple. The way to tell if the antenna has single or coax feed is to simply look at the antenna. If the bottom is a ⅜-in. screw it's single feed. If it's any sort of coax connector with a shield (usually the mounting screw) and center conductor the antenna is coaxially fed and probably has a tapped base-loading/matching coil.

Good Guys! I gave you some bum dope last issue on using 1976 antennas in the 1977 era of 40-channel CB rigs. I said *most* CB antennas cannot handle the full 40, when I should have said *some*. For the full facts on 40-channel antenna tests on 1976 antennas turn to page 39. You'll be surprised! ■



"We're right on the threshold, sir . . . but we've hit one snag . . . it keeps stopping!"

LITERATURE LIBRARY

301. Get acquainted with the new *EICO* products, designed for the professional technician and electronics hobbyist. Included in brochure are 7 IC project kits, *EICO*'s "Foneaids," security products and many varied kits.

302. *International crystal* has illustrated folders containing product information on radio communications kits for experimenters (PC boards; crystals; transistor RF mixers & amplifiers; etc.).

303. *Regency* has a new low cost/high performance UHF/FM repeater. Also in the low price is their 10-channel monitoradio scanner that offers 5-band performance.

304. *Dynascan's* new *B & K* catalog features test equipment for industrial labs, schools, and TV servicing.

305. Before you build from scratch, check the *Fair Radio Sales* latest catalog for surplus gear.

306. Get *Antenna Specialists'* catalog of latest mobile antennas, test equipment, wattmeters, accessories.

307. Want a deluxe CB base station? Then get the specs on *Tram's* super CB rigs.

308. Compact is the word for *Xcelite's* 9 different sets of midget screwdrivers and nutdrivers with "piggyback" handle to increase length and torque. A handy show case serves as a bench stand also.

310. *Turner* has two booklets on their Signal Kicker antennas. They give specifications and prices on their variety of CB base and mobile line. Construction details help in your choice.

311. *Midland Communications'* line of base, mobile and hand-held CB equipment, marine transceivers, scanning monitors, plus a sampling of accessories are covered in a colorful 18-page brochure.

312 *The EDI (Electronic Distributors, Inc.)* catalog is updated 5 times a year. It has an index of manufacturers literally from A to X (ADC to Xcelite). Whether you want to spend 29 cents for a pilot-light socket or $699.95 for a stereo AM/FM receiver, you'll find it here.

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

315. *Trigger Electronics* has a complete catalog of equipment for those in electronics. Included are kits, parts, ham gear, CB, hi fi and recording equipment.

316. Get the *Hustler* brochure illustrating their complete line of CB and monitor radio antennas.

317. *Teaberry's* new brochure presents their complete lines of CB and marine transceivers and scanners for monitoring police, fire and other public service frequencies.

318. CBers, *GC Electronics'* 16-page catalog offers the latest in CB accessories. There are base and mobile mikes and antennas; phone plugs; adaptors and connectors; antenna switchers and matchers; TVI filters; automotive noise suppressor kits; SWR power and FS meters; etc.

319. *Browning's* mobiles and its famous Golden Eagle base station, are illustrated in detail in the new 1977 catalog. It has full-color photos and specification data on Golden Eagle, LTD and SST models, and on "Brownie," a dramatic new mini-mobile.

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.

322. *Radio Shack's* 1977 catalog colorfully illustrates their complete range of kit and wired products for electronics enthusiasts—CB, ham, SWL, hi-fi, experimenter kits, batteries, tools, tubes, wire, cable, etc.

323. Get *Lafayette Radio's* "new look" 1977 catalog with 260 pages of complete electronics equipment. It has larger pictures and easy-to-read type. Over 18,000 items cover hi-fi, CB, ham rigs, accessories, test equipment and tools.

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.

328. A new free catalog is available from *McGee Radio*. It contains electronic product bargains.

329. Semiconductor Supermart is a new 1977 catalog listing project builders' parts, popular CB gear, and test equipment. It features semiconductors—all from *Circuit Specialists*.

330. There are over 450 electronic kits described in *Heath's* new catalog. Virtually every do-it-yourself interest is included—TV, radios, stereo & 4-channel, hi-fi, etc.

331. *E. F. Johnson* offers their CB 2-way radio catalog to help you when you make the American vacation scene. A selection guide to the features of the various messenger models will aid you as you go through the book.

332. If you want courses in assembling your own TV kits, *National Schools* has 10 from which to choose. There is a plan for GIs.

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.

334. *Sprague Products* has L.E.D. readouts for those who want to build electronic clocks, calculators, etc. Parts lists and helpful schematics are included.

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.

337. *Pace* communications equipment covers 2-way radios for business, industrial and CB operations. Marine radiotelephones and scanning receivers are also in this 18-p. book.

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.

342. *Royce Electronics'* new full-color catalog updates information on their CB transceivers (base, mobile, handheld). It also describes new product lines—CB antennas and a VHF marine radiotelephone.

344. For a packetful of material, send for *SBE's* material on UHF and VHF scanners, CB mobile transceivers, walkie-talkies, slow-scan TV systems, marine-radios, two-way radios, and accessories.

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.

350. Send for the free *NRI/McGraw Hill* 100-page color catalog detailing over 15 electronics courses. Courses cover TV-audio servicing, industrial and digital computer electronics, CB communications servicing, among others. G.I. Bill approved, courses are sold by mail.

352. Send for the free descriptive bulletin from *Finney Co.* It tells all about their new auto FM radio signal booster (eliminates signal fading).

353. *MFJ* offers a free catalog of amateur radio equipment—CW and SSB audio filters, electronic components, etc. Other lit. is free.

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.

356. Send for *Continental Specialties* new breadboarding prototest devices. They vary in prices from a mini-budget kit at $19.95. Featured is the new logic monitor, giving information on what it does, how it works, and how to use it.

357. *Dage Scientific Instruments* offers a 16-page booklet on how to build an electronic thermometer with control. Included is an introductory course on thermocouples, schematics and many applications.

358. *PixTronics* announces its new Model 200 Super Sensitive Electronic Darkroom Exposure Meter, used to determine the correct exposures of all black-and-white and color negatives. Useable with any enlarger.

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.

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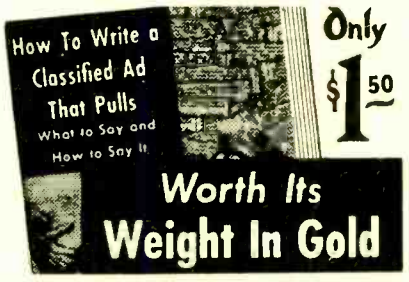

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CRYSTAL Experimenter's Handbook—50¢. 20 Crystal Set Plans Handbook—50¢. Catalog 25¢, refundable. Laboratories, 1477-G, Garden Grove, CA 92642.

TUBES. Oldies, latest. Supplies, components, schematics. Catalog free. (Stamp appreciated). Steinmetz, 7519-EE Maplewood, Hammond, IN 46324.

CITIZENS band! Simple attachment for car radio. Listen to smokeys, accidents. Warranty. Send $29.95. Alicia, 915 Industrial Bank Building, Providence, RI 02903.

RUBBER STAMPS

RUBBER stamps made. Three lines, $3.75. Rubber stamps, B1337 Waldo, Arkansas 71770.

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AUTOMATIC Fishhooks, Profitable samples. $2.00 (refundable), Arons, 61 Mastic Beach, NY 11951.

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FIREWORKS. Spectacular novelties, simplified manufacturers textbook, $5.00. Guaranteed. Tropic, Box 95M4, Palm Bay, FL 32905.

SONGWRITERS

SONGWRITERS: Poems, Songs Wanted. Creative Music Productions, Box 1943-A1, Houston, TX 77001.

EXCITING Offer! Send poems, songs. Crown Music, 1270-RX, Broadway, New York 10001.

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SURPLUS EQUIPMENT

GIANT Bargain Packed Canadian Surplus Catalogs $1.00 Etco Electronics-DG, Box 741, Montreal "A".

TAPE RECORDERS, SOUND EQUIPMENT

OLD time radio programs on tape. Catalog $1.50. J. Fiorino, Box 153-EE, Brooklyn, NY 11209.

WATCHES, WATCHMAKING & REPAIRING

WATCH and clock repairing books, tools, materials. Free catalog. North American, Box 77, EE25, Fox River Grove, IL 60021.

Computer Readout

(Continued from page 76)

3. The Programming Manual, which provides a detailed description of each of the 56 basic instructions and the possible variations of those instructions.

In addition, expansion memories and software that eases programming tasks have recently been announced. Total cost of the KIM-1 is $245, a real bargain.

CONVERSION FOR DECIMAL TO HEXADECIMAL NUMBERS

Decimal	Hexadecimal
0-9	0-9
10	0A
11	0B
12	0C
13	0D
14	0E
15	0F
16	10
17	11
31	1F
32	20

How It Works. Let's take a closer look at the make-up of this bargain microbrain. The four left-most digits of the display show the address of a selected memory location in hexadecimal code (explain in our November/December, 1976 issue). For example, 0000 is the first location and 03FF is the one-thousandth location. The two right-most digits always show the data that is in, or being put into, a memory cell. The data (or any address) can be selected by the keyboard, which has the hexadecimal values 0 through F (0 through 15 in decimal notation) along with control keys.

The control keys are *GO* for making your program run, *ST* to make it stop, *RS* for reinitializing your program (or peripheral devices), *AD* for selecting the address mode—that is, any keys you press will show on the left-most LED digits—*DA* for selecting the data mode (enter data via the keyboard), *PC* to display the contents of the program counter which keeps track of the next memory location to be used in the program, and + which increments the displayed address by one. There is also a slide switch marked *SST* which can be used with the *GO* key to step through a program one step at time—a handy and unusual feature.

KIM-1 PROGRAM FOR ADDING TWO NUMBERS

AD			
0 0	0 0	0000	XX
DA			
	0 4	0000	04
+	0 5	0001	05
+	GO	0009	XX

Lots of IC Chips. There are lots of integrated circuit chips on this KIM-1 board. The nerve center is the MCS 6502 microprocessor chip. This chip has a 16-bit address bus for addressing 65,536 memory and input/output locations. It also has an 8-bit bidirection data bus (the data bus transfers data to the location specified by the address bus), and two input ports that accept interrupt signals. These order the program to stop temporarily, or to change course.

The memory center of the KIM-1 is in eight MCS 6102 RAM (random access memory) chips that provide a total of 1024 locations, each holding 8 bits, for the user to store his program and data.

Finally, the input/output control of

KIM-1 PROGRAM FOR PLACING DATA INTO MEMORY

Press Keys	Display		Action
AD			
0 0 0 2	0002	XX	Select location 0002
DA	0002	A5	Load accumulator
A 5	0003	00	from location 0000
+ 0 0	0004	65	Add value in location
+ 6 5	0005	01	0001 to accumulator
+ 0 1	0006	85	Store accumulator value
+ 8 5	0007	FA	in location 00FA
+ F A	0008	4C	
+ 4 C	0009	4F	Display result
+ 4 F	000A	1C	
+ 1 C			

First the numbers (data) to be added are placed into locations in memory, using data-placement program. Then addition program is carried out by pressing keys listed in first four steps in program above. Thereafter only the + key is pressed. KIM-1 takes actions listed in the right column while displaying readout shown in middle column.

the unit is contained in two MCS 6530 chips each of which contain 1024 locations of ROM (read only memory) that have been stuffed with *monitor* and *executive* programs. These programs are safe from accidental destruction (when power is off) because they are stored in the ROMs. They control the display of digits on the LED readout; they receive and translate digits from the keyboard; and they permit teletype (TTY) connection, as well as regulating all input and output of the KIM-1.

A Simple Program. Let's write a program that simply adds any two numbers and displays the results. First memory location 0002 is selected via the keyboard, then the *Data Address* mode is selected, to start putting instructions (data is a misnomer here) into memory. The instructions load a special memory, called an accumulator, with the number in memory-location 0000, then add it to the number from location 0001. The result is automatically placed in the accumulator but the program, at steps 0006 and 0007, places the sum in location 00FA and the remaining steps use ROM-stored programs to display the result.

Our program is flexible because it will add together any numbers you place in locations 0000 and 0001. To put numbers there, just address the locations, press *DA* for data mode, enter your desired values, then press *GO* to run the entire program. In my example the values 04 and 05 will be added and 09 will be displayed. Note that the display program in the ROM is tricky—it causes the result to appear at what is normally the address side of the display because there are four digits available there. You are probably saying to yourself about now that using a microcomputer can't be this easy—but it is.

Next Time. In our next column we'll have a lot more of KIM-1 to read and learn about. We'll see how it connects to an inexpensive cassette tape recorder to allow programs to be saved. I'll also tell about a Users Group that has sprung up and has written some clever programs. And I'll describe MOS Technology's interesting new hardware that can be connected to KIM-1 to increase its memory and let it talk via a TV screen. If you have some special subjects you would like to see covered in this column, just drop me a line. ■

Scan Top of 40

(Continued from page 58)

sells for $119.95. Other PRO-6 models are available, at the same price, for 450-470 MHz (PRO-5, UHF), and for 148-174 MHz only (PRO-4A) at $99.95. For more information, Circle number 32 on the Reader Service coupon.

With the extra 17 channels which become available to CBers on January 1, 1977 (and on sets which go on sale thereafter) there will be a lot of wide open space for the CB communicator who wants to work without interference. There will be so much empty space that you just won't believe you're on CB at all—at least until people start discovering what a pleasure it is to work uncluttered channels. If you want to find lots of good space on these new channels, or even on the old ones, just get hold of a PRO-6 pocketable VHF Scanner and make this super-fast conversion. You'll be glad you did. ■

Anti-Rip-Off Antenna

(Continued from page 77)

tenna goes all the way unless the main power is turned off.) So follow instructions and connect the antenna power wire to a *fused* accessory circuit controlled by the ignition switch.

How does it work? Terrific! Tuned for minimum SWR on channel 12 (almost 1.1:1) the worst-case SWR on channels 1 and 23 was only 1.8:1, and that's great for a short, center-loaded whip. The stub sticks out two to three inches when the antenna is retracted, the exact length determined by the SWR adjustment.

So grab your tools and follow the steps as we show you how to install your own electric antenna. ■

Pong IV Video Game

(Continued from page 60)

way, Dakota City, Nebraska 68731. You simply feed the video output of *Pong IV* (collector-to-emitter of Q4) through a shielded cable to the PXV-2A, then connect the output of the PXV-2A to your VHF antenna terminals on the TV (being sure to disconnect the regular antenna) and tune to an unused channel between 2 and 6. (When you build the PXV-2A Kit, you program the desired output channel).

If you don't want to build an r-f modulator, then you can feed the Pong IV video output directly into the video amplifier input of your TV set.

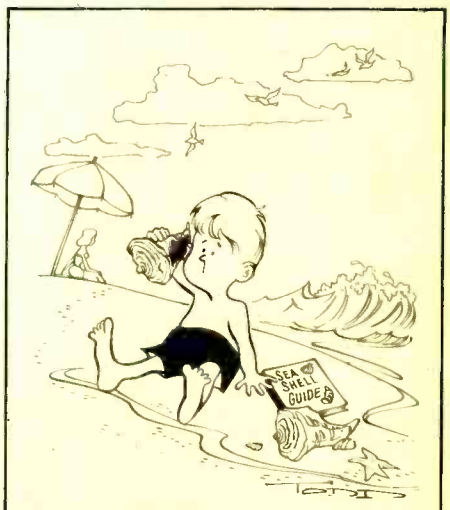
Playing the Game. After you've connected *Pong IV* to your TV set, plug in the *Pong IV* wall transformer. You should hear the game beeping. Now tune the TV until you get an indication of a signal being received. Adjust R1 and R2 for vertical and horizontal hold, R7 and R8 for court borders, and R78 and R79 for score position on the screen. Once these are adjusted, they don't need to be set again. Choose either tennis or handball with the selector switch. The ball will be traveling randomly around the court, but there will be no paddles until you press the start button.

In about three seconds the first serve will go to the right-hand player. From then on, anytime a player misses the ball, the score adds one for the opponent, and the next ball is served to the one who missed last. 18 is game, and when this score is reached by either side, the paddles disappear and the ball goes back to bouncing randomly against the walls until the RESET button is pushed, which also makes the score 00:00. You can control both the horizontal and vertical movement of the paddles unless a player is on automatic. In that case you control horizontal, and the computer controls the vertical. You can also vary the paddle size from small to large.

Problems? Interfab offers a repair service for $15, including return postage.

Conclusion. Pong IV is a challenging kit that can be built by any patient hobbyist with reasonable mechanical aptitude and good soldering technique. The result is a game in which you'll take a lot of personal pride. You'll amaze your friends with your skill and intelligence, and you'll be the hit of every party!

Pong IV-D kits are available for $79.50 from the Interfab Corp., 27963 Cabot Road, Laguna Niguel, CA 92677. *Pong IV-C,* which has the printed circuit board parts soldered to the board, costs $89.50, and the completed kit, *Pong IV-B,* is priced at $99.50. Add $4.00 shipping charges for each unit, and 6% sales tax for California residents. For further information circle no. 73 on the Reader Service coupon. ■



"Breaker 10, Little Buddy . . . My handle is Jaws . . . what's your 20!"

ELEMENTARY ELECTRONICS INDEX TO ADVERTISERS

CB Buzzin' Bee

(Continued on page 78)

by?" The first voice asked.

"I haven't said a word since we left Opp (a small town in South Alabama)." the other declared.

"Somebody did!" was the angry reply.

Wilson realized the trucks were about a mile away on another highway.

Wilson says he's learned his lesson. From now on he's going to identify himself and the vehicle of the driver to whom he is talking before telling him to do anything that could bring on an accident.

Everything You Ever Wanted to Know

Antennas come in all shapes, sizes, and configurations, and can get your head spinning if you can't sort out the facts from the fables. Antenna Specialists offers a compact 15-page booklet which clarifies all the facts about CB antennas in plain language. It's well worth its 40-cent price tag. To request your copy send 40 cents and a note asking for *CB Antenna Facts and Fables* (by Forest H. Belt) to The Antenna Specialists Co., 12435 Euclid Avenue, Cleveland, OH 44106. Tell 'em you got the buzz from the Bee!

AtTENtion!

In case you haven't heard, the ten-code was originally devised by Eugene F. Brown of the Iowa State Police as a means for apprehending the big-time bank robbers of the 1930's. In this era, Bonnie and Clyde and the rest of the bank-robbing clan were having a heyday making quick getaways with their loot and they were giving the Bears a real run for that stolen money. Two-way radio existed, but no terse, concise method of communicating existed. According to the *CB Times Journal,* Mr. Brown invented the ten-code because it was a quick and easy way to relay frequently-needed information. His system helped bring about the downfall of the Barrow gang's bank heists, and has been used by two-way radio buffs ever since.

And with that, folks, I'll be buzzin off 'til next time. ■

NEWSCAN

(Continued on page 33)

pass invention. The U.S. Navy awarded him a Certificate of Commendation for "Outstanding Service" to the Navy, and he was the recipient of the Presidential Certificate of Merit for his activities with the National Defense Research Council. In 1964 he received the David Sarnoff Award of the Institute of Electrical and Electronics Engineers (IEEE) for outstanding achievements in the field of electronics. In 1969 he received the IEE Award in International Communications. In 1974 he was elected a Fellow of the Radio Club of America.

Despite a heavy schedule of work in electronics, Busignies also finds some time for some hobbies. He was his own architect in building and landscaping a modern home. He also has kept up his music and is an avid amateur photographer. His interest in music, electronics, and his general interest in the arts has prompted him to develop a theory of natural beauty, involving the eyes, and feedback processes and brain computer action. He has lectured several times on this subject, and he hopes to find time to formalize it and write a book on the subject sometime in the future. ■

STATEMENT OF OWNERSHIP

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I certify that the statements made by me above are correct and complete.

(signed) V. C. Stabile
Vice President and Treasurer

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(signed) V. C. Stabile
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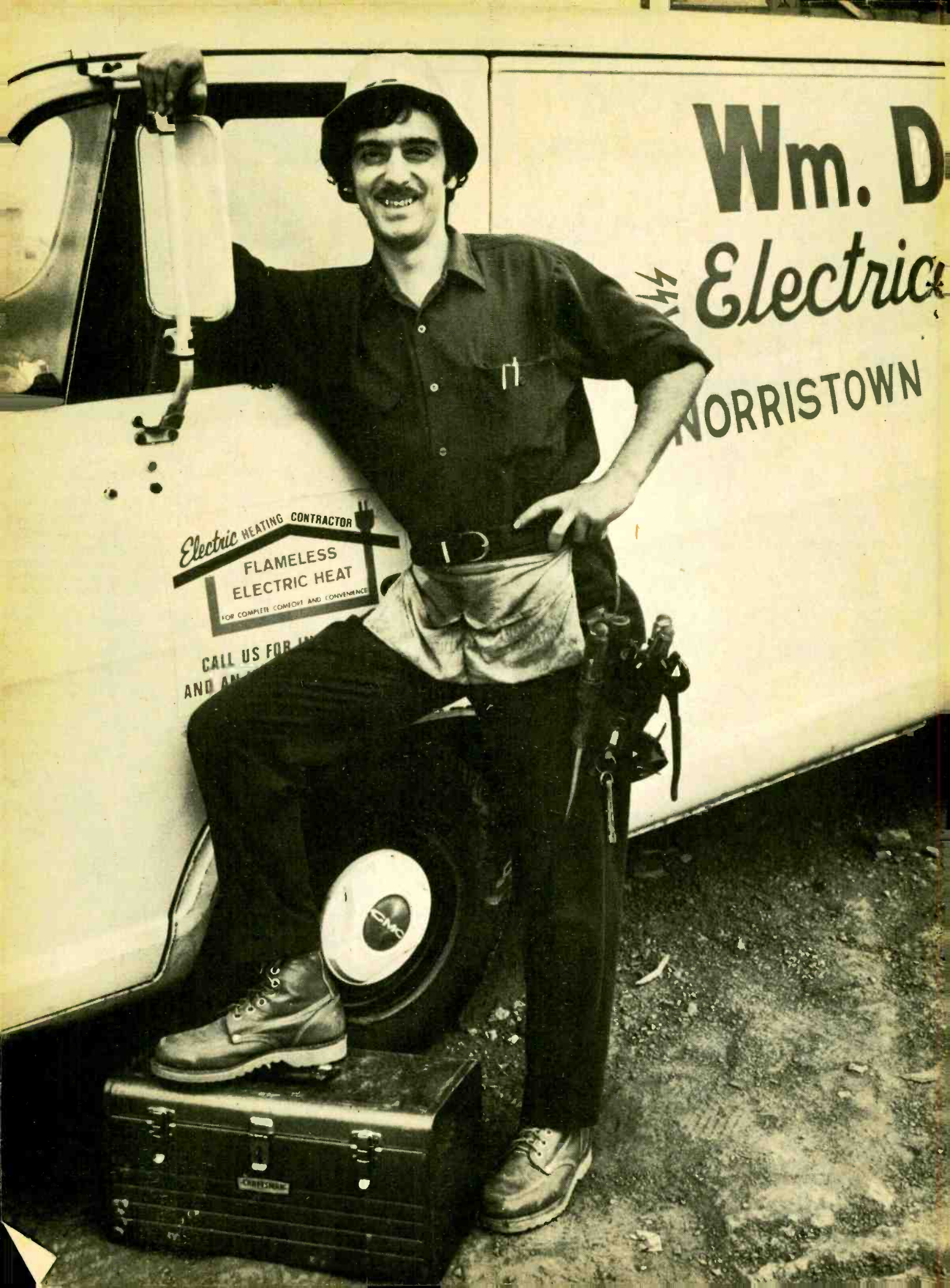
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