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ANNIVERSARY 15th ISSUE

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Page 69

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Page 40

...ECKS

...omputer

...Auto
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Talk yourself into the best. President SSB.

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Just tell yourself about the Adams—President's finest SSB mobile—and about how you'd enjoy the extra range and performance of SSB.

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CIRCLE 23 ON READER SERVICE COUPON

NEW ASTRO-FANTOM™

CB ANTENNA

GOES WHERE NO CB ANTENNA HAS GONE BEFORE!

SUPERIOR PERFORMANCE FOR AUTO, TRUCK, MARINE, RV, MOTORCYCLES AND HOME USE

It Mounts On Glass Transmits and Receives THRU Glass

Now from the AVANTI Research Laboratories comes a sleek, 22″ full 1/2 wave antenna, so unique that it mounts on glass, transmits through glass and receives through glass...yet requires no grounding to metal as do conventional 1/4 wave antennas. No holes to drill...no clamps, clips or magnets to ever mar or scratch your car's finish! No more leaks or pinched cables to run in through doors, windows or trunk. The Astro-Fantom is a handsome, low profile antenna that provides the ultimate in convenience!

EASY INSTALLATION. The Astro-Fantom is so uncomplicated that installation takes only five minutes and requires no tools. It bonds securely to the glass with an all weather tested 3M press-on adhesive, yet can be quickly transferred when desired. The fiberglass whip removes instantly for storage, car wash or theft protection.

ONE MOUNT SATISFIES EVERY NEED. Astro-Fantom's unique mount attaches anywhere there's a metal framed window. Front, side, or rear of vehicle, boat and motorcycle windshields, even home installation.

CLEAREST COMMUNICATIONS. Avanti's exclusive space age co-inductive™ coupling box actually rejects static and interference as it establishes a highly tuned circuit to transmit and receive radio signals through the glass.

FULL 360° SIGNAL. Astro-Fantom's full 1/2 wave design eliminates dead spots and directional problems found in conventional CB antennas.

PATENT PENDING **Model AV-200**

Length 22″

avanti® antennas

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IN CANADA: Lenbrook Industries,
1145 Bellamy, Scarborough, Ontario M1H 1H5

CIRCLE 67 ON READER SERVICE COUPON

elementary electronics

November/December 1978
Volume 18, No. 6

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☆ Cover Stories

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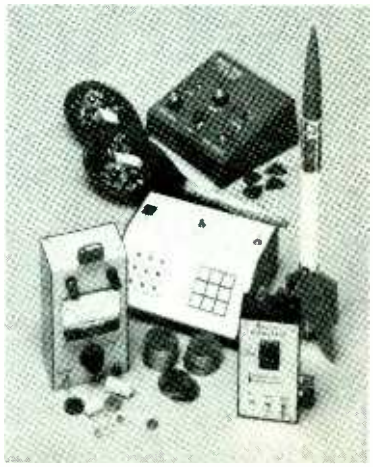

Cover photo by Hugh Bell

COBRA RE-INVENTS THE REMOTE CB.

The first remote CBs were nothing more than a CB transceiver that you locked in your trunk and an oversized mike that could barely fit in your hand.

Such was the state of the art when the first remotes were introduced. Which was why Cobra spent till now improving the state of the art.

Introducing the result. The Cobra 62XLR. Small enough to go under the seat or on the firewall as well as in the trunk. Strong enough to take the bounces and jolts those early remotes couldn't. Powerful enough to punch through loud and clear.

The receiver has automatic gain control, switchable noise limiting, plus Dual-Gate Mosfet and Monolithic Crystal Filter to keep interference to a minimum. So the voice you hear always comes through loud and clear.

The streamlined mike puts all the controls at your fingertips. Speaker, channel selector and squelch are built right in. So there's no fiddling around while you're driving around.

And with Cobra's reputation for building them right and our nationwide network of Service Centers making sure they stay that way, you can be pretty sure that nobody's ever going to improve on the 62XLR.

Cobra may not have been the first to make a remote. But we were the first to do it right.

Cobra®

Punches through loud and clear.

Cobra Communications Products
DYNASCAN CORPORATION
6460 W. Cortland St., Chicago, Illinois 60635
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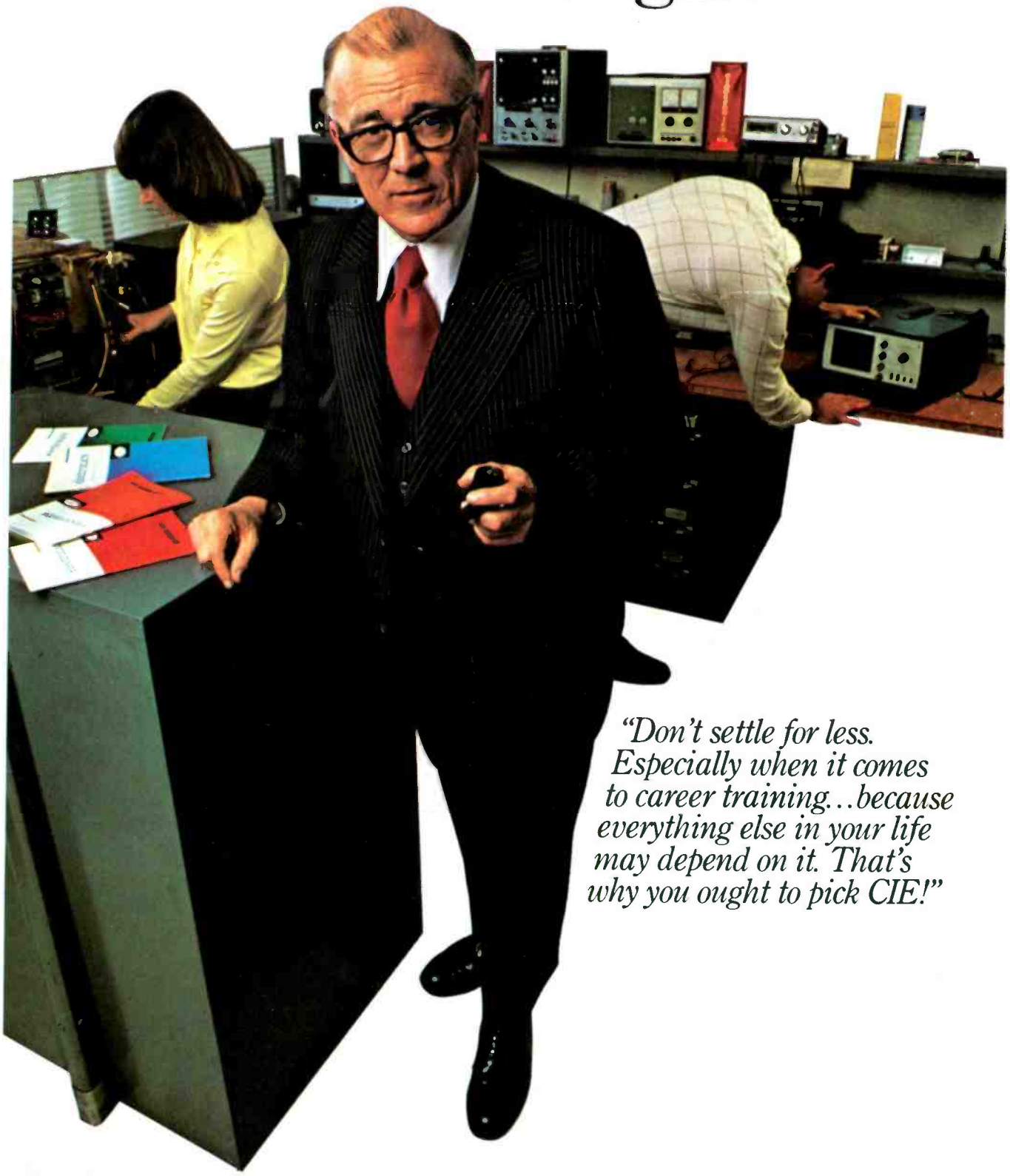
CIRCLE 9 ON READER SERVICE COUPON

"If you're going to learn electronics, you might as well learn it right!"



"Don't settle for less. Especially when it comes to career training...because everything else in your life may depend on it. That's why you ought to pick CIE!"

You've probably seen advertisements from other electronics schools. Maybe you think they're all the same. They're not!

CIE is the largest independent home study school in the world that specializes exclusively in electronics.

. . .

Meet the Electronics Specialists.

When you pick an electronics school, you're getting ready to invest some time and money. And your whole future depends on the education you get in return.

That's why it makes so much sense to go with number one . . . with the specialists . . . with CIE!

There's no such thing as bargain education.

If you talked with some of our graduates, chances are you'd find a lot of them shopped around for their training. Not for the lowest priced but for the best. They pretty much knew what was available when they picked CIE as number one.

We don't promise you the moon. We do promise you a proven way to build valuable career skills. The CIE faculty and staff are dedicated to that. When you graduate, your diploma shows employers you know what you're about. Today, it's pretty hard to put a price on that.

Because we're specialists, we have to stay ahead.

At CIE, we've got a position of leadership to maintain. Here are some of the ways we hang onto it . . .

Our step-by-step learning includes "hands-on" training.

At CIE, we believe theory is important. And our famous Auto-Programmed® Lessons teach you the principles in logical steps.

But professionals need more than theory. That's why some of our courses train you to use tools of the trade like a 5 MHz triggered-sweep, solid-state oscilloscope you build yourself—and use to practice troubleshooting. Or a beauty of a 19-inch diagonal Zenith solid-state color TV you use to perform actual service operations.

Our specialists offer you personal attention.

Sometimes, you may even have a question about a specific lesson. Fine. Write it down and mail it in. Our experts will answer you promptly in writing. You may even get the specialized knowledge of all the CIE specialists. And the answer you get becomes a part of your permanent reference file. You may find this even better than having a classroom teacher.

Pick the pace that's right for you.

CIE understands people need to learn at their own pace. There's no pressure to keep up . . . no slow learners hold you back. If you're a beginner, you start with the basics. If you already know some electronics, you move ahead to your own level.

Enjoy the promptness of CIE's "same day" grading cycle.

When we receive your lesson before noon Monday through Saturday, we grade it and mail it back—the same day. You find out quickly how well you're doing!

CIE can prepare you for your FCC License.

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

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

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CIE training is not for the hobbyist. It's for people who are willing to roll up their sleeves and go to work . . . to build a career. The work can be hard, sure. But the benefits are worth it.

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Mail the card or the coupon or write CIE (mentioning name and date of this magazine) at: 1776 East 17th Street, Cleveland, Ohio 44114.

Patterns shown on TV and oscilloscope screens are simulated.

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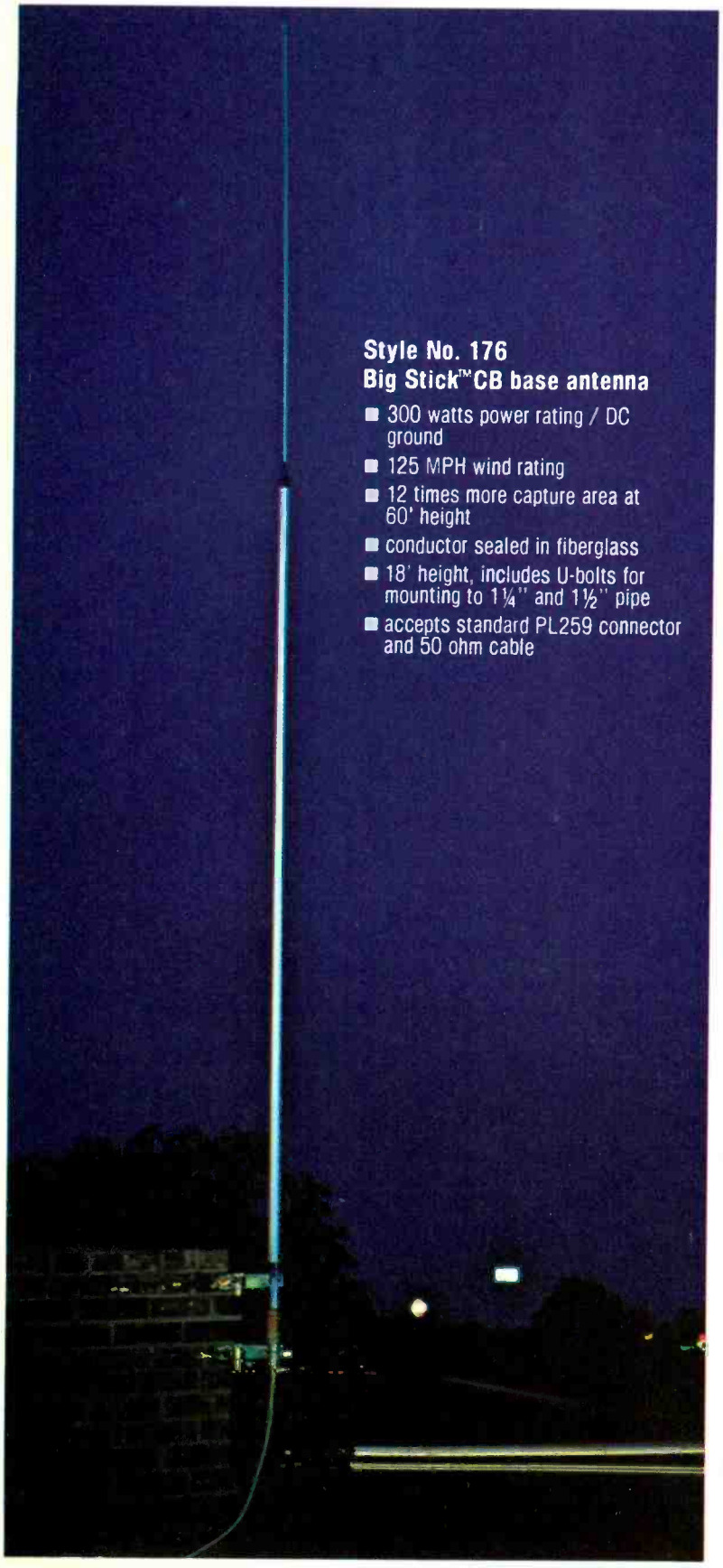


Style No. 176
Big Stick™ CB base antenna

- 300 watts power rating / DC ground
- 125 MPH wind rating
- 12 times more capture area at 60' height
- conductor sealed in fiberglass
- 18' height, includes U-bolts for mounting to 1¼" and 1½" pipe
- accepts standard PL259 connector and 50 ohm cable

At a loss for words?

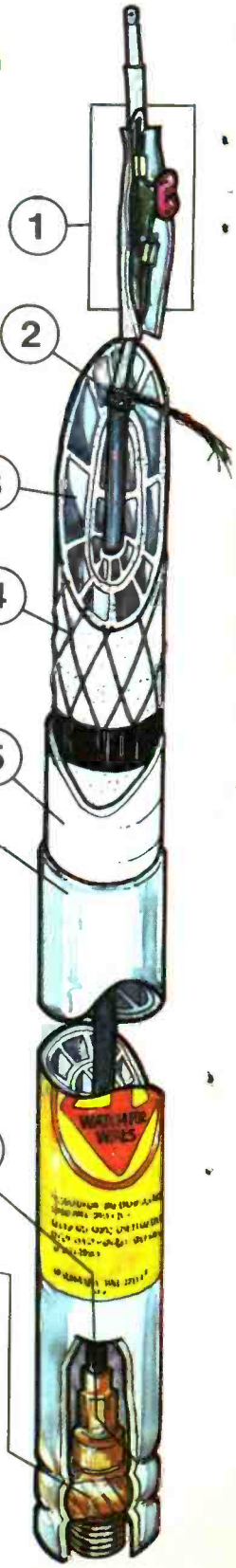
Big Stick™ Antenna gets out when the skip gets thick. With its unique design, this antenna delivers the longest possible range, the strongest signal capture area, and the lowest radiation angle of any omni-directional antenna in its class.

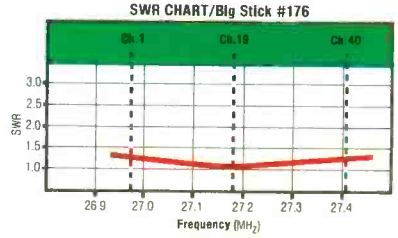
Only two pieces make one Big Stick

You can count on Big Stick's engineering for performance that'll keep you talking. It's the one and only two piece antenna that's a cinch to install **and** trouble-free.

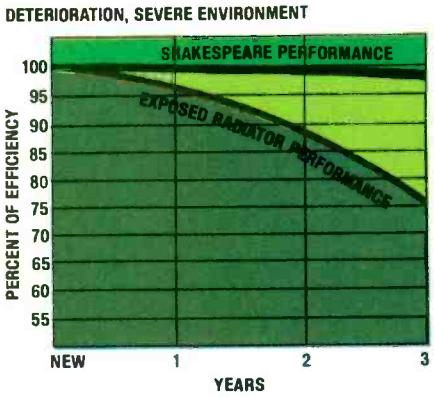
U.S. Patent #4,097,870

(1) Big Stick has a band spread tuned circuit that yields a low SWR across all 40 channels. (See SWR chart) (2) Its DC ground provision lowers static noise and reduces lightning hazard. (3) Signal loss is prevented by its innovative polystyrene air cell dilectric structure. (4) The silver plated copper braid in the decoupling sleeve lowers resistance and increases efficiency. (5) The metal radiator is completely protected by a sheath of high grade fiberglass. (6) Its aluminum mounting sleeve includes U-bolts for easy installation. (7) Factory designed crimping permanently locks the SO 239 connector in position. (8) And the connector is sealed and protected from the elements.

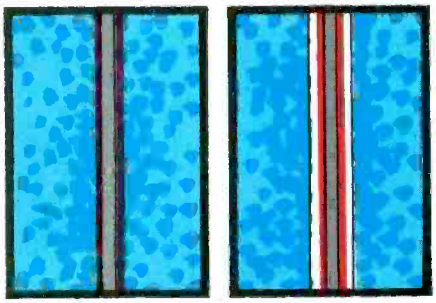




EVERYONE TALKING!



The principal of "skin effect." A transmitted signal, in the form of energy, travels on the surface of the metal radiator of an antenna. This occurs regardless of the length, density, or thickness of the metal radiator. Picture an antenna surface after it has been bombarded by millions of tiny particles day after day. Dust, dirt, pollutants, salt, chemicals...all of them impinging on the surface to create obstacles that offer resistance to your transmitted signal. Within six months exposure, surface resistance on an exposed radiator can rob you of up to 20% of your power.



METAL ANTENNA (TYPICAL)

SHAKESPEARE FIBERGLASS ANTENNA

A speck of dust? It's hell in your eye... even worse on your antenna!

When it's the surface of an antenna that's designed to radiate the signal, you're in for problems...

Metal corrodes...fiberglass does not. And the fiberglass surface of the Big Stick is far less susceptible to pollution and contaminants in the environment.

With a Shakespeare fiberglass antenna, surface contamination and crud does not mar performance because the surface is not the radiator. Instead, the radiator is sealed inside the fiberglass sheath, which is transparent to radio frequencies and lets the signal through without interference or distortion.

Tried and True!

Built in the factory so you don't have to rebuild it on your roof. Big Stick comes in two pieces. Not like the multi-pieced antenna puzzle you helped your neighbor put up last summer. You know...the one with all those radials and that huge bag of bolts. The same one that came crashing down during the windstorm.

The Big Stick is super engineered. Quick, easy installation allows you more time to modulate. High winds or solid ice...it's built to keep you talking whatever the weather.

RELAX...the world's largest Fiberglass antenna plant just made your next antenna.

200,000 square feet devoted entirely to communications antennas and related fiberglass products, complete with advanced testing facilities and laboratories for research and development.

Shakespeare®

ELECTRONICS AND FIBERGLASS DIVISION
Antenna Group/P.O. Box 246, Columbia, S.C. 29202

The Shakespeare Company / Manufacturers of Communication Equipment, Fishing Tackle, Industrial Fiberglass, Wonderthread and Specialized Monofilaments, Golf Equipment, Automotive Products, Saddlery and Equestrian Accessories, and Marine Taxidermy.

CIRCLE 25 ON READER SERVICE COUPON

Performance that's easy to handle.

The Motorola® System 500 Remote CB. The first full-featured Remote that's easy to handle. It's designed to feel natural. To operate effortlessly. With about as much thought as you give to shifting gears.

But what good is a Remote that fits your hand, if it doesn't fit your needs? The Motorola System 500 Remote features a 2-speed channel selector. A local/distance switch that reduces interference and background noise. A channel 9 emergency switch that puts you in touch with help instantly when you need it.

You also get the CB features you've come to expect from Motorola. Like a phase lock-loop synthesizer. Power mic. Phosphorescent control labels for easy identification. Hot-last channel memory. L.E.D. channel readout. And an optional relay which interrupts radio audio as CB messages are received.

As easy as it is to handle and operate, this CB is tough to steal. The transceiver chassis is compact—easily hidden away in the trunk, under the seat, or mounted on the firewall.

The complete, uncomplicated Motorola System 500 Remote. Because when you're driving, you've got enough to handle.

MOTOROLA
CB

To find the dealer nearest you, write: Market Relations Manager, Motorola, Inc., Automotive Products Division, 1299 East Algonquin Road, Schaumburg, Illinois 60196.
Motorola is a registered trademark of Motorola Inc.

CIRCLE 99 ON READER SERVICE COUPON

Hey, look me over

Showcase of New Products

Shirt Pocket Micro Cassette

What's 10½ ounces and delivers 60 minutes of recording and playback operation? The answer is Panasonic's new RQ-165 AC/battery Micro Cassette recorder. The new unit is a combination of compact size, good sound and versatile performance. Panasonic Model RQ-165 also features: Capstan drive which

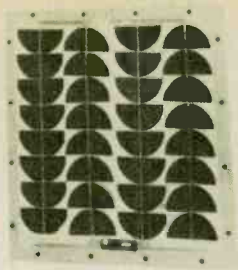
CIRCLE 102 ON READER SERVICE COUPON

helps provide constant tape speed; built-in condenser microphone; a battery recharge system with optional rechargeable battery pack RP-094; one-touch recording and cue and review controls. The unit also features Easy-Matic circuitry for automatic recording level; lockable pause control and LED record/battery indicator. It is equipped with AC adaptor/recharger and operates on two AA-size batteries. Sells for $99.95. Details can be had by writing to Panasonic, One Panasonic Way, Secaucus, NJ 07094.

Sun-Powered Marine Battery Charger

Solarex Corporation of Rockville, Maryland presents a new 7-watt Solar Energizer—a marine battery charger that has no moving parts and requires no fuel other than sunlight. The Solar Energizer is invaluable to the boater who wants to conserve on-board fuel, since it allows operation of electrical equipment without running the engine or draining the battery. It's perfect for sailboats and yachts that have no auxiliary power—and therefore no generator—yet require electricity to operate running lights, communication equipment, and other electrical gear. Designed for use with 12-volt systems, the Solar Energizer will maintain your boat's battery at full charge with power left over to, for example, operate an FM or CB transceiver, remove thousands of gallons of water with a bilge pump, or operate navigation lights for hours. It's maintenance and pollution-free, silent, and fully auto-

CIRCLE 100 ON READER SERVICE COUPON



matic, charging your battery on sunny or overcast days, at dockside or at sea. Installation is simply one hole to drill, two wires to connect. Solar Energizer weighs four pounds and generates 0.6 amperes of current in full sunlight and up to 18 ampere-hours of energy per week in an average United States location. Sells for $349. For more information, write to Solarex Corporation, 1335 Piccard Drive, Rockville, MD 20850.

Logic Probe

A new B&K-Precision logic probe is the Model DP-50, a multi-family device that is compatible with TTL, DTL, RTL, HTL, CMOS, MOS and high-noise immunity logic (HiNIL). The DP-50 simplifies troubleshooting and analysis of digital circuits by clearly displaying in-circuit activity. Three bright LED indicators display pulse presence and high and low

HEY, LOOK ME OVER

(Continued from page 11)

logic states. The DP-50 will continue to indicate pulse presence through its maximum frequency of 50 MHz. For high-speed or intermittent pulses, the DP-50 offers a memory mode to "freeze" and store the pulse display. In the pulse

CIRCLE 85 ON READER SERVICE COUPON

mode, short duration pulses are "stretched" for a clear visual indication. To ensure that the instrument has no effect on the circuit under test, input impedance is 2 megohms in all modes. The B&K-Precision DP-50 is fully overload protected and will withstand ±50 VDC at the input. Reverse polarity protection for the power leads is also 50 volts. Sells for $50.00. For additional information, contact B&K-Precision, 6460 W. Cortland St., Chicago, IL 60635.

Low-Price, No-Crystal Scanner

Regency's new Touch K100, a synthesized scanner, requires no crystals—just simple touch entry of frequencies using the special pressure sensitive panel. The K100 has 10 channels available for storing any of 15,757 possible frequencies. It can also search within a band for unknown frequencies if the user enters the upper and lower limits of the search spectrum on the program panel. The listener may delay the resumption of the scan or search process to hear a response to a call. Tapping "Delay" will keep the scanner on the frequency until he is ready to continue scanning or searching. In addition to showing the operating frequency, the

CIRCLE 101 ON READER SERVICE COUPON

K100 LED indicators indicate a power failure, programming errors, all channel lockouts, and status of the scan delay function. List priced to sell at $269. For additional information, write to Regency Electronics, Inc., 7707 Records St., Indianapolis, IN 46226.

Cassette Deck with Automatic Program

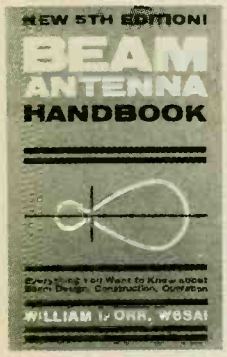
RT-1125 front loading cassette deck from Sharp Electronics has a noise reduction system and the exclusive "Sharp Eye" Automatic Program Search System

CIRCLE 89 ON READER SERVICE COUPON

(APSS) which enables a user to skip to the start of the next song or back to the start of the present selection. Packaged in a handsome black cabinet, RT-1125 has large VU meters, LED record indicator, individual bias and equalization switches, narrow gap permalloy head, automatic end-of-tape shut-off, servo controlled DC motor, mechanical pause control, front panel inputs for stereo headphones and microphones and a digital tape counter. Wow and flutter is 0.09 per cent WRMS, frequency response is 40-13,000 Hz, and Signal/Noise ratio is 56 dB. Suggested retail price is $149.95. Get all the facts on the RT-1125 and other audio component products by writing to Sharp Electronic Corp., 10 Keystone Place, Paramus, NJ 07652. ■

BOOKMARK
BY BOOKWORM

Beam Antenna Handbook, 5th Edition is the latest revision of the DX antenna handbook from William I. Orr (W6SAI) and Stuart D. Cowan (W2LX). This book covers it all, from theory of signal propagation, up to hints on installing one of the often behemoth beams atop a tower. The first chapters deal, in an interesting and readable way, with antenna theory that other handbooks sometimes make dry and untenable. The authors guide their readers from a layman acquaintance with basics into a complete understanding of how and why a beam antenna works. The idea of parasitic elements arranged about a central dipole as reflectors and directors is lucidly explained both in easy to follow prose and illustrative drawings. If you've tried before – and failed – to understand beam arrays, give these chapters a try and they'll probably set you straight. Matching systems and transmission line theory are given the same illuminating treatment. By the time it comes to building an antenna, the reader will have a firm knowledge of just what it takes to have everything involved operating at theoretical perfection. Once the theory is down, the *Handbook* treats how to design the physical dimensions of a beam by applying concepts already learned. This is accomplished with a minimum of math, and a great deal of straightforwardness. Then, from simple two and three-element parasitic arrays, the reader is introduced to special purpose beams. Multiband beams and loading coils are covered in minute detail. True specialty items, such as beams made out of 12-gauge wire, are also talked about. The Handbook also details how to check a finished antenna's performance, and the test instruments you will need. One worthy chapter completely explains everything you might need to know in order to construct a beam—either from a design in the *Handbook* or one of your own. If you have ever wondered how F/B ratios, boom length, etc., can be converted into real, operating hardware then these chapters will be invaluable. The *Handbook* is available for $4.95 from Radio Publications, Inc., Box 149, Wilton, Conn. 06897.



You can both build and understand DX beam antenna arrays.

Soft Cover
198 pages
$4.95

Semiconductor Reference. The 1978 edition of the Archer Semiconductor Reference and Application Handbook is a compilation of data on Radio Shack's complete line of Archer-brand semiconductors. It contains a cross-reference listing for replacement of more than 46,000 transistors, diodes and other interchangeable devices. The cross-reference/replacement listings are totally computer cross-referenced for greater accuracy and are based on careful analysis of the important parameters of the listed devices. Application information, including actual circuit diagrams, is given for most of the listed IC's schematics for all clock chips and modules, and detailed information is provided on the 8080A CPU chip. Also has information on the Archer line of display and opto-electronic devices. Available exclusively from Radio Shack stores and dealers. ■

Soft cover
144 pages
$1.95

DX central reporting

A world of SWL info!

By Don Jensen

☐ Almost every shortwave listener cuts his teeth on English language programs. Luckily there are scores of overseas shortwave broadcasters that do transmit in English. But, as many of these outlets as there are that use English in their programming day, you are unnecessarily limiting your listening adventures if you automatically dial out any station not broadcasting in "Big E!"

So, sooner or later, if you are a serious SWL, you will want to DX those stations which broadcast in other languages. And, again fortunately, listening to other lingos isn't all as tough as you might imagine.

Key Words. Obviously, you can never learn all the languages on shortwave. There are hundreds of different languages and dialects to be heard on SW. Most of the Latin American countries use Spanish, and Brazil uses Portuguese. In West Africa, French is an important tongue. Swahili is spoken in a number of countries of eastern Africa. Arabic programming is aired by stations in North Africa and the Middle East. Scores of languages and dialects are used by stations in the Soviet Union, both for foreign and internal transmissions.

But it is not necessary to be fluent in a language to be able to pick out certain key words that will allow you to identify the station and tell something about its programs.

One good way to familiarize yourself with the "sound" of various foreign languages is to listen to the regular transmissions of some of the major international broadcasters, such as the Voice of America. Prior to each transmission, you can hear announcements indicating the language to be used for the following programs.

With some time and effort you will eventually come to learn the basic sounds of the various languages; which ones are soft and musical, which harsh and gutteral. You will recognize by "sound," the Romance languages, the ones that belong to the Germanic-Nordic grouping, the Slavic tongues, the sing-songy tonal languages of Asia.

Sounds Familiar. But, of course, you probably should learn the meanings of a few words in the major languages of the world. The words you should concentrate on, at least initially, are those often heard as part of the station identifications.

For example, in both Spanish and Portuguese, one of these key words is *transmite* (which is pronounced with the "A" sound for the last syllable). It means just what you probably think it does . . . transmits.

Part of the identification, in Portuguese, of the governmental station at Luanda, Angola, is: ". . . *Transmite a Radio Nacional.*"

Many Spanish language station identifications begin with the words, *Esta es . . .* In translation, that means, "That is" and is normally followed by the name of the station, as in *Esta es Radio Ecuatorial, Bata,* an African station in Equatorial Guinea, a former Spanish possession.

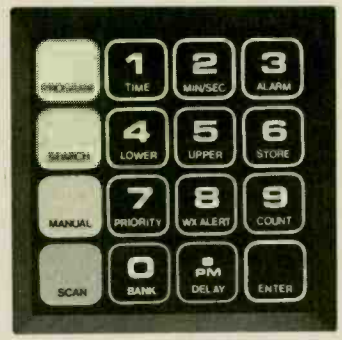
An equivalent in French is *Ici.* Radiodiffusion Ivoirenne, the governmental station in Abidjan, the capital of the former French outpost in Africa, the Ivory Coast, identifies as "*Ici Abidjan*—"Here is Abidjan."

Other "radio words" are not too difficult. In Spanish speaking Latin American countries, frequencies will be given in *kilociclos;* German-speaking stations will use *kilohertz,* now well known to most U.S. listeners. ■

The last word. We thought we'd said it last year. But it turns out we spoke too soon.

The reason for our premature announcement is the Touch K500. It's not just more to say, it's almost a whole new vocabulary in scanners. With totally new words to describe totally new features. For example.

RAM* Scanning: Program in frequency numbers. Enter them into channels. Then scan the channels to hear a call. Simple concept. Monumental capability. Because the Touch K500 gives you 40 channels to scan any of 15,757 different frequencies. You need never even mention the word "crystals".



ROM* Scanning: There are no words or numbers required. Just choose from the three sets of frequencies: police, fire, or marine and weather. Then tap the symbol that corresponds to the set you've chosen. The red light symbol is for police, the flame means fire and the boat will get you marine, weather and mobile phones. Next, get ready. The Touch K500 will promptly scan through every common frequency in the ROM set. So you can actually scan police calls without ever knowing the frequencies, just remember that the red light symbol calls the cops.

Search and Store: With a conventional radio you turn the tuning dial to seek new signals. With ours you search automatically. Besides being easier, our system has some definite performance advantages. Because the Touch K500 not only covers each frequency individually, it also remembers where it heard a call. You can go on searching and enjoying. Then later, you can ask the radio to go back and recall the frequencies it heard. As always, it will respond instantly to your touch.

Et Cetera: There's a lot more to say about our Touch K500: like priority, programmable scan delay, channel activity count, remote equipment switching, Weather Alert®, and even digital clock with alarm. But enough of our speech. There's something more important you should hear. That is:

The Good Words: Try it. When you go to your Regency retailer, to see the Touch K500, the best thing he can say is: "Try it". Because after just one touch, you'll know you're listening to the scanner from the company that's said it all: Regency.

Regency
Touch K500

Last year we introduced the last word in scanners. This year we've got more to say.

MORE—591 Channels, Search, Store, Time—MORE

Regency Electronics, Inc. • 7707 Records St. Indianapolis, IN 46226 *RAM: Regency Alterable Memory *ROM: Regency Organized Memory

CIRCLE 28 ON READER SERVICE COUPON

HI-FI REPORTS

HI•FI REPORTS

A look at some medium-weight champs — the Koss CM-1010 speaker system and SAE's 3100 power amp. By Gordon Sell

☐ WHEN I THINK OF A SPEAKER and amplifier combination I often think of a championship boxer who can really deliver the ol' one-two. The amplifier is the brain of the outfit. It has to dance dodge and weave around a complex musical input without stumbling, falling flat or getting knocked out by surprise transients. Then it must accurately deal out what it took in, with force. The speaker is the muscle and glove of the system. It has to be strong enough to handle any load put on it by the amp and yet have the dexterity to deliver that power with absolute precision.

I recently had a chance to observe a couple of championship quality medium-weights working out — audio medium-weights that is: the SAE 3100 power amp and a pair of Koss CM-1010 speakers. They are medium weights only in terms of the power output and handling capabilities; their quality is championship all the way.

SAE 3100. I've always been a little bit nervous around SAE (Scientific Audio Electronics, Inc.,) equipment.

SAE 3100 Power Amplifier

CIRCLE 62 ON READER SERVICE COUPON

It looks so professional and I sort of of half expect it to reveal some major flaw in my electronics training. It's the kind of equipment where you really do read the instruction book from cover to cover before you take the set out of the box. Once you've tried SAE equipment however you will realize that all such fears are groundless.

The SAE 3100 is at the bottom of a line of power amps that range from the 3100's four watts per channel RMS right on up to 400 watts for the 2600. The interesting thing is that, except for power output, the specifications for all sets are the same. SAE seems to belive that you shouldn't have to sacrifice quality just because you don't need a lot of power. I happen to think that's a pretty good philosophy.

The first thing that strikes you about the SAE 3100 is the distinctive string of 17 LEDs that make up the power indication system. When the center LED is lit the power is on and the amp is idling without an input. The 3100 has only two inputs and two outputs with no switches. Its volume is controlled by the level of input from a pre-amp. The unit gets its power from the switched, line-out plug of the pre-amp. When the pre-amp is turned on the amp will receive power.

As the input signal increases from zero the left- and right-channel LEDs light up coresponding to the power being put out. These lights are marked for power levels (calibrated for an 8-ohm load) of .02, .09, .37, 1.5, 6, 25, 50 and 72 watts per channel RMS, with 72 watts representing an overload. We found it to be very accurate for an LED display; even above 6 watts it was within 10%. You can also judge frequency response from the lamps since they vary in intensity to reflect power levels in between. When inputting a 20 to 20,000 Hz test signal the lamps didn't flicker from one end of the audio spectrum to the other, a sure indication of a flat frequency response. Indeed the measured frequency response at 50 watts into 8 ohms was a mere ±0.1 dB from 20 to 20,000 Hz with no more than 0.15% THD at any frequency. A one-volt input level was needed to produce a 50-watt output. The hum and noise level, referenced to the 50-watt output, was a very respectable −95dB.

As you can see the SAE 3100 is really a very simple unit even though it uses the most up-to-date technology possible. For $350, suggested retail price, the 3100 is something to consider if you want to give your system the versatility that an individual power amp provides. For more information about the SAE 3100 and other SAE products circle number 62 on the readers service coupon. But, beware, the SAE "look" and sound can be habit forming.

Koss CM-1010. If you are looking for a good "medium-weight" high quality speaker to make up with your system you might be interested in the Koss CM-1010. Unlike most speakers, which utilize acoustic suspension design where there is an air-tight seal behind the speaker, the Koss CM-1010 utilizes a vented-speaker box with a passive radiator. For the uninitiated

(Continued on page 83)

BUILD 20 RADIO
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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, switches, solid state devices, 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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- SOLDERING IRON
- ELECTRONICS TESTER
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- VALUABLE DISCOUNT CARD
- CERTIFICATE OF MERIT
- TESTER INSTRUCTION MANUAL
- HIGH FIDELITY GUIDE • QUIZZES
- TELEVISION BOOK • RADIO TROUBLE-SHOOTING BOOK
- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

SERVICING LESSONS

You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets that you construct. You will learn symptoms and causes of trouble in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the dynamic Radio & Electronics 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

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."

SOLID STATE

Today an electronics technician or hobbyist requires a knowledge of solid state, as well as vacuum tube circuitry. The "Edu-Kit" course teaches both. You will build vacuum tube, 100% solid state and combination ("hybrid") circuits.

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.

Progressive "Edu-Kits" Inc., 1189 Broadway, Dept. 593-DJ Hewlett, N.Y. 11557

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

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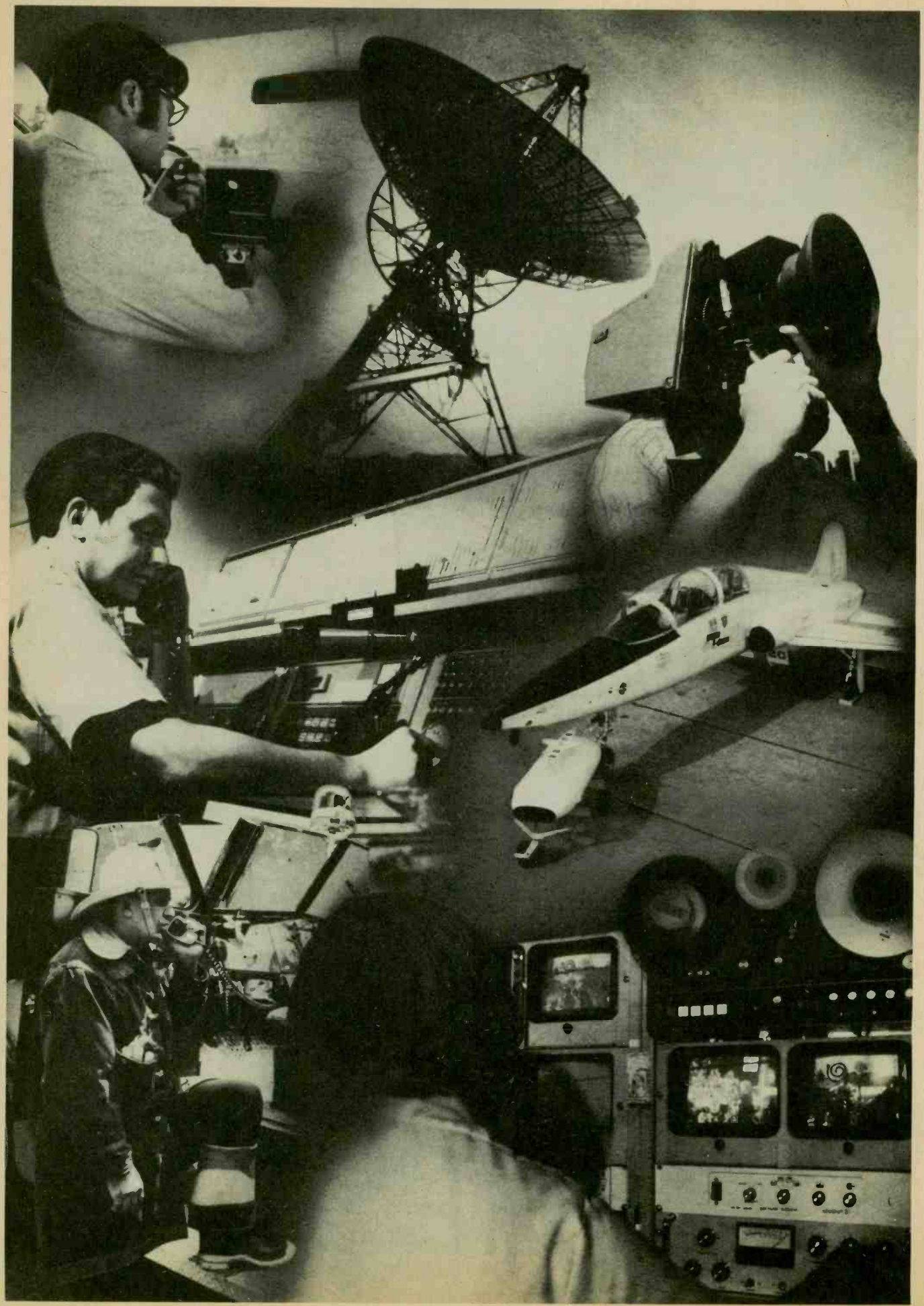
CIRCLE 24 ON READER SERVICE COUPON



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NRI training is "hands-on" training. You get practical bench experience as you build and test this industrial quality two-way radio and power supply. You reinforce theory lessons as you induce and correct faults, study individual circuits and see how they interface with others.

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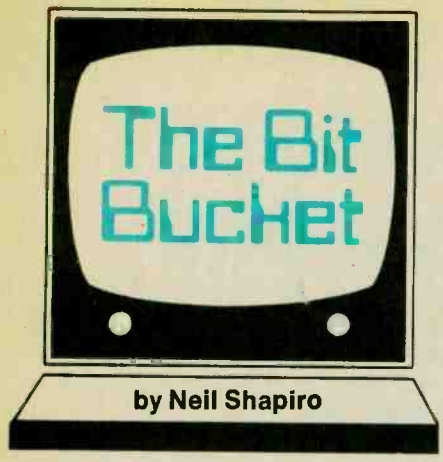

by Neil Shapiro

Choose a computer as logically as if you were a computer too!

☐ Have those new, assembled computers with BASIC in ROM caught your eye? They can be a fine way to enter Personal Computing, the only problem lies in choosing which one is right for you. Done haphazardly, the choice can seem confusing to the point of being overwhelming. But take it all step by step—rather than programming yourself into an endless loop.

Skin Deep. The best place to start your search is the packaging, the outer skin of the machine. The Radio Shack TRS-80, the Apple II, Commodore's PET and others all have slightly varying design philosophies. The TRS-80 and Apple both have fine keyboards with rollover (an important feature if you happen to type two letters nearly together), the main difference in appearance being the TRS-80's monitor and the Apple II's TV. Commodore, on the other hand, has gone with a calculator-style keypad arrangement and a built-in CRT. Other manufacturers have come up with even other packages.

Never buy a computer unless you've tried out the keyboard at least once. They all have a different "feel" and if you pick one that you just don't like you will really *hate* typing in any lengthy programs!

Talking It Up. All of the new, self-contained computers have the BASIC language in ROM. The question is, which BASIC? Radio Shack's TRS-80 uses a so-called Tiny BASIC in its Level One. If you want to use most published software, you really must invest in a Level Two machine. The Apple II has an Integer BASIC so if you want decimal point numbers then you'll need either their Applesoft II tape or ROM (we recommend the ROM due to the memory saving).

Painting the Picture. Many of these new computers offer built-in graphic capabilities. Just about all of the systems are different and some are easier to program—and thus *use*—than the others.

The Apple II will display 15 colors on a color TV in its low resolution mode and four colors in high resolution.

Radio Shack's TRS-80 plots points on the screen by means of the basic commands "SET" and "RESET. It s a bit harder than the Apple to get the hang of and is, of course, limited to black and white.

The PET is unique in that the keys are labeled with graphic designs that can be displayed on the CRT one after the other to form pictures, etc. This can be quicker in some ways, but somewhat limiting in others. Again, it's what works for you that counts.

Memories Are Made Of This. Get enough memory. Get more memory than you think you'll need—because you're probably going to need it!

Radio Shack can handle up to 16K on-board and beyond that requires their Expansion Interface (to 48K total). Once you have the interface, the memory is priced competitively with the other systems.

The PET is only available as an 8K machine, although the gents at Commodore keep saying that sooner or later the 4K models will appear. Adding memory will require an interface not yet available.

The Apple II can go up to 48K of memory just by plugging memory chips into an already socketed motherboard. This is a very handy way to add-on memory, as it cuts out cost for an entire PC board.

You'll note that we have not set out to tell you which computer is "better." This is simply because the worth of a computer depends on how it fits application. Try them out for size before you buy.

A Computer Coup. How would you like to play a wargame with your computer as referee—or even play against the computer itself? If you're not familiar with the wargaming scene, let me enlighten you.

Wargames are very little like *wars* and the best ones are not really *games*. They are very complex simulations of historical or quasi-historical battles played out on maps of the actual terrain. The pieces, usually flat counters, represent real military units. Combat effectiveness, size, etc., are carefully researched and documented.

(Continued on page 89)

BEARCAT® SCANNERS ANNOUNCE AMERICA'S ONLY 50-CHANNEL, MICRO PROCESSOR CONTROLLED SCANNER. IT SEARCHES, STORES, REMEMBERS AND ALL BUT THINKS FOR YOU.

The new *Bearcat* 250.
An unbelievable advancement
in no-crystal scanning.

Bearcat's new, 250 is fully synthesized
for punch-in programming. It searches,
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Automatically.
Unbelievable? Read and
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CRYSTAL-LESS. Micro processor controlled. Brings in every local frequency, automatically, without a crystal.

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SEARCH/STORE. Seeks out and stores up to 64 active local public service frequencies automatically.

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5-BAND COVERAGE. Low, high, UHF, UHF-T. Plus 2 meter amateur ham band, and other UHF frequencies.

COUNT. Transmissions on each frequency counted automatically to determine which are most active.

SCAN/SEARCH LOCKOUT. A unique feature. Not only locks out channels while scanning, it also eliminates unwanted frequencies while searching.

AND MUCH MORE! Selective Scan Delay. Direct Channel Selection. Scan Speed Control. Automatic Squelch. Track Tuning Circuitry. Front-Mounted Speaker. Decimal Display. Quality Construction. AC/DC. UL listed. FCC Certified.

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CIRCLE 13 ON READER SERVICE COUPON

Ask Hank, He Knows!

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

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

Farad Facts

What gives here? I'm new to electronics and something seems amiss. In one breath the texts tell me that capacitive reactance goes down *with frequency. OK, I'll buy that. But in the next breath, I get this story: "If you want to eliminate interference, use shielded coaxial cable for a TV lead in." Seems to me that TV signals are fairly high in frequency. My antenna will have to be over 120 feet from the set. Every foot of coax seems like a capacitor feeding my signal to ground! How can I use coax for a lead-in at high frequencies to eliminate interference, If capacitive reactance keeps going* down *as frequency goes up?*

—B.K., Westmont, NJ

Coax cable has capacitance as would any lead-in system. However, the capacitance per foot is measured in picoFarads. True, 120 feet of cable has losses, but if the coax line is correctly matched to the antenna and TV set, your results should be good if the signal is strong in your area. You may need signal amplification from an MATV amplifier placed at the antenna.

Canadians Make It Easy

Hank, in case you didn't know, Radio Canada International QSL cards are supplied blank to SWLers. To obtain verification simply fill in the card, including some brief details about the content of the broadcast heard. Mail the card to RCI in an envelope and if all the details are correct, the card will be verified and returned to you. Cards with incorrect reception details will not be returned. To get your blank card and program guide, write to Radio Canada International, P.O. Box/ C.P 6000, Montreal, Canada H3C 3A8.

—D.N., Walden, NY

Thanks for the tip. I'd like to point out that the QSL card is for RCI and not CBC Northern Service.

Hot Stuff

Should a 6800 microprocessor chip run warm to the touch?

—L.W., Denver, CO

Yes. Each transistor junction in the chip may use only a few microwatts, but add them all up and the chip will get warm. No, the heat is not dangerous to the chip, if allowed to be cooled by room air.

Lend A Hand

Here's our list guys—hope you will be able to assist! If anyone out there needs help, write to me, Hank Scott, and I'll try to do my best to give you coverage. Keep your question limited to one item (or piece of equipment).

Δ Sylvania TV Lab Scope type 404, service manual and/or schematic diagram urgently needed; Clyde N. Smith, 11 Brown Street, Reynoldsville, PA 15851.

Δ Decca Model TT-33 AM/LW battery operated receiver, schematic diagram needed; Bruce L. Werner, 206508 Ross Parkway, Big Rapids, MI 49307.

Δ Hammarlund HQ-145X shortwave receiver, operators manual; Robert R. Hart, 193 Lee Ave., Ashland, OH 44805.

Δ Hallicrafters SX-101, Multielmac RMR-7, Multielmac AF-68, Multi-Products M-1070, need operators manual to get this station on the air; Eric L. Munson, 903W Franklin, Jackson, MI 49203.

Δ Hallicrafters Model S-38B shortwave receiver, need schematic diagram and operators manual; Allen Loyd, 125 Baltic Circle, Tampa, FL 33606.

Δ Hallicrafters SX-140 amateur receiver, schematic diagram and alignment info requested; R.C. DeWitt, P.O Box: 1433, Honolulu, HI 96806. ■

newscan

Electronics in the News!

Programming takes Honors

Eighth grader Ralph Lipe of McLean Middle School in Fort Worth, Texas received top honors in a recent Science Fair competition with a computer program for the 1040-A tax form. Using a Radio Shack TRS-80 Microcomputer System, Ralph wrote a program designed to guide a person, step-by-step, through the 1040-A tax form.

Fourteen-year-old Ralph Lipe took top honors at a Regional Science Fair by programming his Radio Shack TRS-80 Microcomputer System to go step-by-step through the 1040-A tax form. With Ralph are his proud parents, Mr. and Mrs. Gary Lipe of Fort Worth, Texas.

It took Ralph, age 14, a total of 60 hours to write and de-bug the program. The idea for writing the program came from his mother, Jane Lipe, a certified public accountant, who assisted him in setting up some of the equations for the tax questions. Ralph then converted the information to Basic computer language for programming the TRS-80 microcomputer.

Tape-A-Chip

An integrated circuit (IC) that will significantly change the way both portable cassette and reel to reel tape recorders are designed has been developed by National Semiconductor.

Designated the LM1818, the device is a linear bipolar integrated circuit containing all the active electronics necessary for building a tape audio system.

What makes the LM1818 unique in the industry is that the standard multipole switch now used in tape recorders can be replaced by a single pole double throw switch. This feature alone will make for significant reductions in the size of handheld portable tape recorders. A size reduction will allow the recorder designer more flexibility in layout, increased reliability, reduced parts count, and lowered labor costs.

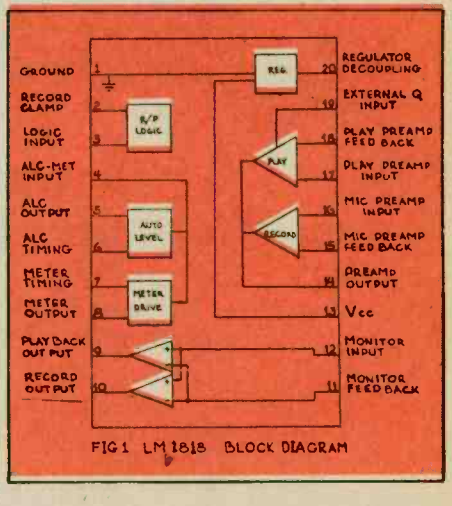

FIG 1 LM 1818 BLOCK DIAGRAM

Dr. Hung Liang Hu is the leader of a group of IBM research scientists who fabricated an experimental chip that stores information in a close-packed array of magnetic bubbles. This chip is the first example of such a device that performs all the reading, writing, and storage functions needed in the operation of a memory.

The LM1818 is good enough for the high quality reel to reel systems, but cost effective enough to be used in the $50 to $100 type portable recorders. The LM1818 is priced at $2.85 each, in 100-up quantities to manufacturers. ■

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9 SELECTED PROJECTS

GETTING BETTER ALL THE TIME

ELEMENTARY ELECTRONICS celebrates 15 years of service to the electronics enthusiast

ELEMENTARY ELECTRONICS marks its 15th birthday with this issue and we thought it would be a good time to look back and see just how far e/e has come since its first publication as an annual in 1963. It's also an appropriate time to look ahead and show you how we intend to keep on getting better all the time.

Progress. A quick look at that first issue not only tells you how far e/e has progressed in 15 years but how far the state of the electronic art has progressed. The equipment in that edition looked positively antique even though it appeared at a time when the electronics hobbyist and the electronics industry were well into the transition from vacuum tube technology to transistors. Sure transistors had been around for 15 years but they were still expensive for the hobbyist. As industry converted to transistors the surplus market became glutted with vacuum tubes. In e/e's second issue a surplus outlet in New Jersey offered "any tube for 33 cents apiece." With prices like these vacuum tube technology was still very popular for construction projects, and almost any old piece of equipment that needed repair used vacuum tubes. The magazine had projects for both technologies.

ELEMENTARY ELECTRONICS took the lead in teaching readers how to make the best use of the tiny new semiconductor wonders. Each issue contained a number of transistor construction projects in addition to stacks of data on transistor theory. The bulk of the first issue was devoted to the basics of electronics. The lead article was a nifty breakdown of the color codes used for resistors, capacitors and transformers; followed articles on tools, reading schematic diagrams, batteries and a 25-page introduction to basic electronic theory. For the shortwave radio buff there were plans for a one-transistor shortwave receiver and an

GETTING BETTER

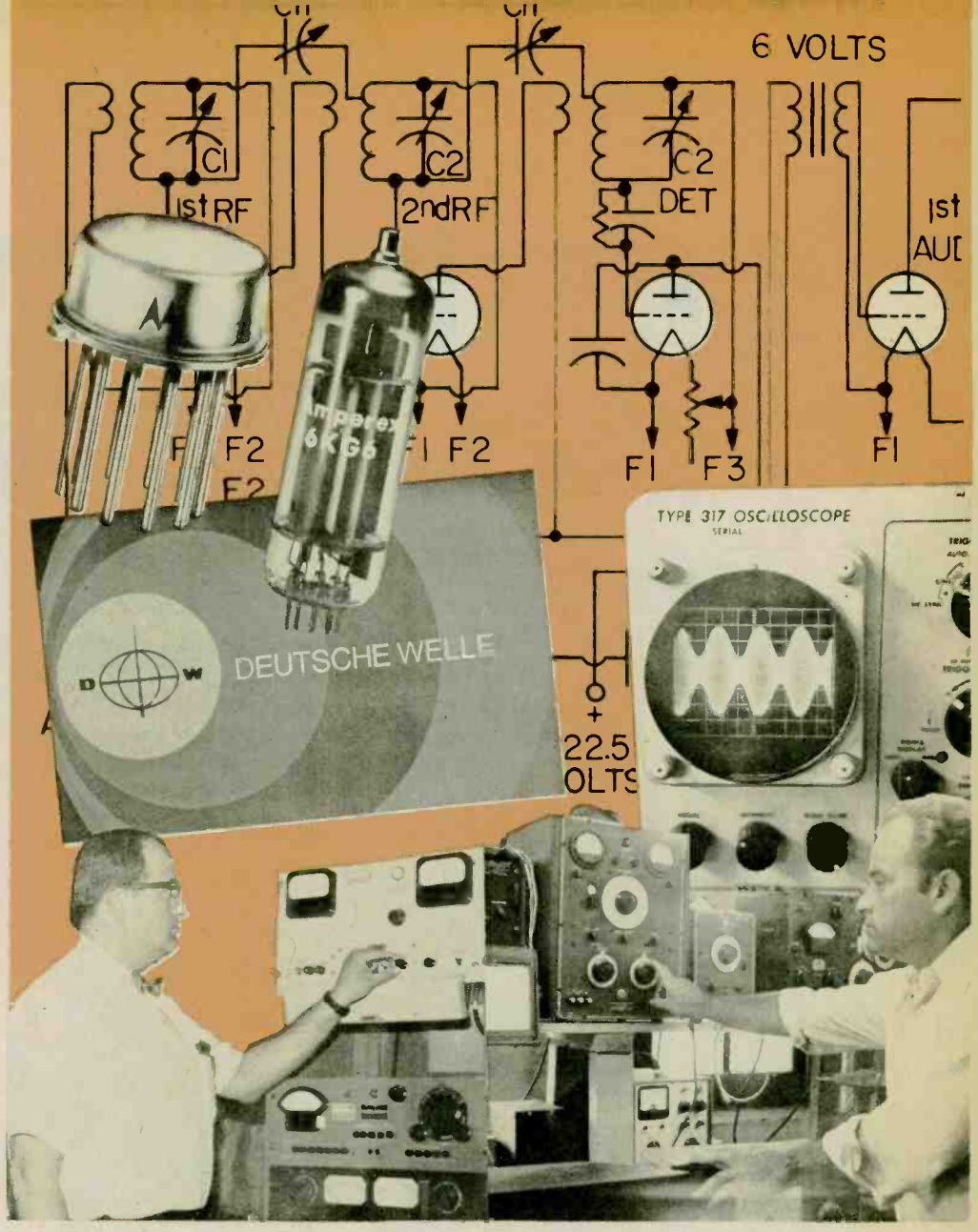
article on radio wave propogation by C. M. Stanbury, who has been a regular contributor to e/e even since.

That first issue was a real success! The magazine grew to biannual in '64, a quarterly in '65 and a bimonthly in '66. The rapid development of reader interest brought numerous improvements, the first of which was "Ask Me Another" by Leo G. Sands, the forerunner of Hank Scott's "Ask Hank, He Knows." Since that time e/e has been able to solve thousands of readers' problems and save them tons of money.

Technology. Shortly after that another regular department appeared and has remained ever since: "Newscan" has helped our readers keep up with state-of-the-art electronic technology and given them ideas to experiment with at home. In those days there was a great deal of interest in the conquest of outer space and the electronics involved in that quest. Computers were also big news even though they were what might be called "primitive" compared to today's machines. Most required massive banks of components and were extremely expensive. The integrated circuit was just being developed and few hobbyists ever thought of using one in a project.

Throughout the '60s e/e published hundreds of construction projects. Some of them employed vacuum tube technology but most used transistors. In the July/August 1969 issue (this country put the first men on the moon during that period) e/e did an article that told all about the new integrated circuit Op-Amps and how the hobbyist could use them. From that point on nearly every issue had articles and construction projects that took advantage of integrated circuits.

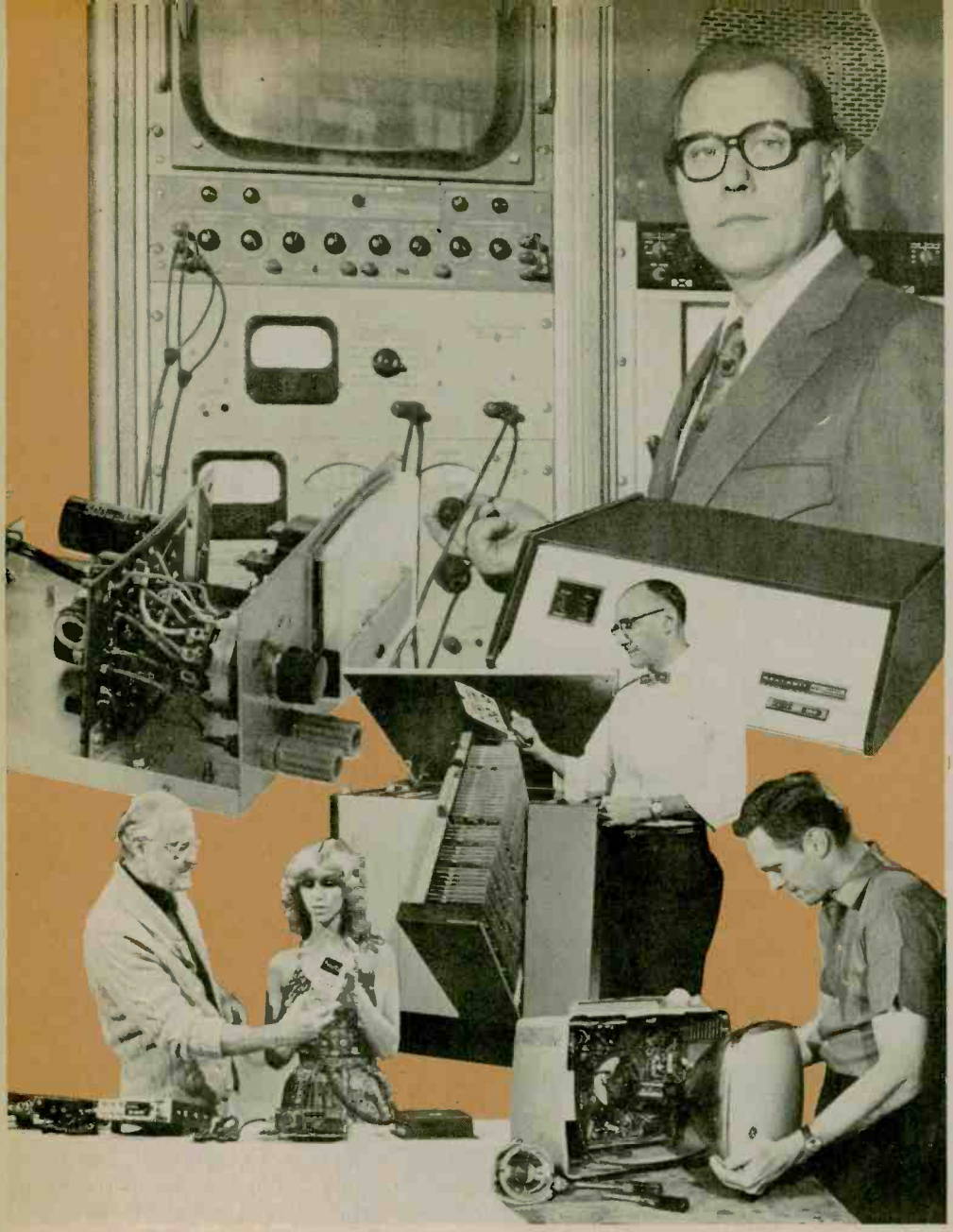
Shortly before that watershed of technology, in the March/April '69 issue, e/e added a new columnist in response to the great volume of letters we were receiving from shortwave radio listeners. Don Jensen's "DX Central Reporting" has been a regular feature ever since. Don started DXing at the age of 11 when he tuned his first foreign station, Equador's HCJB. Since then he has logged more than 220 countries and stations from remote spots such as Antarctica and the Falkland Islands. Don has been in contact with thousands of DXers from all over the world and he founded the Association of North American Radio Clubs.



He is presently a newspaper reporter in Kenosha, Wisconsin and spent many years working in the broadcast industry. Truly a man who knows radio from both sides of the microphone.

Nineteen-sixty-nine was a busy year for e/e. A few months after Don's arrival Kathi Martin become e/e's first woman columnist, writing "Kathi's CB Carousel" for all the CB buffs. Kathi was one of the first people to recognize that CB was going to be more than just a hobby for a few enthusiasts. She saw CB becoming an integral part of America culture—something that would become an everyday appliance used by people from every walk of life. She was the first editor here who could speak fluent CB and she has worked hard to breakdown the language barrier that kept some people off the air. Kathi is constantly trying out new CB sets, gadgets and gizmos to see if they really work. When she likes something she sends it to our laboratory to see how it stands up on the test bench; then, and only then, does she write about it.

Into the Seventies. As ELEMENTARY ELECTRONICS moved into the '70s it continued to publish an evermore-interesting list of construction projects; a telephone scrambler, an electronic door latch, stereo speakers, light-beam radios, radio pre-amps, digital clocks, darkroom equipment, digital meters and hundreds of others. As the demand for these projects increased e/e expanded its services to project builders. The editors bent over backwards to help readers find hard-to-locate parts. Hank Scott who took over as workbench editor in 1971, began spending more and more time answering questions from project builders who wanted to know the hows and whys of various



projects, and how to modify them for different purposes.

The digital revolution began during this period and, in an effort to help readers make correct buying decisions about pocket calculators, we did a "how-to-choose" article. In those days a basic, add-subtract-multiply-divide-square-and-square-root calculator was a bargain at $90—at least some things have gone down in price. When the digital VOMs were introduced e/e was first-in-line to check 'em out.

We also checked out digital watches, clocks, tuners, shortwave receivers and just about anything else that could be tested in e/e's comprehensive testing laboratory. This lab has been hard at work since 1965 when the editors realized that what manufacturers advertised was not always what they delivered. A lot of products that look good on paper don't always work out that way, and when a customer goes to get the facts from a salesman he often finds he is talking to someone who doesn't know anything about the product. ELEMENTARY ELECTRONICS' test reports also perform another vital function; they report on products that go on the market with so little advertising that many readers and potential purchasers would never know they existed.

Another segment of our readership began to make its presence known in the early '70s—the Antique Radio Buff. It's hard to find an electronics enthusiast who doesn't take at least a passing interest in these old beauties. Collecting and restoring these old sets is not only fun but, in these days of inflation, it can be a sound investment. From time to time e/e did an article on radio nostalgia but it just wasn't enough. So, when James A. Fred, a noted expert on early radios, avid collector, author and electronics engineer offered to write "Antique Radio Corner" the editors jumped at the chance. Since that time interest in old radios has mushroomed. Many readers have taken to searching out flea markets and rummage sales for these old and sometimes tattered works of art.

Just two short years ago e/e began covering a new area of electronics—personal computers. There were only a few on the market then and a few hard-core enthusiasts who were building there own, but prices were tumbling ever down and down. Since then thousands of readers have set up their own home computer centers and e/e has been checking out more and more computers and computer devices in the lab. By September of '76 the staff recognized the need for a computer column. One of the editors took on this demanding task for two months then passed the job on to Norm Meyers, a noted personal computing expert. In addition to Norm's "Computing Readout" column e/e has kept on top of the subject with articles about computer theory, applications and the many computer languages.

The Future. As you can see ELEMENTARY ELECTRONICS hasn't stood still while technology moves ahead. The staff of e/e will always be looking to see where the needs of the electronic hobbyist lie and what the magazine can do to aid *you* our valued reader. ELEMENTARY ELECTRONICS is a dynamic magazine. Take, for example, hi-fi.

Fifteen years ago audio equipment was often home-built. In the late ment was often home-built. In the late sixties and early seventies the flood of mass-produced hi-fi gear made some of those home brews sound amateurish and hi-fi as an electronics hobby all but died out. Hi-fi is now becoming a users hobby and many electronics enthusiasts are setting up recording studios in their homes. The recordist of today is usually extremely knowledgeable about electronics—often they go on to careers in the recording or broadcast industries. To serve these people and the hobbyist who just wants good sound we are returning to do more coverage of audio equipment.

Readers of e/e have much more to look forward to in the years ahead—more construction projects, more product tests, more shortwave features, more Ham radio primers, feature articles about antique radio, more integrated circuit projects and more computer coverage. With 15 years of solid growth behind us we still intend to keep on getting better all the time. ■

It's Simply BASIC

by Larry Friedman

Figure out the best bank for your dollars with this month's program in computer BASIC.

AN INTERESTING PROGRAM!

```
0100 REM "SAVING" BY LARRY FRIEDMAN
0105 REM COMPOUND INTEREST, DAY OF DEPOSIT TO DAY OF WITHDRAWL
0110 DATA 31,28,31,30,31,30,31,31,30,31,30,31
0120 DATA 31,29,31,30,31,30,31,31,30,31,30,31
0130  S=0
0140 INPUT "ENTER YEAR",Y
0150 PRINT "ENTER DATE OF INITIAL DEPOSIT (AS MM,DD)";
0160 INPUT M1,D1
0170 GOSUB 620
0180 PRINT "ENTER LAST DATE OF INTEREST PERIOD (AS MM,DD)";
0190 INPUT M2,D2
0200 IF M1>2 THEN 240
0210 IF Y/4=INT(Y/4) THEN Z=1
0220 IF Z<>1 GOSUB 620
0230 IF Z=1 FOR N=1 TO 12:READ X2:NEXT N
0240 FOR V1=1 TO 12
0250 READ A
0260 IF V1>M2 THEN 330
0270 IF V1<M1 THEN 310
0280 IF V1=M1 S=S+(A-D1)+1:GOTO 310
0290 IF V1=M2 S=S+D2:GOTO 310
0300  S=S+A
0310 NEXT V1
0320 IF Z<>1 GOSUB 620
0330 PRINT "TOTAL OF ";S;" DAYS."
0340 PRINT :PRINT
0350 PRINT "SAVINGS OR COMMERCIAL BANK INTEREST  (S OR C)";
0360 INPUT A$
0370 IF A$="S" THEN IF S=366 PRINT "INTEREST IS BASED ON 365 DAY YEAR"
0380 IF A$="C" THEN 410
0390  R=360
0400 GOTO 420
0410  R=365
0420 PRINT "ENTER INTEREST RATE  (AS X.XX)  ";
0430 INPUT A
0440  A=A/100
0450 PRINT "HOW MUCH MONEY IS ON DEPOSIT";
0460 INPUT M
0470 IF Z=1 THEN IF R=365 THEN R=366
0480 IF A$="S" THEN IF S=366 THEN S=365
0490  X=LOG(1+(A/R))*S
0500  Y=EXP(X):Y=Y*M
0510  P=Y-M
0520 PRINT "INTEREST EARNED FOR THE PERIOD OF"
0530 PRINT M1;"/";D1;"  TO  ";M2;"/";D2;"  IS  $";P
0540 PRINT :PRINT "TOTAL VALUE OF INVESTMENT ON ";M2;"/";D2;
0550 PRINT "  IS $";Y
0560 PRINT :PRINT
0570 REM ** LINES 580-590 RECYCLES PROGRAM ON REQUEST
0580 INPUT "REPEAT, USING DIFFERENT INTEREST RATE",E$
0590 IF LEFT$(E$,1)="N" END
0600 GOTO 420
0610 REM ************************************************
0620 REM ** CHECK FOR LEAP YEAR ERROR
0630 IF M1<>2 THEN 670
0640 IF D1<>29 THEN 1100
0650 PRINT "RE-ENTER DATE, 2/29 IS ONLY VALID FOR LEAP YEARS."
0660 GOTO 110
0670 IF M2<>2 RETURN
0680 IF D2<>29 RETURN
0690 PRINT "RE-ENTER DATE, 2/29 IS ONLY VALID FOR LEAP YEARS."
0700 GOTO 180
0999 END

READY
#RUN
ENTER YEAR? 1977
ENTER DATE OF INITIAL DEPOSIT (AS MM,DD)? 1,1
ENTER LAST DATE OF INTEREST PERIOD (AS MM,DD)? 12,31
TOTAL OF 365  DAYS.


SAVINGS OR COMMERCIAL BANK INTEREST  (S OR C)? C
ENTER INTEREST RATE  (AS X.XX)  ? 7.75
HOW MUCH MONEY IS ON DEPOSIT? 1000
INTEREST EARNED FOR THE PERIOD OF
1 /1   TO  12 /31   IS  $80.57

TOTAL VALUE OF INVESTMENT ON 12 /31  IS $1080.57



REPEAT, USING DIFFERENT INTEREST RATE? NO
-
READY
#
```

☐ The way some banks tell it, their compound interest will eventually make you a millionaire. No way, unless you live to be 900 years! But sharp investing at the highest interest can mean a few *extra* dollars in your pocket each year, particularly if you let your interest remain to collect additional interest —compounding.

This month's program, SAVING, will help you sort out the conflicting interest claims of banks so you can realize the highest return on your investment. The program is short, so you can load it quickly any time you want to check out some new bank scheme to attract your hard-earned dollars. Since most people are interested in yearly interest, SAVING is limited to calculations up to 365/366 days. This keeps the program some 15 to 20 lines shorter and maintains an accuracy of 1¢ in the final calculation. If you want to modify the program for multiple year interest by all means go ahead and do so.

Take note that savings and thrift institutions (which I call savings banks) often calculate interest on a 360 day year credited on a 365 day basis. They forget about leap year because it's a third place decimal variation that pays the same as 365 days. If the bank rounds off the third place, which is usually the case, the interest is the same. In short, you generally get a few cents more interest than you would compute using the standard equation of $FV=PV\ (1+R)^n$.

Commercial banks, on the other hand, give you nothing extra, so SAVING handles their interest payments on a strict 365 or 366 day basis.

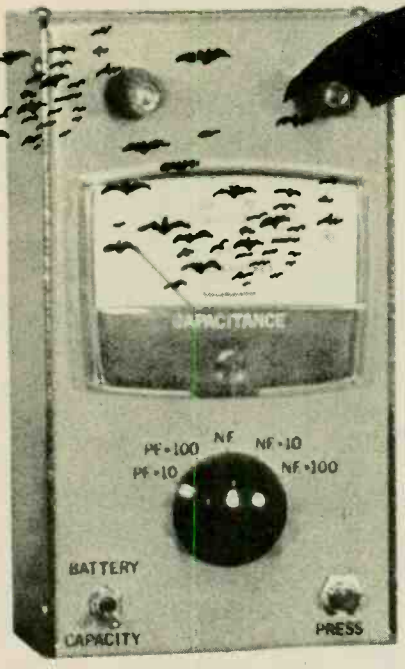
SAVING assumes compound interest, day of deposit to day of withdrawal. If your bank pays less it's time to start looking for a new bank because you're getting the short end.

If your savings bank uses other than a 360 day basis for paying interest simply change line 390 to their basis.

Dual data lines—110 and 120—is not the usual way to handle the problem

(Continued on page 82)

COUNT CAPACITA



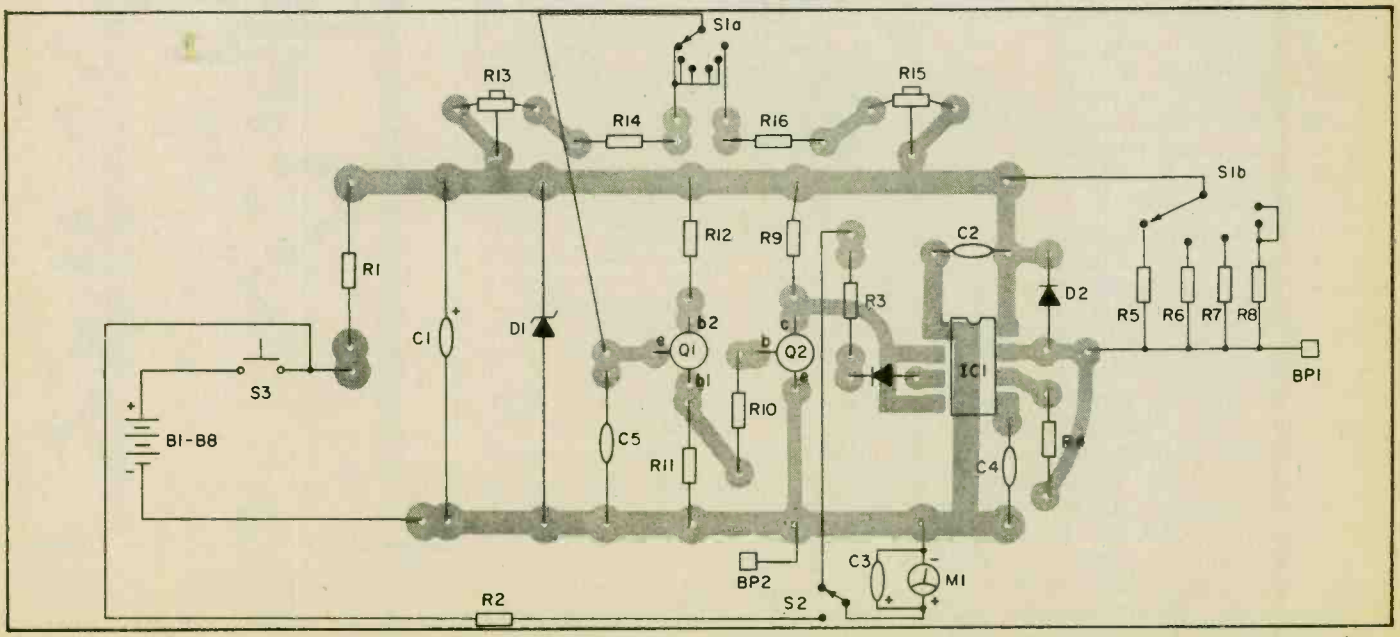
Bring Your Junk Box Capacitors Back From The Dead!

by Walter Sikonowiz

MAYBE YOUR JUNK BOX looks like a haunted mansion? Full of mystery and intrigue? Do you sometimes wonder just what values all those surplus or unlabeled capacitors really are? All the VOMs, frequency meters, power meters, FETVOMs and tachometers in the world aren't going to help you here. What you need is a visit from the Count—*Count Capacita*—our own toothsome capacitance meter.

You can use this capacitance meter to separate good capacitors from bad ones in your junk box. In addition, if you ever have to repair a television or radio, Count Capacita will quickly put the bite on a defective capacitor, thus saving you the expense of a repair bill in the process. Last, but certainly not least, the Count will enable you to purchase surplus capacitors, and this is where you can really save money.

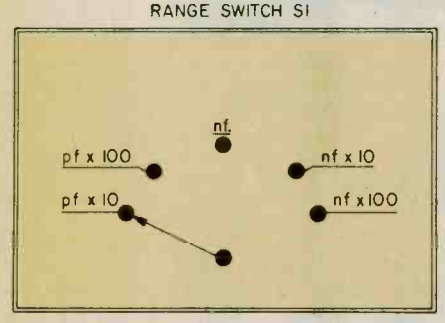
Surplus capacitors are sold at discount rates, usually by mail-order dealers and for several reasons. First, suppose an audio manufacturer decides to completely phase-out his old capacitively coupled amps in favor of direct-coupled designs. His inventory of new and perfectly good capacitors is now useless to him, so he disposes of the lot on the surplus market. Second, sometimes a capacitor manufacturer wants to get rid of old, mislabelled or out-of-tolerance units; he can do this on the surplus market. You can take advantage of the savings—often more than 75%—if you know the Count. With our meter, you can spot the mis-



Take your mind off those eerie noises from off the moors by building our sanguine Count. Here's where the components lie. The Count will bring back to life all of those once-useless, unmarked capacitors once doomed to a junkbox graveyard!

e/e COUNT CAPACITA

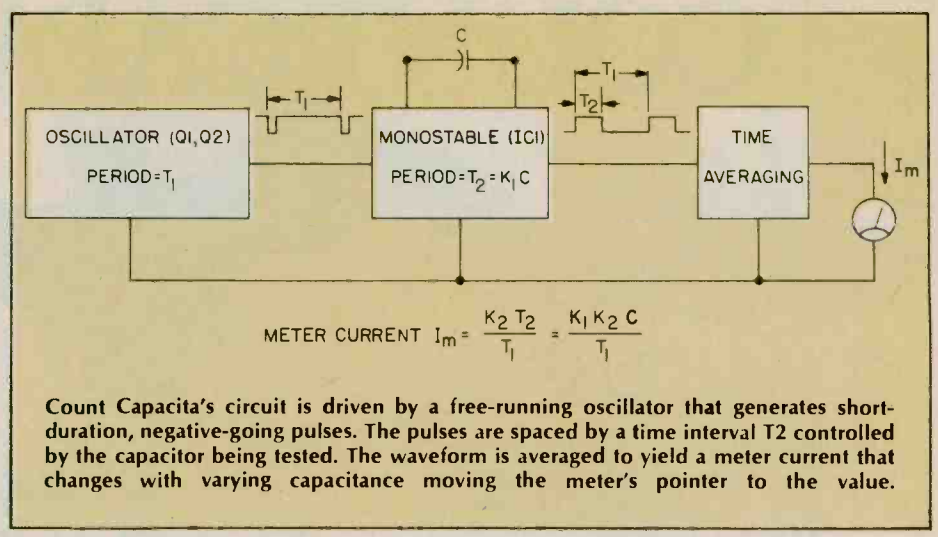
labelled or out-of-tolerance units, identify unmarked devices, and eliminate the occasional defective unit. If you do much experimenting, your savings may soon pay for your capacitance meter.



The Count will measure capacitances from about 100 picofarads to 5000 nanofarads (5 microfarads). See the text for further info on converting readings to varying measures.

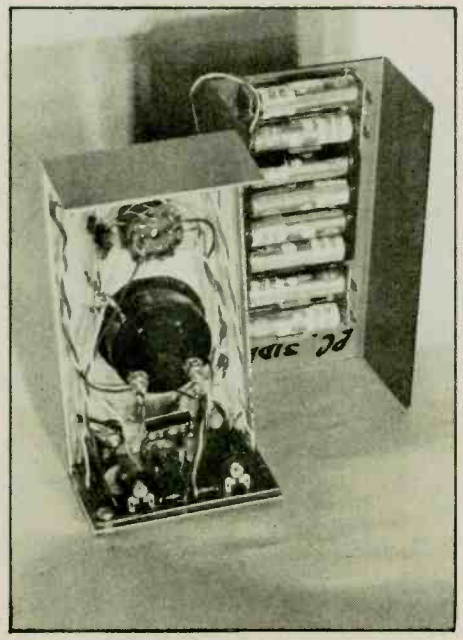
Transylvanian Circuitry. Let's begin discussion of this particular circuit with the block diagram. The circuit is driven by a free-running oscillator that generates short-duration, negative-going pulses. These pulses are spaced by a time interval T_2. Now, T_2 is controlled by the capacitor under test. Specifically, T_2 is equal to k_1C, where k_1 is just a constant of proportionality. At the monostable's output, there is a rectangular waveform that is high for a time T_2, and low for a time equal to $(1_1\text{-}T_2)$. This waveform is then time-averaged to yield a meter current equal to $(k_2T_2)/T_1$, where k_2 is another constant of proportionality. Since T_2 is equal to k_1C, it follows that meter current Im must also equal $(k_1k_2C)/T_1$. Therefore, there is a direct relationship between meter deflection and capacitance; by choosing the right values for k_1, k_2 and T_1, you get a capacitance readout.

The Count's various constants have been chosen to allow a useful measurement range that spans from less than 100 picofarads to 5000 nanofarads (5 microfarads). In case you are unfamiliar with the above nomenclature, one microfarad is one-millionth of a farad, the standard unit of capacitance. It takes a thousand picofarads to equal one nanofarad, and a thousand nanofarads to equal one microfarad. The scales on this meter measure capacitance in terms of picofarads and nanofarads; with the above information, you should be able to easily convert between units when necessary.



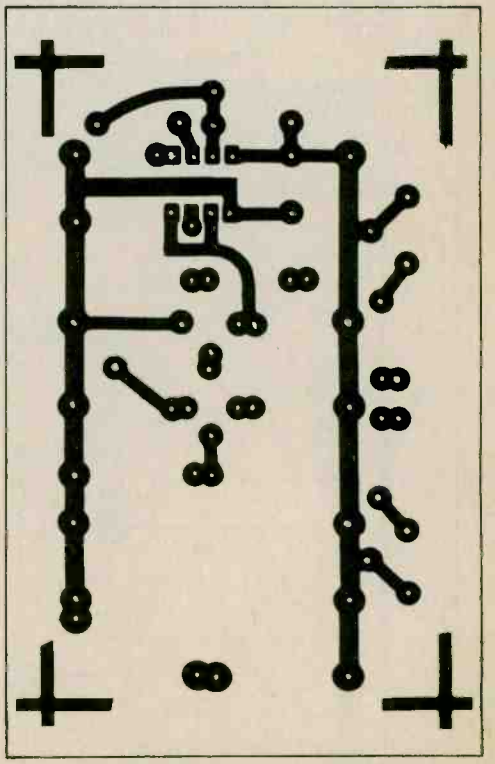
Count Capacita's circuit is driven by a free-running oscillator that generates short-duration, negative-going pulses. The pulses are spaced by a time interval T2 controlled by the capacitor being tested. The waveform is averaged to yield a meter current that changes with varying capacitance moving the meter's pointer to the value.

Let's now consider the schematic diagram. Assume that switch S2 is in its *battery* position and that S3 is pressed down. Battery current will flow into meter M1 through resistor R2, and M1's deflection will indicate whether or not the batteries are good. Fresh batteries will provide a meter indication of about "45"; batteries should be changed when the indication drops below "33", or thereabouts. Now, flip S2 mentally back to its *capacitance* position, and let's proceed with the rest of the circuit.

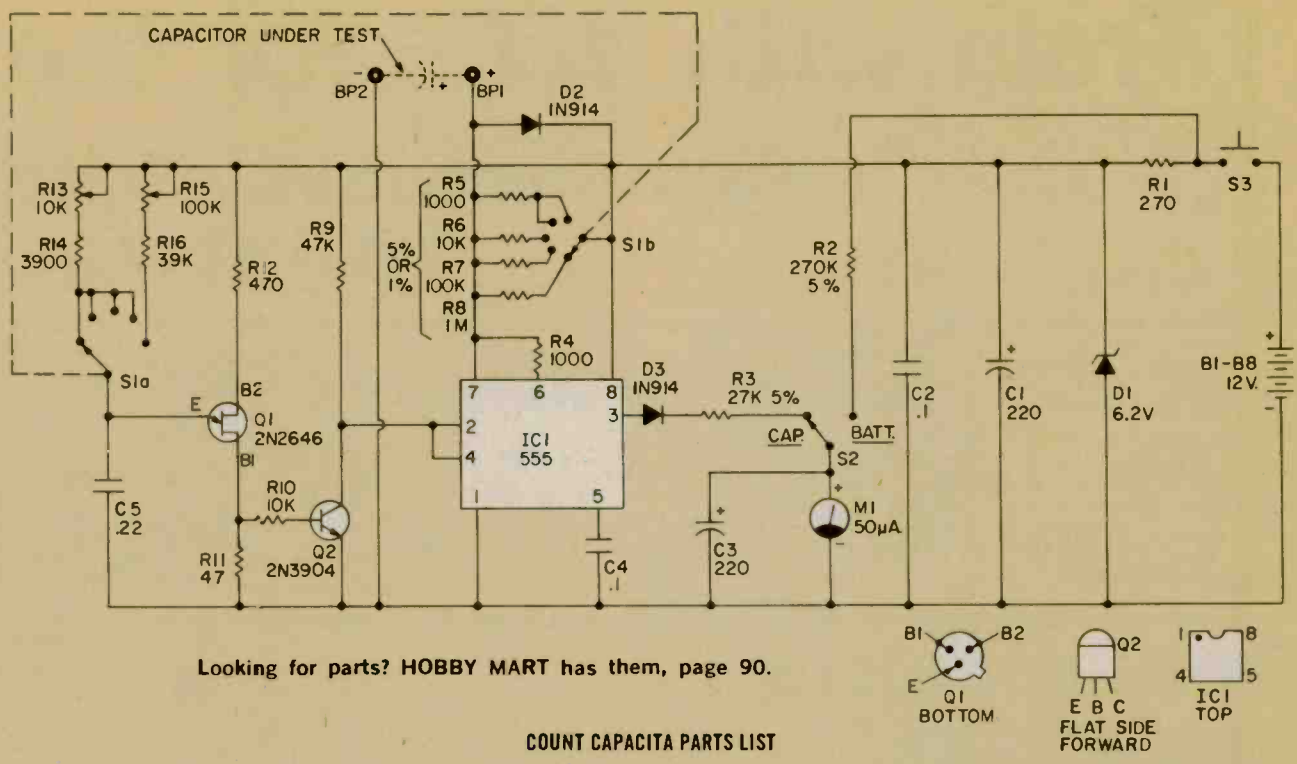


Construction of the Count is far from gruesome. Just be certain to minimize stray capacitance effects between the binding posts by keeping their leads both short and direct.

Battery current flows through resistor R1 to yield a regulated 6.2-volt supply potential across zener diode D1. Capacitors C1 and C2 bypass the supply and stabilize the circuit. The free-running oscillator is composed of unijunction transistor Q1 plus associated components. Timing capacitor C5 is charged through R13 and R14, or R15 and R16, depending on the setting of *range* switch S1. When the voltage on C5 reaches a specific level, Q1's emitter breaks down to a low impedance, thus discharging C5 through resistor R11. When the capacitor has been discharged to a sufficiently low level, Q1 ceases to conduct, and C5 once again begins to charge. This charging and discharging of C5 proceeds alternately, causing a voltage spike to appear across R11 each itme C5 discharges. Transistor Q2 inverts and amplifies the pulse, which is applied to the inputs (pins 2



Here's your PC board template to bring the Count home to roost. Use either photo-etch materials or just use a resist marking pen.



Looking for parts? HOBBY MART has them, page 90.

COUNT CAPACITA PARTS LIST

B1-B8—1.5 VDC AA-cells, connected in series
BP1, BP2—binding posts
C1, C3—220-uF, 16-volt electro ytic capacitor
C2, C4—.1-uF ceramic capacitor
C5—.22-uF, 10% tolerance, mylar capacitor
D1—1N753A Zener diode, ½-watt at 6.2-volt
D2, D3—1N914 diode
IC1—555 timer
M1—0-50 microamp meter (Radio Shack 22-051 or equiv.—see text)
Q1—2N2646 unijunction transistor
Q2—2N3904 NPN transitor

ALL RESISTORS ARE 10% TOLERANCE, ½-WATT UNLESS NOTED.

R1—270-ohm resistor
R2—270,000-ohm resistor, 5% tolerance
R3—27,000-ohm resistor, 5% tolerance
R4—1000-ohm resistor
R5—1000-ohm resistor, 5% tolerance or 1% if desired
R6—10,000-ohm resistor, 5% tolerance or 1% if desired
R7—100,000-ohm resistor, 5% tolerance or 1% if desired
R8—1-Megohm resistor, 5% tolerance or 1% if desired
R9—47,000-ohm resistor
R10—10,000-ohm resistor
R11—47-ohm resistor
R12—470-ohm resistor
R13—10,000-ohm trimmer potentiometer
R14—3900-ohm resistor
R15—100,000-ohm trimmer potentiometer
R16—39,000-ohm resistor
S1—rotary switch, 5-position, double-pole
S2—SPDT toggle switch
S3—SPST pushbutton switch

Misc.—battery holders; knobs; cabinet (LMB #C-R 632, from Circuit Specialists, Box 3047, Scottsdale, Arizona 85257); wire; press-on lettering; etc.

and 4) of monostable IC1.

The monostable's period is determined by the capacitor under test in conjunction with a resistor—either R5, R6, R7 or R8—selected by *range* switch S1. In operation, the capacitor being tested first gets connected across a pair of binding posts, and then S3 is pressed to take a reading. You will note that these binding posts are polarized, with BP1 being positive and BP2 (which connects to ground) being negative. This is an important consideration with polarized capacitors such as aluminum and tantalum electrolytics; the capacitor's positive terminal must connect to BP1. Reverse connection is harmful to such capacitors, so be careful. The standard non-polarized capacitors—mica, paper, mylar, polystyrene, ceramic and glass—may be connected across the binding posts in either direction.

Diode D2 functions to provide a quick discharge of the capacitor under test when S3 is released. Monostable IC1's output, pin 3, drives meter M1 through R3. Averaging of the pulses is accomplished by capacitor C3 across M1 Finally, diode D3 ensures that no current is emitted from IC1's output when it drops low (to about a tenth of a volt).

Since this is not a temperamental circuit, though the Count *is* a bit batty) you should have few problems with its construction. One point that you should bear in mind, however, is that the binding posts must connect to the rest of the circuitry via short and direct wires spaced at least an inch apart. This minimizes stray capacitance between the binding posts and maintains good accuracy on the lowest range (pf. X 10).

As specified in the parts list, resistors R2 and R3 must have 5% tolerances. Likewise, the tolerances of R5, R6, R7 and R8 must be at least 5 percent. If you desire, 1% precision resistors could be used for R5 through R8. This will improve accuracy somewhat on the four lowest ranges, but it will also be more expensive. You won't be needing hair-splitting precision, so 5%-tolerance resistors should be quite adequate here.

Although it might seem more difficult at first, printed-circuit construction is far and away the most convenient method of assembly. For your convenience, a PC foil pattern is provided elsewhere in this article, and it may be used in conjunction with a printed-circuit kit from any of the electronics retailers. An equally effective construction method involves the use of perfboard. Either technique is capable of turning out a small, neat circuit board.

(Continued on page 88)

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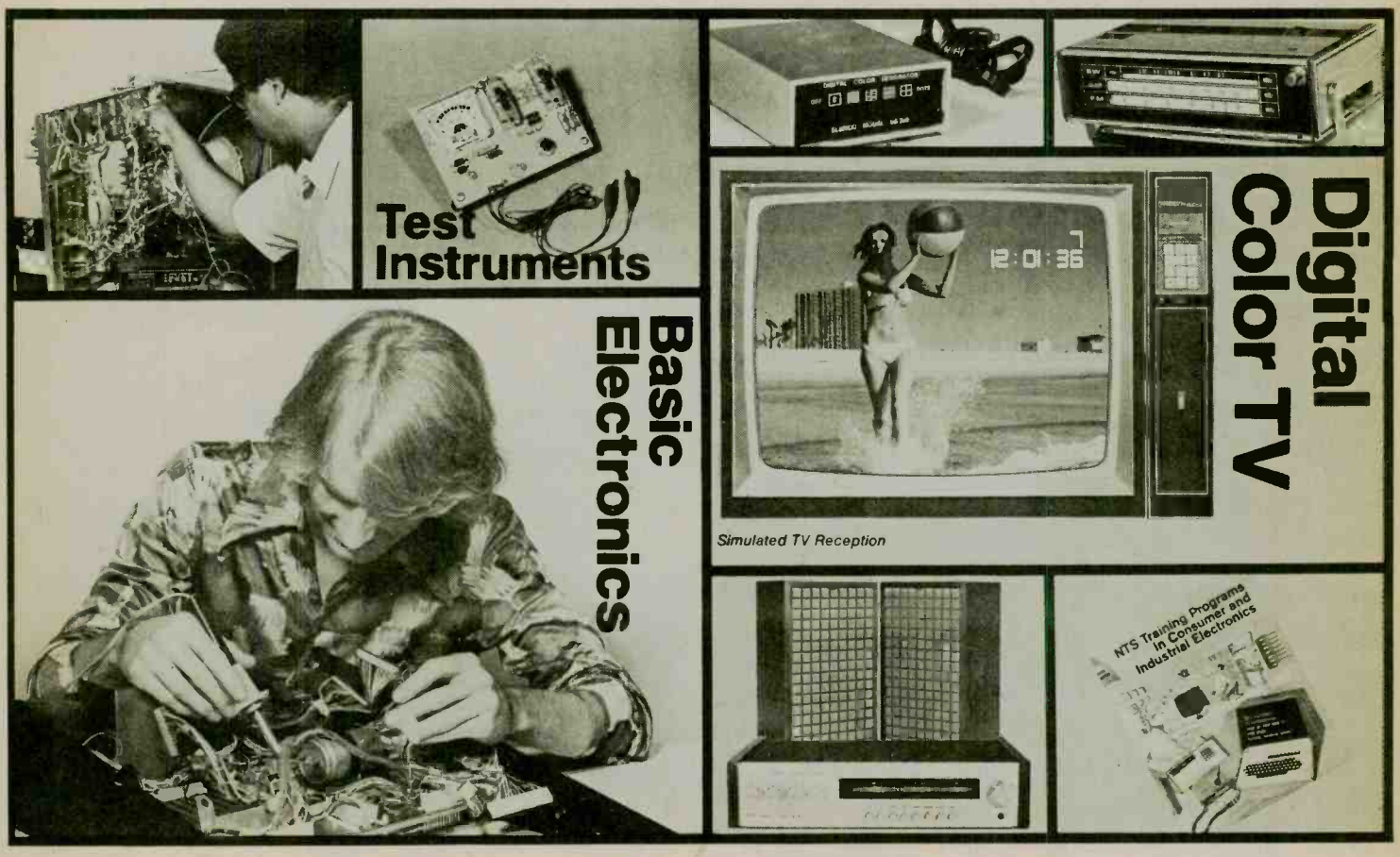

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FIVE WAYS TO QSL HAPPINESS!

Use these timely tips to collect exotic cards from all over the world

by
Roger A. Peterson

QSL CARDS, SENT BY MAIL from shortwave broadcasters, are the DXer's proof of having actually tuned in to stations from the far corners of the world. Many DXers seek them avidly and, when they receive them, pin them up on the wall of their "Listening Shack" or carefully place them in an album for safekeeping.

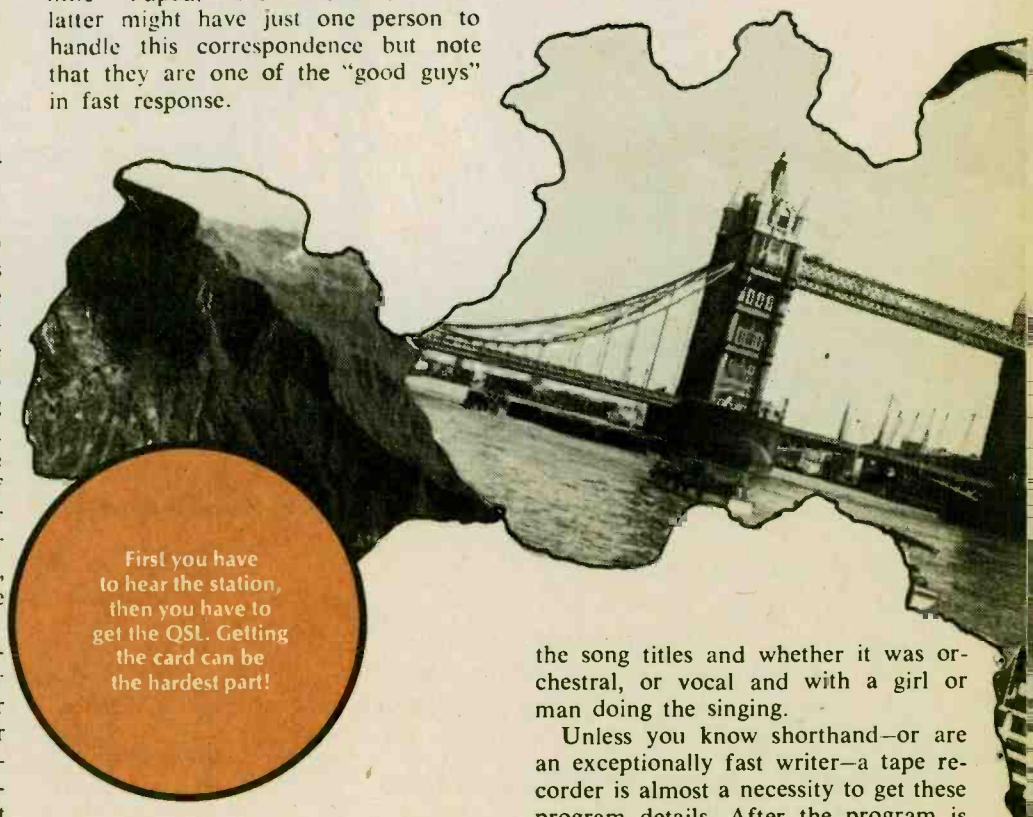
Many beginning DXers, however, find that getting these cards is a slow and painful process. In fact, sometimes they never receive an answer. How then can the DXer increase his chances of getting these verifications in response to his reception reports?

1. Be Selective In Stations You QSL

Not all shortwave broadcasters send out QSL cards or even bother to answer reception reports. Some will do so in time—a matter of several months—while others will reply quickly. We have supplied lists of 16 "Fast Responders"—all who responded to the author's reports during 1977; stations who responded in average time during the same period; and 14 who took a long time to reply. Obviously, there are other broadcasters who fit one of these categories but who the author did not tune to. But, assuming your receiver will tune to these stations, here are some 42 QSL cards you are pretty sure to get.

I should stress the "pretty sure" because many things can go wrong, either with your reporting or the broadcaster could change his policy. The author sent a report in to Ethiopia, for example, just prior to their recent revolution. The religious station I had sent the report to was seized by the new government and its current anti-American policy makes it very unlikely that I'll ever receive an answer.

Several reasons exist for the differences in reply time by these stations. First of all, you are dealing with the mails. While we are often critical of the U.S. Postal Service, it is far ahead of some foreign nations. There is also the matter of the number of reports a station receives and the size of the staff they have to respond. Radio Finland, a fast responder, stated recently that they average 200 reception reports a week. The BBC, an average responder, with far more air time, and probably heard by much more of the World, must get many times that number. Australia, another "powerhouse" of international broadcasting, must get many more reports to handle than little Papua, New Guinea. The latter might have just one person to handle this correspondence but note that they are one of the "good guys" in fast response.

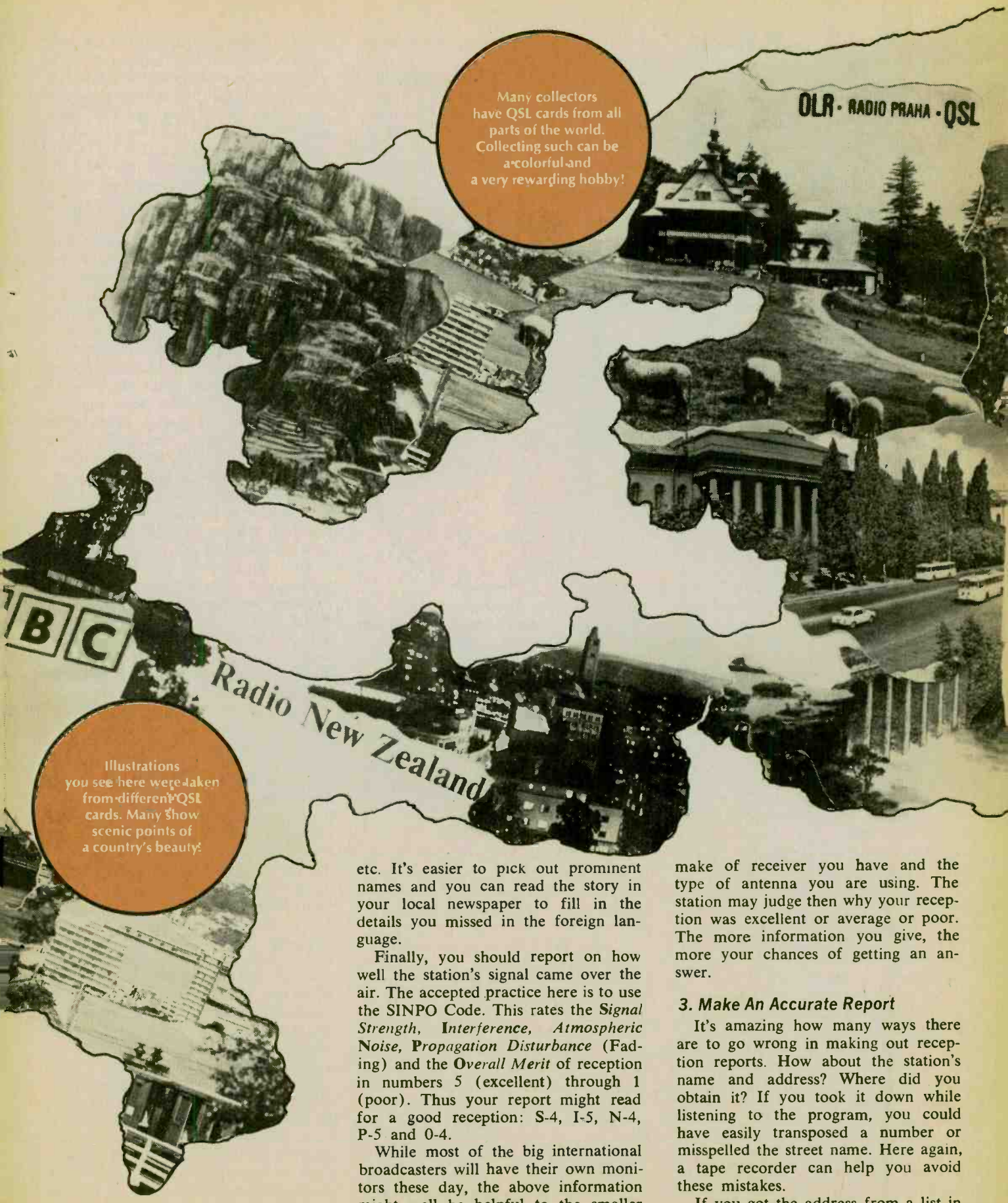


There are two ways to keep current on shortwave broadcasters' QSL policies. One is to have a copy of the latest WORLD RADIO TV HANDBOOK. It will give you the current policy of most stations. The other way to stay abreast of the situation is to join a shortwave club that publishes a monthly bulletin to inform you on the QSL experiences of other members.

2. Make A Complete Report

Your report should have three basic elements to be acceptable to most stations. Give the frequency, the time and the date you heard the program. Then prove that you heard the program by giving some details. If it was a news broadcast, write down some of the items they reported. It isn't enough just to say "news program." If it was a musical program, write down some of the song titles and whether it was orchestral, or vocal and with a girl or man doing the singing.

Unless you know shorthand—or are an exceptionally fast writer—a tape recorder is almost a necessity to get these program details. After the program is over, you can play back the recorder at your leisure and pick up what was said to give you an accurate program report. If the station is broadcasting in a foreign language, the recorder will also be of help in making a translation. Incidentally, the best time to get a foreign language report is when some important world event takes place—the election of a new president of a major nation, an assassination, earthquake,



etc. It's easier to pick out prominent names and you can read the story in your local newspaper to fill in the details you missed in the foreign language.

Finally, you should report on how well the station's signal came over the air. The accepted practice here is to use the SINPO Code. This rates the **S***ignal Strength*, **I***nterference*, *Atmospheric* **N***oise*, **P***ropagation Disturbance* (Fading) and the **O***verall Merit* of reception in numbers 5 (excellent) through 1 (poor). Thus your report might read for a good reception: S-4, I-5, N-4, P-5 and 0-4.

While most of the big international broadcasters will have their own monitors these day, the above information might well be helpful to the smaller station and will often be appreciated. Another thing you should add is the make of receiver you have and the type of antenna you are using. The station may judge then why your reception was excellent or average or poor. The more information you give, the more your chances of getting an answer.

3. Make An Accurate Report

It's amazing how many ways there are to go wrong in making out reception reports. How about the station's name and address? Where did you obtain it? If you took it down while listening to the program, you could have easily transposed a number or misspelled the street name. Here again, a tape recorder can help you avoid these mistakes.

If you got the address from a list in a book or magazine, how up-to-date was the issue? I used an address from

e/e FIVE WAYS TO QSLs

If you follow our five rules on asking for QSLs you can't go wrong. Soon enough, you'll have the "wallpaper"!

a book published two years ago and discovered it had changed when I got my latest copy of the WORLD RADIO TV HANDBOOK. I never received an answer—my report is probably gathering dust in some dead letter box! It pays to have a copy of the Handbook. It not only contains the current station addresses but often gives you the name of the person to address your report to. If you don't have a name, write something like, "Att: QSL" in the lower left hand corner of the envelope. In the case of the larger stations with huge staffs, this will save you a day or two in getting delivery to the right department.

Another common error is reporting an incorrect date for when you heard a program. If you are listening to a broadcast from the BBC in England on October 10 at 9:30 P.M., Eastern Standard Time, the broadcast is being sent out at 0230 Greenwich Mean Time. This means it is now October 11 as far as the broadcaster is concerned. You should report both your local time and the broadcast time in the twenty-four hour clock system. GMT is the shortwave broadcasters' system.

When writing down frequencies, it is easy to make an error. A simple mistake in copying down the frequency numbers of one station almost cost me a QSL card a few months ago. Fortunately, the broadcaster (Trans World Radio in Monoco), notified me by post card that my reception report was in error and thus unacceptable because of the wrong frequency. I immediately sent in another report and ultimately received the QSL Card. I doubt if many stations would take the trouble to do this and there are probably a good many DXers waiting right now for cards that will never come because of similar error.

A number of DXers, including the author, use printed forms for reception reports. These have several advantages over a letter. First of all, everything is in place on these printed forms so that you can't forget to fill in all necessary data. Information such as the SINPO Code is simply checked off on the form for the rating you give the station's signal. Finally, the forms are printed in several languages so that a clerk at Radio Madrid, for example, simply reads the report in Spanish, with the exception of the part where you write about the program content. These forms can be purchased from Gilfer Associates, P.O. Box 239, Park Ridge, N.J. 07656.

4. Postage

If you DX all of the stations listed, it will cost you $13.44 in postage using 32¢ Overseas Air Mail stamps. A little over $9 additional is added for the stations that require return postage; note that only about one-quarter of the stations require this.

It is possible to trim this figure down a bit by using post cards instead of envelopes or by using surface mail instead of air mail. I do not advise surface mail as this would add months to your waiting time. Post cards would require your reception reports to be extremely brief—too much so for some stations. You need envelopes for the stations you send return postage to anyway.

Return postage is generally sent in the form of International Reply Coupons that can be purchased for 42¢ apiece at your local Post Office. Check the stations that I sent return postage to and how many IRC's for each particular station. My information on when to send postage and when not to came from either the WORLD RADIO TV HANDBOOK or from my DX club monthly bulletin.

5. Add An Extra Touch

The primary reason stations bother to go to the trouble and expense of sending out QSL Cards is to build a reputation for being good responders so that more listeners will tune in for their programs. Hopefully, after a DXer has heard the station's program for his reception report, he will tune in again and listen to more of their broadcasts. Another reason to maintain this reputation is to build a good statistical record of reaching U.S. (or other nation's) listeners. Such statistics probably help the station manager to prove the success of his broadcasts and to justify his budget requests. Thus, anything you can add to your report that indicates your interest in the station's future broadcasts or in the country itself, may make a difference in the care and handling of your report.

The way I handle this aspect of reporting is to always request a broadcast program or schedule. This indicates that I plan to tune in again and that I am not simply a QSL card chaser. In some cases, I also requested literature about the station's country as well. If you have room, a statement such as, "I was very much interested in this program and intend to listen to it regularly" will also help.

Many people in Shortwave Radio believe that the days of QSL cards may be numbered. Their reasoning is that if SWL becomes more popular, the stations simply won't be able to afford the cost of a staff large enough to handle all the requests. Don Jensen reported in these pages a few issues back, that DXing has become so popular in Japan that Radio Australia has been swamped with QSL card requests. Radio Canada International recently changed its policy by only sending out blank QSL cards twice a year when listeners requested their program schedule. The DXer must fill out his own card and mail it back to the station for a stamped approval.

Many DXers feel that only a so-called "full-data QSL card" is valuable. By this they mean that all the verification data—time, frequency and date must be on the card. Some of the stations do this automatically, some when requested, but the trend is away from it because of the clerical cost. Major broadcasters, such as the BBC won't do

(Continued on page 84)

DISCO KING

Drum up a storm with this percussive project!

by James Barbarello

DISCO MUSIC ENJOYS a phenomenal popularity, as evidenced by many of today's most popular records and movies. This popularity is due, in part, to the uniquely identifiable Disco percussion pattern which is basically identical in all songs. *Disco King* is a low cost rhythm unit which produces the standard Disco pattern plus three variations (selected by moving the "Pattern Select" jumper wire). The King also doubles as a base drum synthesizer which is triggered by means of a standard footswitch.

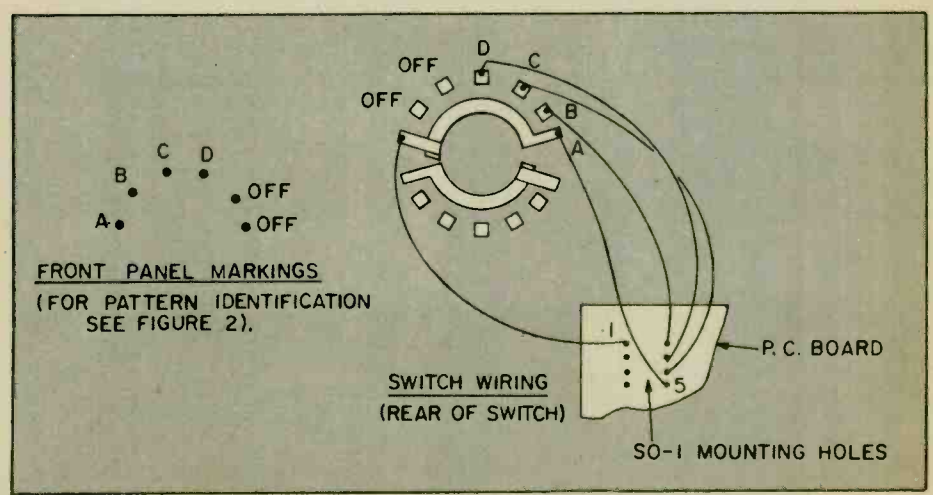
Disco King is simple to construct, uses readily available CMOS and analog active devices and is powered by two 9 volt batteries. Construction cost for the basic unit should be less than $20.00 (see parts list for kit availability).

How It Drums. As indicated in the schematic diagram, CMOS NAND gates IC1A and IC1B form a gated oscillator which serves as the clock for the unit. The clock output frequency (set with *Tempo* control R2) is divided by two in D Flip Flop IC2B and again by two in D Flip Flop IC2A. Either the clock output, the Q output of IC2A or B or the Q output of IC2A can be used as the cymbal trigger signal.

Transistor Q1 generates a continuous white noise signal which is A.C.-coupled through C9, amplified in IC3A and provided to IC4, a transconductance Operational Amplifier. The trigger signal selected is A.C. coupled through (and differentiated by) C7 and used to Amplitude Modulate the white noise signal in IC4. In this way, a repeating pattern of cymbal sounds is generated. Initially, R20 is adjusted to set the decay portion of the differentiated trigger pulses to create the characteristic amplitude envelope of a high hat cymbal. A portion of the IC4 output signal is tapped off *Cymbal Level* control R16 and provided to IC3B, where it is further amplified and summed with the synthesized base drum.

The Q output of IC2A is differentiated by C4 and R5 to produce a narrow trigger pulse. D1 eliminates the negative portion of the differentiated pulse. The Q output signal is also inverted in IC1C which drives LED 1 to indicate the start of the pattern (in musical terms, the start of the *bar*). In lieu of the Q output, a switch may be connected to J1. When depressed, the switch will manually generate a trigger pulse. In this manual mode, C3 and R4 eliminate switch bounce which would cause undesirable multiple triggering. In either the manual or automatic mode, the resultant pulse triggers the base drum generator.

C5, C6, C8, R11, R13 and R14 form



Here's an easy modification to our Disco King! Our own unit uses jumper wires in the SO-1 socket to change the beat but if you'd like a rotary switch could be installed.

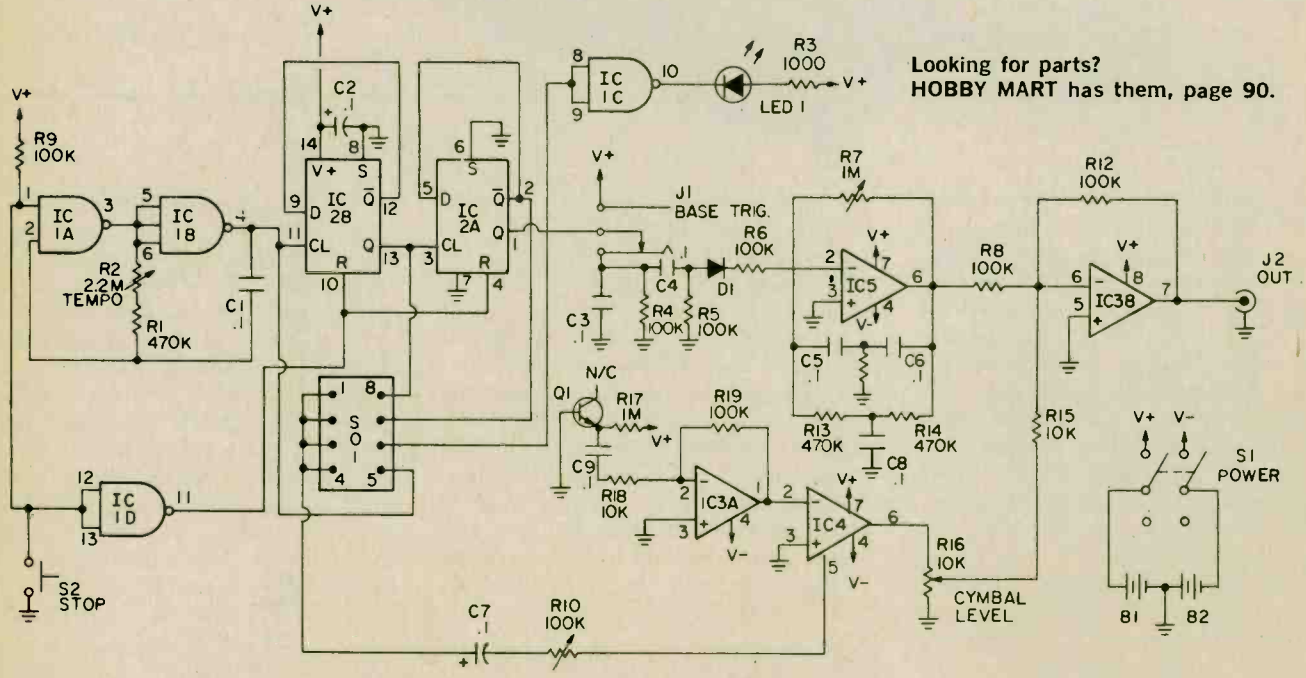
DISCO KING

a Twin-T notch filter tuned to the base drum frequency and make up one of two feedback loops for Op Amp IC5. If this were the only feedback loop, IC5 would simply oscillate at the notch frequency. Feedback loop R7, however, provides sufficient negative feedback to suppress continuous oscillation. The positive going trigger pulse momentarily overcomes the feedback through R7 and generates a damped sine wave output. The setting of R7 determines the amount of feedback and, accordingly, how long the oscillation lasts before it decays to zero. The synthesized base drum output of IC5 is summed with the cymbal signal in IC3B.

With S2 open, operation is as described above. Closing S2 (*stop*) grounds the input to pin 1 of IC1A, stopping the clock and resetting both Flip Flops with the high output of inverter IC1D. When S2 is released, the clock restarts and the sequence restarts at the beginning of the bar with the base drum sound. Power (±9 volts) is supplied by two 9 volt batteries.

Construction. Although not absolutely necessary, a PC Board is recommended as the means of construction. A PC pattern and components placement guide are provided. Observe standard precautions when handling and soldering CMOS ICs 1 and 2. Sockets may be used if desired. The CA3080 IC in the TO-5 can is available in two different lead configurations. The "S" configuration has the leads preformed in an 8 pin DIP (Dual Inline Package) pattern, where the "plain" configuration does not. If necessary, form the leads in an 8 pin DIP pattern prior to insertion. After all components are installed, perform final wiring.

Any suitable case may be used to house the project (although a case is not actually necessary). The case may be marked as shown in the photo using transfer lettering or other similar marking methods. A suitable holder for the two 9 volt batteries can be formed from a 1" by 3" strip of aluminum. Drill a 3/16" hole in the center of the strip and form it into a stubby "U" shape, the two shorter sides being 3/8" each. Drill a 3/16" hole in the bottom of the case and pass a #6-32 x 1" machine screw through the hole, between the two batteries and on through the



Looking for parts? HOBBY MART has them, page 90.

PARTS LIST FOR DISCO KING

B1, B2—9-volt battery
C1, C3, C4, C5, C6, C8, C9—.1-uF capacitor, disk ceramic, 25VDC
C2, C7—1.0-uF electrolytic capacitor (radial leads), 10VDC
D1—1N4148 or 1N914 diode
IC1—4011 Quad 2-input CMOS NAND Gate
IC2—4013 Dual CMOS D Flip Flop
IC3—Dual 8-pin Op Amp (5558, LM1458 or similar)
IC4—Transconductance Op Amp (CA3080 or CA3080S or similar)
IC5—741 Op Amp (8-pin DIP)
J1—Phono jack, closed circuit, ¼-inch
J2—Phono jack, open circuit, ¼-inch
LED 1—Light Emitting Diode, type NSL5053, TIL32 or similar
R1, R13, R14—470,000-ohm resistor, ¼-watt
R2—2.2 Megohm linear taper potentiometer, ½-watt
R3—470-ohm resistor, ¼-watt
R4, R5, R6, R8, R9, R12, R19—100,000-ohm resistor, ¼-watt
R7—1 Megohm trim potentiometer, ¼-watt
R10—100,000-ohm trim potentiometer, ¼-watt
R11—4700-ohm resistor, ¼-watt
R15, R18—10,000-ohm resistor, ¼-watt
R16—10,000-ohm linear taper potentiometer, ½-watt
R17—1 Megohm resistor, ¼-watt
SO-1—8-pin DIP socket
S1—DPST slide switch
S2—Momentary pushbutton switch, N/O (normally open)

Misc.—Suitable enclosure, aluminum strip, knobs, wire, solder, hardware, etc.

Note: The following are available from BNB Kits, RD #1, Box 241H, Tennent Road, Englishtown, N.J. 07726; Parts Kit (DK-1) consisting of all electronic parts, controls, switches, jacks, wire and etched and drilled P.C. Board at $18.95. Etched and drilled P.C. Board alone (DK-1PC) at $5.95. Prices include handling and U.S. Postage. Canadian residents please add $1. U.S. Funds only. Please allow 3 to 6 weeks for delivery.

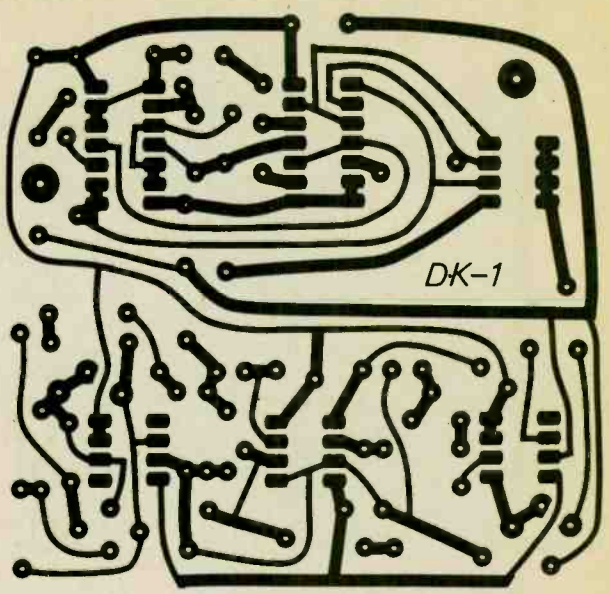
Note: Blank case as shown in photo available from Continental Specialties Corporation, 44 Kendall Street, P.O. Box 1942, New Haven, CT 06509 (DMC-2). Write for current price.

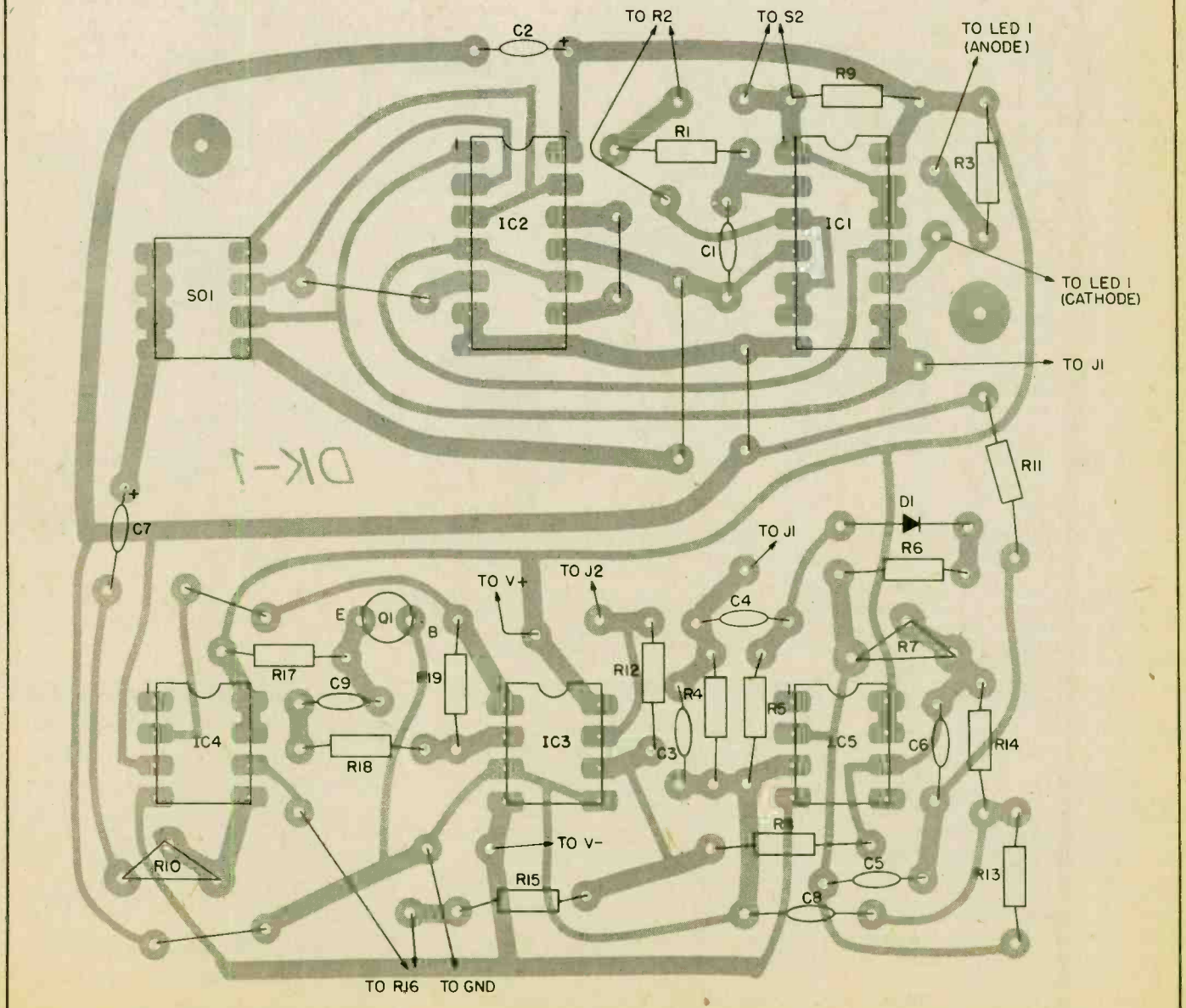
hole in the holder. Secure the holder with a #6-32 nut.

Initial Adjustment and Checkout. Set Trim Potentiometers R7 and R10 and controls R2(*Tempo*) and R16 (*Cymbal Level*) to mid position. Connect the output of the unit to a music amplifier or hi-fi. When power is applied, you will hear a repeating base drum sound. Adjust R7 for a non-boomy, short duration "thud" sound. Form a jumper from a short length of #20 or #22 solid wire and insert it into pins 4 and 5 of socket SO-1. Set R2 for medium speed and adjust R10 for a short duration cymbal sound. This completes the adjustments required. To insure the unit is performing properly, check the following. Note that R16 can adjust the cymbal volume from full off to maximum. Note that

(Continued on page 86)

The beat goes on... and on... and on when you build our Disco King. It's simple to put it all together as it uses readily available CMOS and analog active devices. The PC template is shown to the upper right and the component-side overlay below. With these you'll be atop the disco scene!





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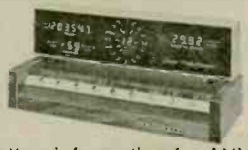

If you need weather information for ANY purpose, the ID-4001 is the way to get it! This microcomputer-based weather instrument displays — time of day in 12 or 24-hour format; wind direction and magnitude; indoor and outdoor temperature; barometric pressure; even wind chill factor! What's more, the computer's memory stores the highest and lowest data for each function so you can recall it for easy and accurate record keeping. Chart recorder and computer outputs provide even more versatility!

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INDIANA — **Indianapolis, 46220,** 2112 E. 62nd St. 317-257-4321.

KANSAS — **Kansas City (Mission, 66202),** 5960 Lamar Ave. 913-362-4486.

KENTUCKY — **Louisville, 40243,** 12401 Shelbyville Rd. 502-245-7811.

LOUISIANA — **New Orleans (Kenner, 70062),** 1900 Veterans Memorial Hwy. 504-722-6321.

MARYLAND — **Baltimore, 21234,** 13, E. Joppa Rd. 301-661-4446; **Rockville, 20852,** 5542 Nicholson Lane. 301-881-5420.

MASSACHUSETTS — **Boston (Peabody, 01960),** 242 Andover St. 617-531-9330; **Boston (Wellesley, 02181),** 165 Worcester Ave. (Rt. 9 just west of Rt. 128) 617-237-1510.

MICHIGAN — **Detroit, 48219,** 18645 W. Eight Mile Rd. 313-535-6480; **E. Detroit, 48021,** 18149 E. Eight Mile Rd. 313-772-0416.

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CIRCLE 1 ON READER SERVICE COUPON

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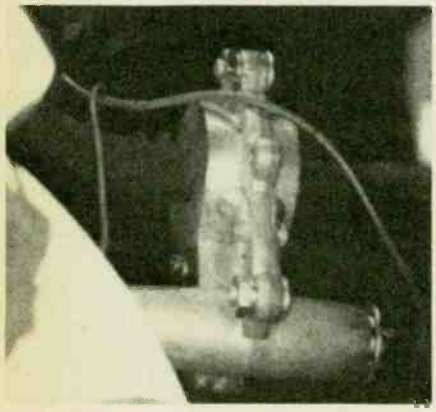
AUTOCOMP AUTOMOBILE COMPUTER

Keep track of gas consumption the space-age way

CIRCLE 95 ON READER SERVICE COUPON

☐ The AutoComp is an interesting, if not outright intriguing, automobile computer. By keeping you continually updated on your gas consumption, both average and instantaneous, it can help you save on fuel (and cash), and in general improve your driving techniques. It's also distracting at first, but after living with AutoComp for a while you'll get used to it—you may even wonder how you ever drove without a helpful device such as this. AutoComp is another example of how microprocessors have begun to make inroads in the automotive world. We can expect to see more of these devices as standard equipment in the cars of the near future.



AutoComp gasoline flow meter in place in fuel line. Device must be kept as far as possible from engine heat. Shielding with neoprene helps sometimes.

What You Get. The AutoComp kit consists of three major components: the read-out module, the analog sensors, and the various cables, clips, and clamps necessary to install the unit in a given car. As it comes from the factory, it is really designed to be installed largely in American cars. While it will work in many imports, the instructions clearly state that the AutoComp cannot be used on fuel-injected or diesel engines, or on the Volkswagen, Volvo, Porsche, Fiat, most French imports, and the BMW.

The read-out module consists of a bright four digit LED read-out display with floating decimal point. Time, average miles per gallon (MPG), instantaneous MPG, distance and total gasoline used are displayed by activating one of a series of clearly marked push buttons. An automatic dimming circuit is installed to reduce night glare, although no means is provided to turn the read-out module off when the car is in use. The micro-processor will store trips up to 1,250 miles; however, the register will re-set to zero after 999.9 miles.

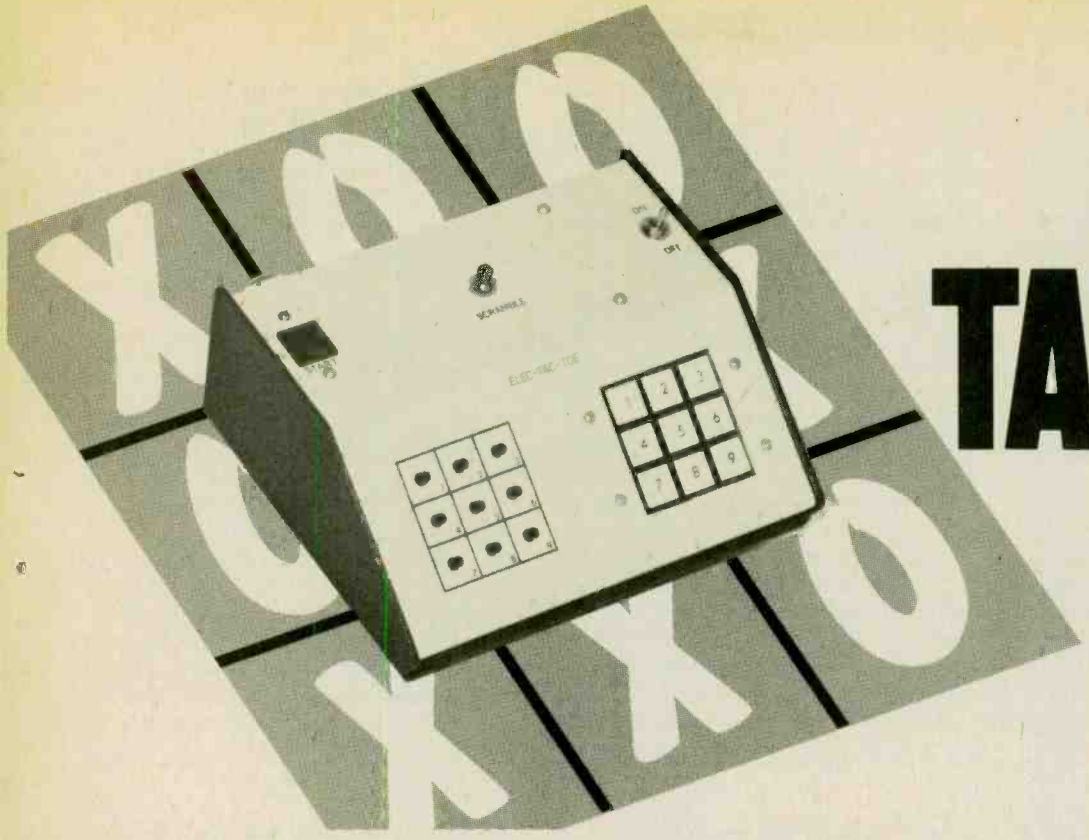
Two analog devices are used to sense distance travelled and amount of gas used. A velocity speed sensor which is attached to the speedometer cable is integrated to give the absolute miles travelled during any given period. A photoelectric type of flow sensor is installed in the carburator gas feed line to determine the absolute amount of gas utilized for a given reference period. The output of both of these analog devices are processed by the read-out module which forms the basis of the device.

Test Your Courage. Installation of the AutoComp, however, can be somewhat of a chore. The instruction manual is both detailed and confusing in sections. No complete circuit diagram of the read-out module, the output of the various analog sensors, or a schematic of their interconnection is supplied. Before installation, we suggest that you read the instruction manual very carefully. Superficial reading may lead to disastrous mistakes and double the amount of time required for the installation. Since every car model is a bit different, a game plane for your individual model should be worked out before installation is attempted.

We installed the AutoComp in a 1976 four-speed Plymouth Volare station wagon. Since the speedometers of most modern American cars are tamper-proof, installation must take place at the transmission. Nowhere in the AutoComp instruction manual was mention made of the need for a large hex wrench that was required to loosen the speedometer cable on the Plymouth. Since this installation is underneath the car, either you have to start acting like a monkey or go to your friendly service station and have the car jacked up for this installation. The flexible extention cable is really not hard to use, and the only worry for this type of installation is that the speed sensor might be positioned so low as to be damaged by road obstacles. What we did was to fit the speed sensor among the undercarriage of the car and well out of the way. The proper grounding of this device may prove a problem, but if you loosen a few bolts, there are always one or two points that will provide a gcod ground.

The flow meter is a bit more difficult to install. First of all, the gas line must be broken. Fortunately, on this 1976 Plymouth there was a length of neoprone rubber tubing between a gas filter and the fuel pump feed-line that greatly facilitated the installation. Not only must the flow sensor be located away from heat and be low to prevent vapor lock, it must also be oriented in

(Continued on page 89)



ELEC TAC TOE

Tic-Tac-Toe goes space age with this IC circuit

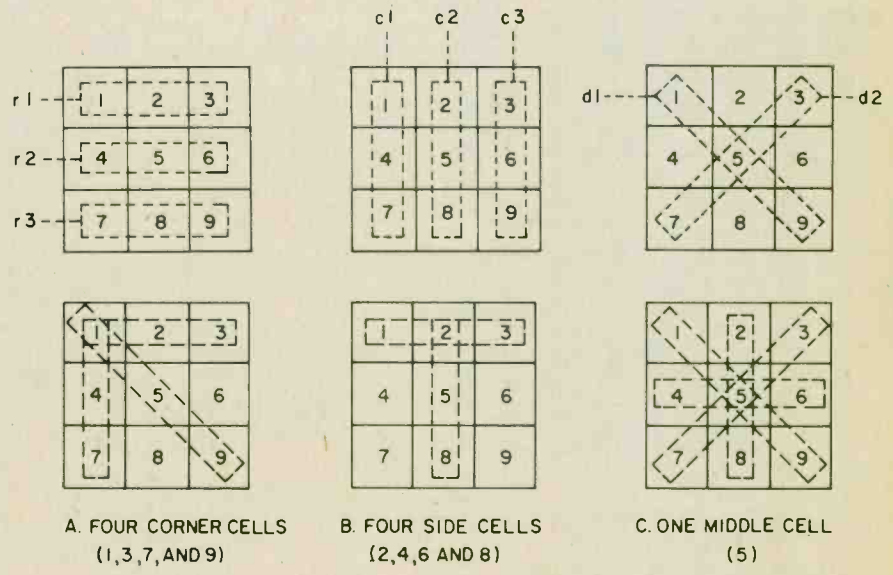
by Walter Sikonowiz

ELECTRONIC GAMES SEEM TO pop up again and again as construction projects, presumably because a game is not only fun to construct, but fun to use. But how many of the games you've seen (or built) are really worth the time and money put into their construction? Sure, electronic dice or roulette wheels are fascinating for the moment, but it's doubtful that anyone clever enough to build such a game could remain intrigued with it for very long. Then consider the other extreme; a cassette-programmed, microprocessor-based TV game. These devices are certainly more entertaining than a simple construction project, yet there are the undeniable disadvantages of high cost and the inability to play without a television receiver.

As a solution to the whole dilemma there is *Elec-Tac-Toe*, a game that is simple to construct, yet always fascinating because it is a game of deductive logic. The rules of play are so simple that even a child can catch on after a few minutes of instruction, but winning will require razor-sharp wits. If you're up to the challenge, read on.

As the name suggests, Elec-Tac-Toe is derived from Tic-Tac-Toe; both use the same 9-cell grid as a playing field. The similarity, however, ends there. In Elec-Tac-Toe there are nine LEDs, arranged so that each one occupies a single cell of the grid. In addition, there is a separate grid of nine pushbutton switches. The internal electronics randomly select three cells out of the grid, and if the pushbutton corresponding to a selected cell is pressed, the LED in that cell will light up. If a pushbutton corresponding to a cell not selected by the electronics is pressed, that cell's LED remains unlit. Two players compete, and the first person to correctly deduce which three cells out of the nine have been selected is the winner.

It is important to note that the three cells selected by the internal circuitry will form one of the scoring sets of traditional Tic-Tac-Toe. The sets are pictorially detailed, and you can see that these are the familiar three row-sets (r1, r2, and r3), three column-sets (c1, c2, and C3), and two diagonal-sets (d1 and d2). A simple-minded way of finding out which set has been selected by the internal circuitry would be to press each of the nine pushbuttons in suc-



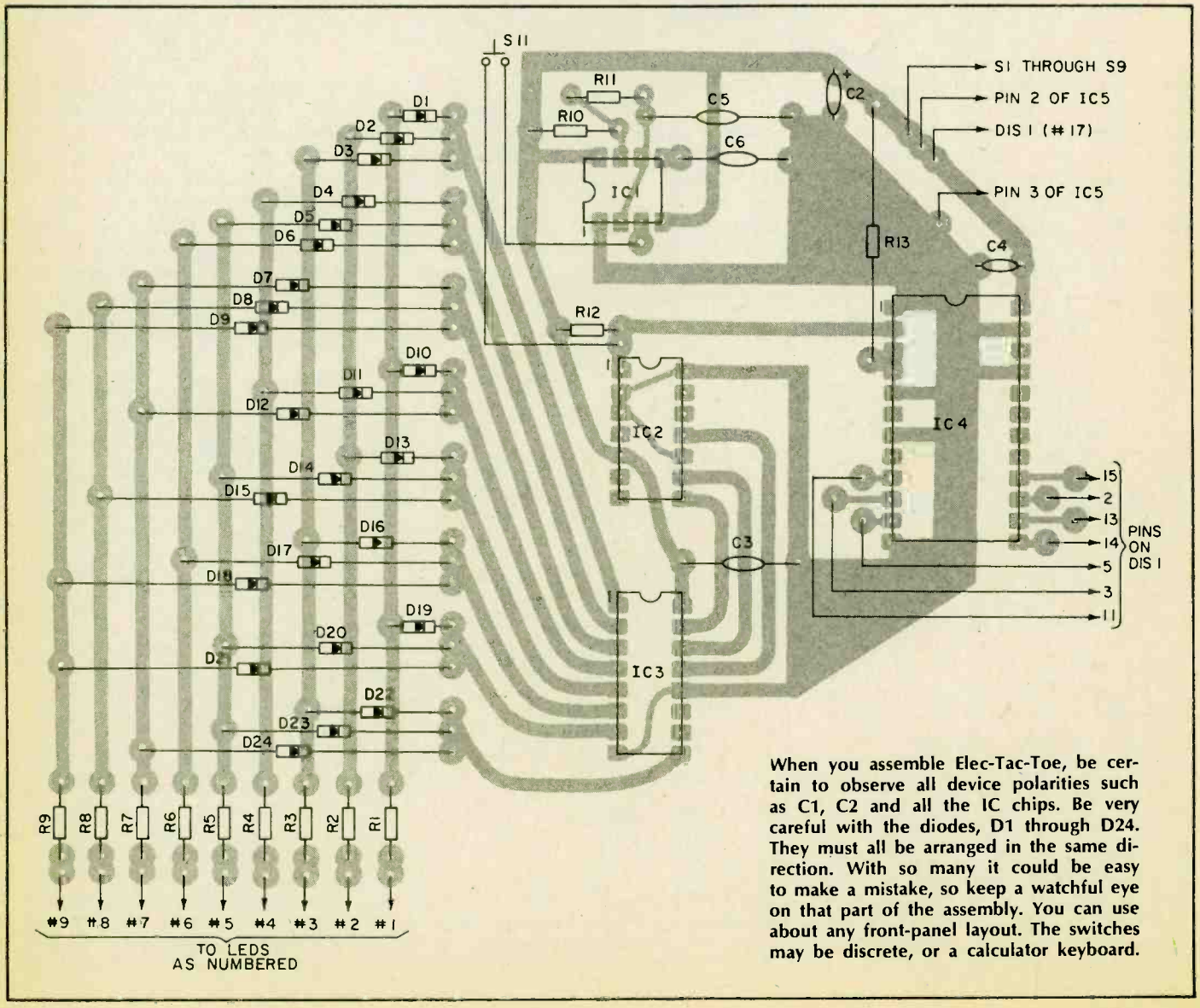
Along the top are pictured Elec-Tac-Toe's rows, columns and diagonals. The fun begins when the two players try to outguess each other as to which three LEDs will light, as secretly selected by the game. As you can see on the bottom pictorial; if LED 1 is lit Row 1, Column 1 or Diagonal 1 may be the scorer. Deductive reasoning will win here!

cession and note which three LEDs lit up. However, we can be more clever than that.

Let's begin by noting that the cells of the grid may be divided up into three classes, as shown. There are four corner-cells (1, 3, 7, and 9), four side-cells (2, 4, 6, and 8), and one middle-cell (5). Furthermore cells of a particular class each belong to a characteristic number of scoring sets. For example, each corner-cell belongs to one row-set, one column-set. and one diagonal-set. Each side-cell belongs to one row-set and to one column-set. And the lone middle-cell belongs to the two diagonal-sets (d1 and d2), to one row-set (r2), and to one column-set (c2). Classifying the cells in the above way is a tremendous help to deducing the correct solution. You can try for yourself to see why this is so—and the examples at the end of this article will explain the reasoning in detail.

A rough outline of a game of Elec-Tac-Toe may be helpful at this point. To begin with, the SCRAMBLE button is pressed, thus causing a new set of cells to be selected by the internal circuitry. This scrambling operation simultaneously causes a random number (0 through 9) to be generated on a display. One player then commences by pressing the pushbutton of the cell (#1 through #9) whose number is called out on the display. If the display shows zero, the player may begin with the cell of his own choice. Next, the opponent presses the pushbutton of his choice. This pressing of buttons alternates until one player has enough information to correctly identify the unknown, electronically selected set. The first player to deduce the solution is the winner. Later on, we'll consider the rules of Elec-Tac-Toe more thoroughly, and examine examples of the logical elimination that is so important in this game. First let's consider the electronic circuit and its construction.

In the schematic you will see IC1, a 555 timer, hooked up as an astable multivibrator. At its output (pin 3) there is available a 14-kHz square wave. Momentarily pressing SCRAMBLE switch S11 causes the square wave to be applied simultaneously to two counters: IC2 and IC4. We will be interested in the resting state of each counter after S11 is released, and because the clocking signal is so rapid, and examine examples of the process of the resting states cannot be predicted by the person manipulating S11; therefore, the outputs of both counters at rest are random. Since the two counters have different count lengths (eight for IC2 vs. ten for IC4), they can both be

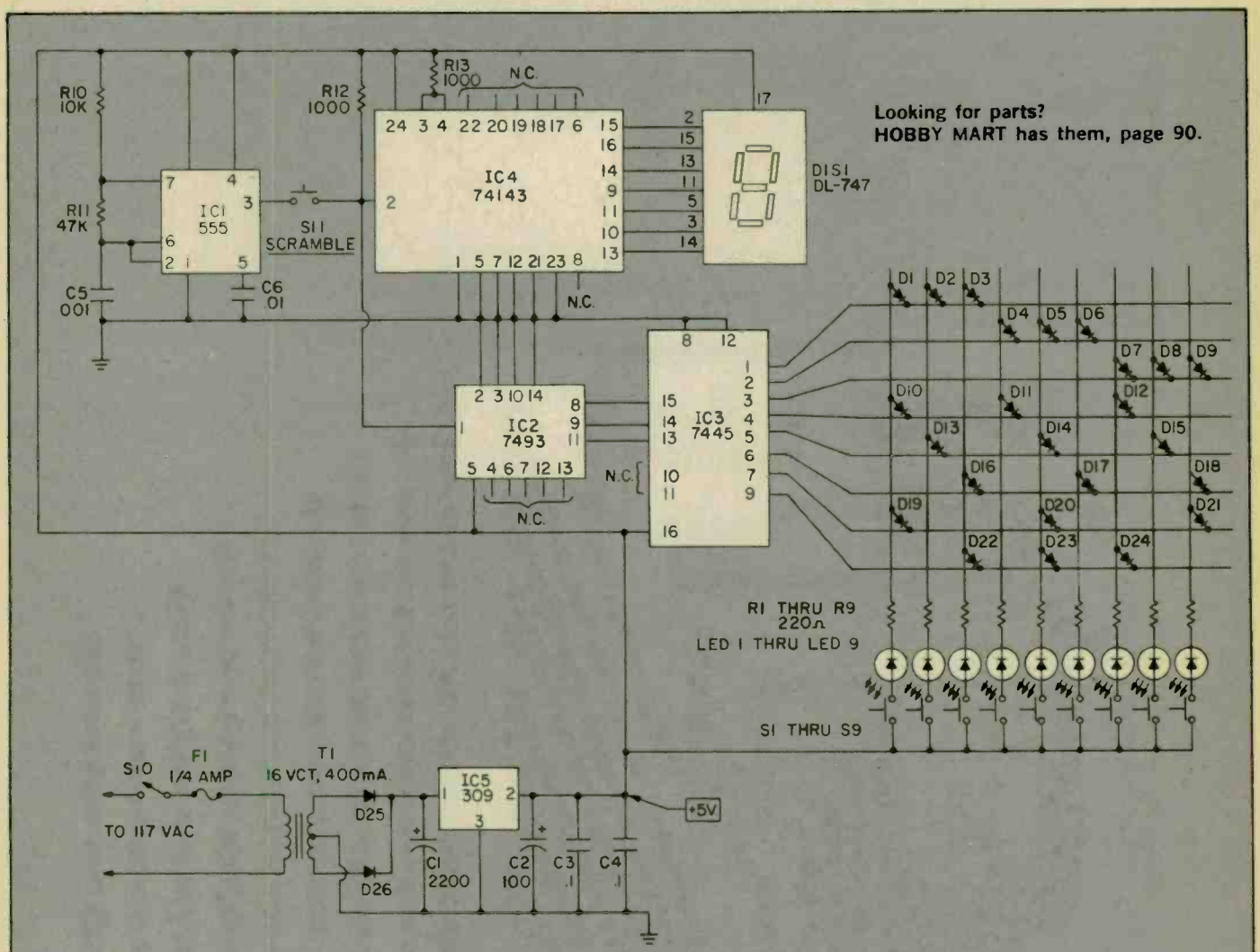


When you assemble Elec-Tac-Toe, be certain to observe all device polarities such as C1, C2 and all the IC chips. Be very careful with the diodes, D1 through D24. They must all be arranged in the same direction. With so many it could be easy to make a mistake, so keep a watchful eye on that part of the assembly. You can use about any front-panel layout. The switches may be discrete, or a calculator keyboard.

randomized by the same clock signal without getting locked together.

Consider IC4 first. Inside this IC we have a decade counter plus a seven-segment decoder. The outputs of this IC are constant-current sinks that connect directly to the display, DIS1, without any intervening resistors. On the display we can read a random number (between 0 and 9), which denotes the cell at which play must begin in a game. This feature prevents players from starting at a particular cell and then working through the cells in a fixed pattern all the time. Such a procedure would make finding the solution somewhat easier because a fixed set of decisions would be made every time. Hence, fewer slip-ups would occur. IC4's inclusion means that players need to remember more facts, so more mistakes are made, and the game becomes more of a challenge. Furthermore, the fact that players alternate at choosing cells adds a little bit more confusion to the game.

Let's proceed to IC2 next. This IC is a 3-stage binary counter, at whose outputs (pins 8, 9, and 11) we may find the binary representation of any number from 0 to 7. The outputs drive decoder IC3, which converts each one of the eight unique input states into a specific output signal. These output signals are such that only one of IC3's eight outputs conducts current to ground in response to any given binary input. Suppose, for instance, that it is pin 1 of IC3 that happens to be capable



PARTS LIST FOR ELEC-TAC-TOE

C1—2200-uF electrolytic capacitor, 25-volt
C2—100-uF electrolytic capacitor, 16-volt
C3, C4—.1-uF capacitor
C5—.001-uF capcitor, mylar
C6—.01-uF capacitor
D1-D24—1N914 diode
D25, D26—1N4003 diode
DIS1—Litronix DL-747 7-segment display
F1—¼-amp. fuse
IC1—555 timer
IC2—7493 counter
IC3—7445 decoder
IC4—74143 counter and decoder
IC5—LM309K 5-volt regulator
LED1—LED9—light emitting diode
ALL RESISTORS ½-WATT, 10% TOLERANCE
R1-R9—220-ohm resistor
R10—10,000-ohm resistor
R11—47,000-ohm resistor
R12, R13—1000-ohm resistor
S1-S9—pushbutton switches, normally open (or use discrete units or a converted calculator keyboard)
S10—SPST toggle switch
S11—SPST pushbutton switch ,normally open
T1—Transformer, 16 VCT, 400 mA.
Misc.—wire, PC board constructing equipment, cabinet, etc.

Note—Insta-Fab #MBK 2-7-6 cabinet is available from Circuit Specialists, Box 3047, Scottsdale, AZ, 85257 for $7.91 plus postage.

Transformer T1 is a Signal #241-4-16 available from Signal Transformer Co., 500 Bayview Ave., Inwood, N.Y. 11696 for $4.85 plus postage.

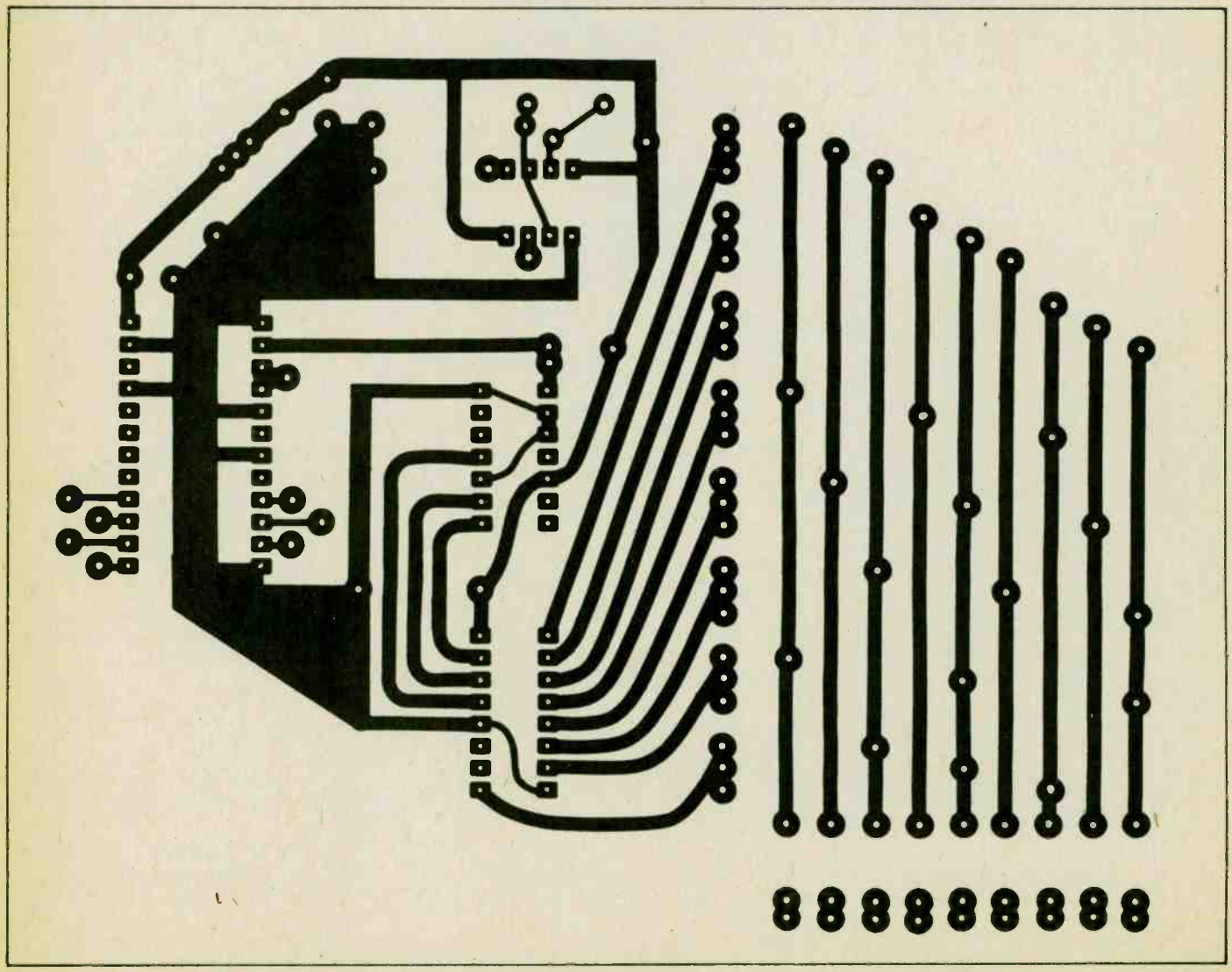
ICs are available from James Electronics, 1024 Howard Ave., San Carlos, Calif. 94070 —write for current prices.

of conducting. We then have three potential paths by which current might flow from the positive supply to ground: S1-LED1-R1-D1, S2-LED2-R2-D2, and S3-LED3-R3-D3. Thus, the set selected by the circuit consists of the three cells in which LED1, LED2, and LED3 reside. Pressing S1, S2, or S3 results in the lighting of LED1, LED2, or LED3, while pressing any other switch will not cause any LED to light. Similar results occur if any one of the seven other outputs of IC3 happens to be the one capable of conduction.

Power for the circuit comes from transformer T1, whose output is full-wave rectified by D25 and D26, then smoothed by electrolytic capacitor C1. Voltage regulator IC5 provides a regulated 5-volt potential between its output (pin 2) and ground. Capacitors C2, C3, and C4 bypass the supply and stabilize the circuit.

There is an optional part to the schematic; see Figure 5. When players become experienced, they may find a solution nearly simultaneously. Because it is difficult to tell who shouted first when sounds are closely spaced, you may wish to build a priority latch. The latch's output consists of two LEDs, one for each contestant. The player who presses his pushbutton first causes his LED to light, and at the same time prevents the opponent's LED from lighting at a later time. Only one IC is necessary to build the latch: a 7474 dual D-type flip-flop. Pressing S11 sends the square wave from IC1 to the CLEAR inputs of the two flip-flops. The first time that this square wave goes low, it sends both Q outputs high; consequently, neither LED is lit. When S11 is relased, R12 holds the CLEAR inputs high, and they no longer have any effect on their respective flip-flops. If the priority latch's S1 is the first switch to be pressed, the latch's IC1a gets clocked and its Q output drops low because its D input is connected to a high potential at the instant of clocking. Naturally, when the Q output drops low, LED1 goes on. Now, suppose at some later time the latch's S2 gets pushed, thus clocking the latch's IC1b. Because the latch's IC1b's D input connects to the latch's IC1a's Q output, which has already gone low, the latch's IC1b's Q output remains high after clocking, and LED2 cannot light. If latch S2 had been the first switch pressed, the situation would simply have been reversed. Pressing Elec-Tac-Toe's S11 again will reset the priority latch.

Since Elec-Tac-Toe's circuit is simple and stable, you can use any construc-



As you can see, Elec-Tac-Toe uses a very neat PC board arrangement and the diodes are well-placed for easy construction. This is a full-size template so you can copy it exactly to make your own board. Use any of the many popular PC boards kits available.

tion method you like. As always, however, a printed circuit will yield the neatest and most professional-looking results. The PC layout accompanying this article may be copied using any of the commercially available etched-circuit kits.

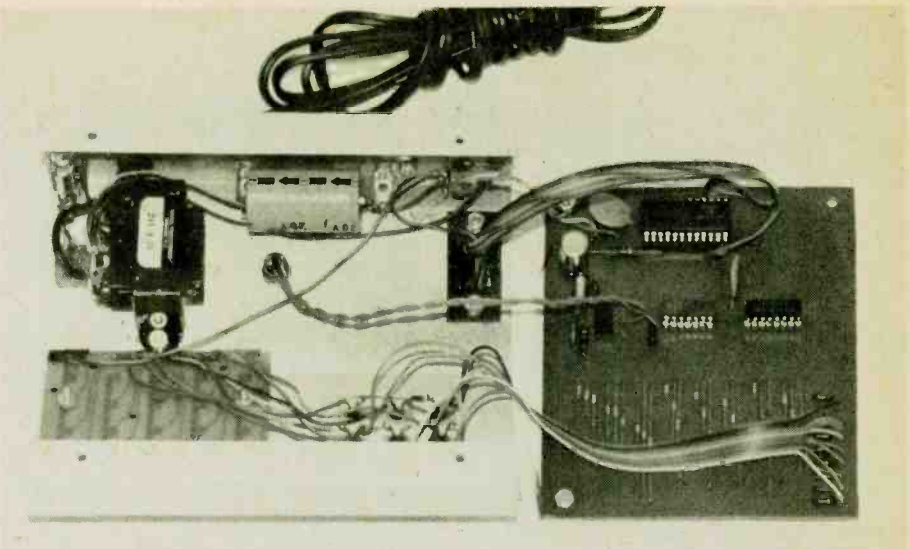
When building the circuit, you will find it wise to use sockets for all the ICs (except IC5). In this way, if an IC should prove to be defective, it can be easily replaced. IC5, the voltage regulator, needs to be heat-sinked. This is conveniently done by simply mounting it against your game's cabinet, provided that you've used a metal (preferably aluminum) cabinet. If this is not the case, you will need to bolt IC5 to a separate heat-sink. All in all, it is much easier to use an aluminum cabinet to begin with. A thin layer of silicone grease between IC5's mounting flange and the aluminum cabinet will improve the heat flow from the IC.

Transformer T1 is a 16-volt, center-tapped, 400 mA. unit. It may be ordered directly from the Signal Transformer Co. for $4.85. Be sure to specify the model number (241-4-16), and include sufficient money for postage. Signal's address can be found in the parts list.

While assembling the circuit, double-check all device polarities. This applies to all the semiconductors as well as capacitors C1 and C2. Be especially careful with diodes D1 through D24; they should all point in the same direction.

Solder connections must be made with resin-core solder and a low-heat iron (25 watts or less). Too large an iron may char the circuit board and damage the components.

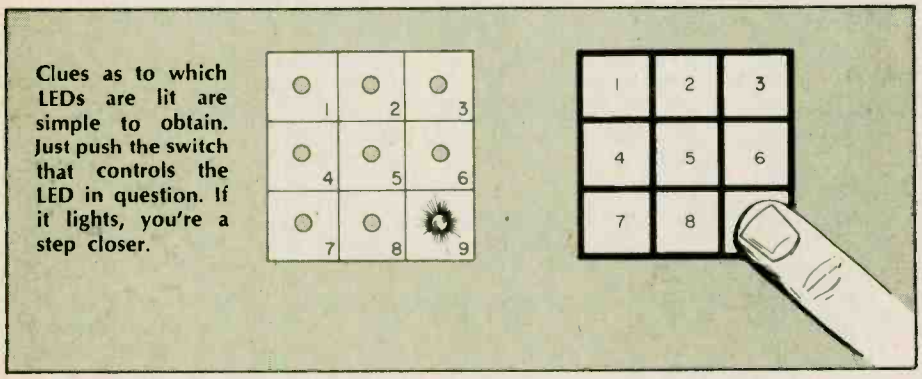
Finally, any suitable front-panel layout can be used. You may, however, wish to copy the prototype's front panel. That particular arrangement proved to be not only functional, but eye-catching as well. As noted in the parts list, switches S1 through S9 may be discrete pushbuttons or a converted calculator keyboard. The LEDs must be mounted in the proper cells of the grid; put LED1 into cell 1, LED2 into cell 2, and so on. This wraps up construction, so let's return to our discussion of the game itself.



Note the wires that go from the Elec-Tac-Toe keyboard to the PC board. Our unit made use of ribbon cable. You'll find that ribbon cable can be almost indispensable once you get used to it—no more messy wire tangles or having to use troublesome cable ties.

The complete rules of Elec-Tac-Toe are as follows: 1) Press SCRAMBLE at the start of each new game. 2) Decide which player goes first; in subsequent games players alternate at taking the first turn. 3) The player going first presses the pushbutton called out on DIS1. Zero denotes a free choice of the first button to be pressed. 4) The other player presses the button of his choice. Players now alternate at pressing buttons until someone has figured out the selected set. 5) The first person to declare knowledge of the solution tests his answer by pressing three pushbuttons simultaneously. If three LEDs light, he wins. 6) If he is wrong, the opponent gets one guess, which he tests as above. If he too is wrong, the game ends in a draw.

As noted previously, the priority latch can be used instead of shouting to determine who first finds a solution. From the rules you can see that this game posesses elements of chance and competition, which together make deduction more difficult. You should also note that a good visual memory is an absolute necessity for winning. In order to get some idea of the thinking necessary in Elec-Tac-Toe, consider the sample games which follow. Each game is a sequence of plays, with no indication who made a particular play or who eventually won.



Clues as to which LEDs are lit are simple to obtain. Just push the switch that controls the LED in question. If it lights, you're a step closer.

GAME 1

Cell 2 lights/Set is r1 or c2.
Cell 1 won't light/Set is c2.

GAME 2

Cell 1 won't light/Eliminate r1, c1, and d1.
Cell 5 lights/Set is r2, c2, or d2.
Cell 3 won't light/Set is r2 or c2.
Cell 2 won't light/Set is r2.

GAME 3

Cell 2 won't light/Eliminate r1 and c2.
Cell 8 won't light/Eliminate r3.
Cell 1 won't light/Eliminate c1 and d1.
Cell 9 won't light/Eliminate c3. Set is r2 or d2.
Cell 5/lights/No new information.
Cell 3 won't light/Set is r2.

Note that in Game 3 the fifth step (testing cell 5) was useless. The players should have known beforehand that Cell 5 would light because it belongs to both r2 and d2, and one of those sets of LEDs had to be the one that would light. But it's easy to criticize when everything is on paper; in play you will often find it difficult to keep track of data. In fact, you may find yourself

(Continued on page 87)

Kathi's CB Carousel

by Kathi Martin, KGK 3916

DAK Mark IX works out as well as it looks.

☐ MANY CBers use their radios purely as a useful, practical tool while many others thoroughly enjoy CB as a hobby in itself, and use CB primarily to chat with folks across town, or down the road a piece. For this you need a super base. Lately the mail has been running very heavy, with more and more of you asking about those super transceivers—the heavyweights with super selectivity, super talk power, and just about every convenience a CBer could dream up.

One super transceiver, in particular, drew an unusually large amount of reader interest, so I decided to take a much closer look than usual at a hobby CBer's dream; in this instance a *gold-plated special* known as the DAK Mark IX.

A Different CB Rig. As you can tell from the photographs the DAK Mark IX bears about as much resemblance to the usual CB transceiver as I do to Robert Redford.

Loaded with meters for just about every important function, the DAK has a *relay rack* front panel and, though supplied in a metal cabinet, it can be easily fitted inside a rack.

The meters are unusually large—professional size—and provide full-time metering (from left to right) of antenna system SWR, RF-output or final plate current (that's right, this rig has some tubes), percent modulation, and received signal strength.

Directly below the meters are a row of extended-handle switches for power, noise blanker, ANL, RF-output/plate current metering, SWR-meter calibrate, and transmit/standby.

The transmit/standby switch is somewhat different than the usual type of standby control. Actually, it's a safety switch to reduce the possibility of accidental or unauthorized operation. In the *standby* position the receiver is *on* and the filaments of the transmitter tubes are also *on*—the transmitter is kept "warm" for immediate use—but the transmitter cannot be keyed with the PTT switch. When the switch is set to *transmit* the rig functions in the usual transceiver manner.

Across the lower edge of the front panel is the microphone input connector, microphone gain control, Delta tuning, channel selector, RF gain control, squelch and volume controls. The channel is indicated by an LED digital display centered under the meters. At the extreme right side of the panel is a headphone jack that automatically disconnects the internal speaker when phones are plugged in. Typical of better quality communications gear, the headphone output has a series resistor of approximately 220 ohms so you can't burn out a set of hi-fi phones by socking it with the full power output. After all, when phones are pressed against your head as little as 100 milliwatts will thunder in your ear like 10 watts feeding a speaker.

Look Inside. Getting to the guts you're in for some surprises. Leading off, there's a tube-type RF final and modulator, even though the rest of the rig is all solid-state. Personally, I like the arrangement because the tubes used have been seen in 30-watt commercial rigs and are virtually coasting at 5 watts. The circuit is a tried-and-true straight plate modulation with a negative peak clipper to prevent in excess of 100% negative modulation.

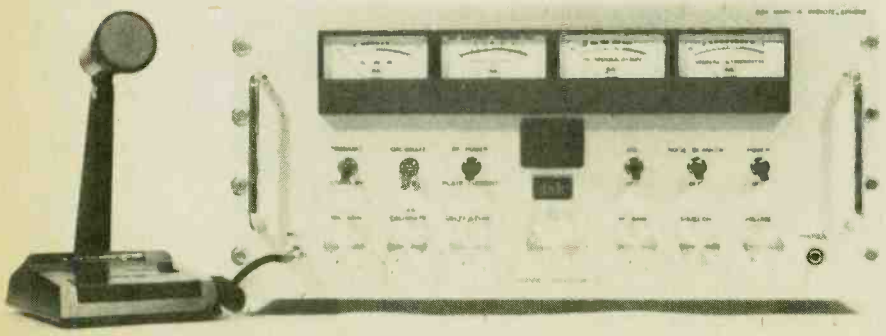
Moving along to overall performance the real *biggie* is selectivity: a whopping 71 dB worse-case. I really didn't believe it so I rechecked the instruments twice, and yup, it was true: 71 dB adjacent channel rejection. Most often you won't even know there's anyone working the adjacent channels.

Another winner in receiver performance is the AGC (Automatic Gain Control) action. An input signal range of 2 to 10,000 uV, representing a variation of 74 dB, comes out of the speaker as 2 dB. In plain terms it means that if the volume is cranked wide open to hear a very weak signal, a very strong signal coming in from down the block won't blast the speaker's cone across the room.

The Delta tuning is completely variable over a range of ±1.2k Hz.

The transmitter delivered exactly 4 watts RF output to a 50 ohm load. The modulation sensitivity is determined by the microphone used and

(Continued on page 86)



CIRCLE 88 ON READER SERVICE COUPON

The DAK Mark IX has a full 19-inch wide relay rack front panel. The base station mike shown is the optional DAK DM100 which contains a compressor.

GET YOUR BNEE DEGREE SECOND SEMESTER

e/e's Bachelor of Novicetry course continues with a look at antennas, CW filters and other operating goodies!

by Thomas R. Sundstrom

YOUR NOVICE LICENSE has arrived and you have made a decision to buy either a transceiver or a separate receiver and transmitter. Now your attention should turn to completing the station. What's next?

CW filters. There are two types of CW filters. These are internally-mounted units and externally-used, self-contained, active audio filters.

Almost all transceivers and receivers provide a spot on the chassis for a plug-in CW filter. Most CW filters have a bandwidth of .4 or .5 kHz at 6 dB, and 2.0 or 2.2 kHz at 60 dB down. The typical SSB filter of 2.1 or 2.4 kHz (at 6 dB) is much too wide for effective CW operation.

The reason for installing an optional CW filter (usually extra-cost, averaging $50) within the receiver or the transceiver is that the narrower bandpass makes the receiver more immune to overload from strong signals near the frequency that you have chosen. Receiver selectivity has to take place in the RF and IF stages to be most effective.

Also seriously consider purchasing an external active audio filter for CW. An outboard unit, such as the variable bandwidth Autek Research QF-1 or the fixed bandwidth MFJ Enterprises CWF-2BX, plugs into the headphone jack of the receiver.

Typically the bandwidth can be reduced to 80 or 100 Hz, and copy of CW in a crowded band is much easier. Shop the ads and compare features; most active audio filters cost between $50 and $70.

Use a CW filter of .4 or .5 kHz to sharpen up the receiver selectivity, and then use the signal-peaking capability of an active audio filter to sort out the two or three remaining signals; frankly, I will never be without an active filter again as I find it does wonder for digging out weaker stations.

Headphones. Headphones are also a must for efficient CW work. Headphones cut down the outside distractions of family, pets, TVs, and stereos.

Make sure the pair you select is comfortable; the impedance of the receiver output and the headphones must be the same. An 8-ohm output will not adequately work with a 2,000-ohm head phone impedance. Check the specifications.

Tape your QSOs. Have you run across a "hotshot" who is sending a bit too fast for you to copy? Someone give you an address that you want to check? Did the signal fade and was that an L (.–..) or an R (.–.)?

Try taping your QSOs as a backup to what you are copying. Use an auto-level casette tape recorder, a Y-adaptor, and a couple of patch cords to take audio out of the headphone jack (before the external audio filter), feeding the headphones and the cassette recorder simultaneously.

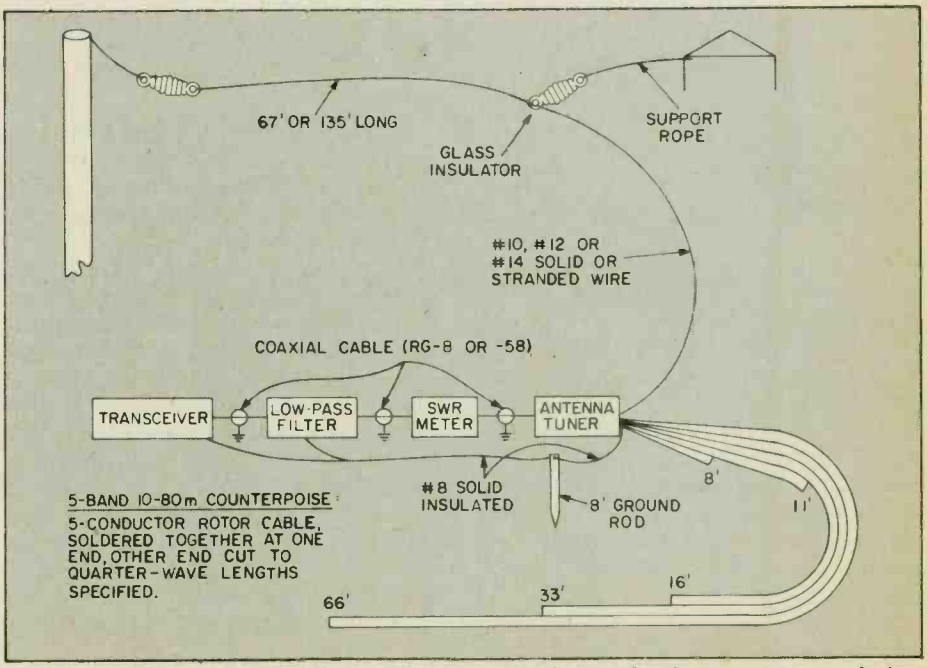
Let the casette run continuously (even when transmitting or just tuning around), and just turn it over as necessary. Rewind and play the portion of the tape containing the missing data before going on the next QSO; that way you won't forget to do it later.

Antennas. Unfortunately, most of us have limited space in which to install antennas. I cannot begin to address the entire question, so let me focus on two types of antennas: a longwire (horizontal) and a trap vertical.

A *longwire* (LW) antenna is one of the easiest antennas to install . . . indoors or (preferably) outdoors. Try to get it as high as possible.

We show a pictorial of the installation, although we have not yet talked about a low-pass filter, an SWR meter, and an antenna tuner (which we'll do next time), but these are necessary components to effectively "fit" the antenna to the transceiver. Order some literature now, to supplement our discussion.

The counterpoise shown is not absolutely necessary, but it helps to keep



A Longwire Antenna will really work out for you—if you take the time to properly install it using a SWR meter, an antenna tuner, a low-pass filter and a good, solid ground.

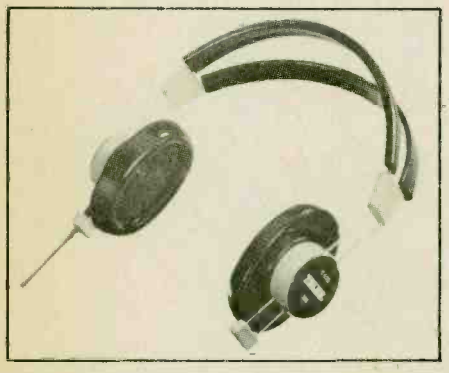
RF out of the radio room and eliminate "hot" equipment. It is well worth the few minutes it takes to make and install.

The longwire is one of the least expensive antennas to install: SWR meters cost as little as $20, antenna tuners can be built from a well equipped junk box or bought for as little at $30, and the wire can usually be acquired for a nominal sum depending on its size.

Most *vertical* antennas are commercially made, either base loaded (requiring a manual change of the loading coil) or traps (automatically tuning the antenna to each band). The trap antenna tends to be higher priced, less than $100, but both types of verticals cover 3-to-5 bands.

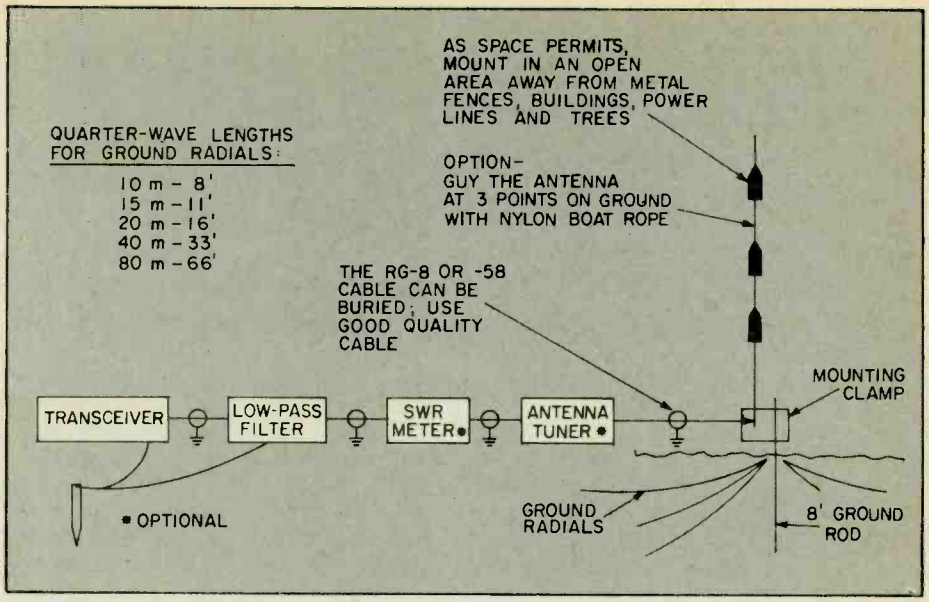
Verticals can be ground- or roof-mounted. In either case, a *good* ground system (as illustrated in our drawings) is a must.

A CW filter can separate the signals when the going gets tough. MFJ makes a few models. Circle number 91 for more information.



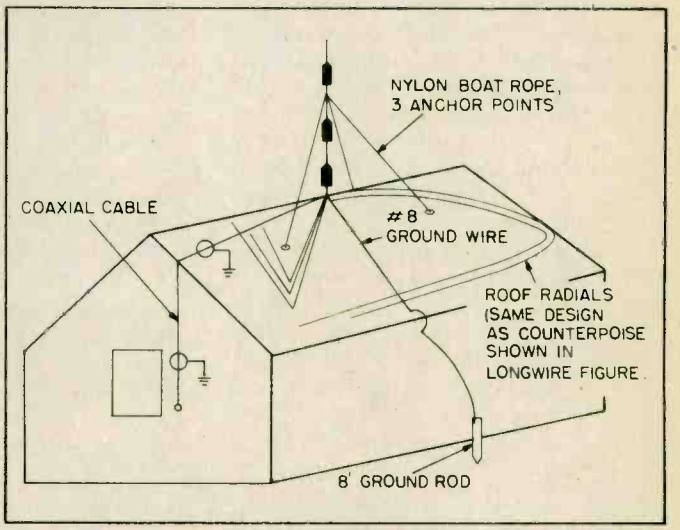
Pulling the weak ones out of the mud often requires the 'phones. Telex makes a good magnetic set. Circle number 83 for info.

From practical experience, I strongly recommend guying a vertical with nylon boat rope. It is particularly important when roof mounting a trap antenna to prevent flexing of the antenna and breaking of internal trap connections (wind gusts from summer thunderstorms sometimes hit 80 m.p.h. around here).



A ground mounted vertical antenna has a long skip zone, but needs a good ground to perform best. They are best on higher bands as on low bands their bandwidth is restricted. If you wish to use one on, say, 80 Meters then an antenna tuner will be a necessity.

Mounting a vertical on a roof calls for a certain amount of care. Make sure you guy it for physical stability. For electrical reliability, use radials cut in the same manner as a longwire's counterpoise detailed in our longwire figure).



Which Polarity? Whether a vertical or a horizontal antenna is best for you depends upon a number of factors. Aside from the physical space problems, some of the major factors are:

One. Vertical antennas have a low angle of radiation and long skip zone, and are less sensitive to close-in ground wave signals (particularly 80 and 40 meters). Horizontal antennas tend to have a high angle of radiation and a short skip zone, delivering a lesser signal than a vertical several thousand miles away.

Two. Vertical antennas are more susceptible to power line and ignition noise pickup than are horizontal antennas. One solution: transmit on a vertical and receive on a horizontal antenna when the noise pops up.

Three. Verticals are restricted in bandwidth on the lower bands; on 80 meters it may be as little as 50 kHz. Antenna tuning is critical, or an antenna tuner is required to make the transmitter see a "perfect" antenna once outside the range of the resonant frequency of the antenna.

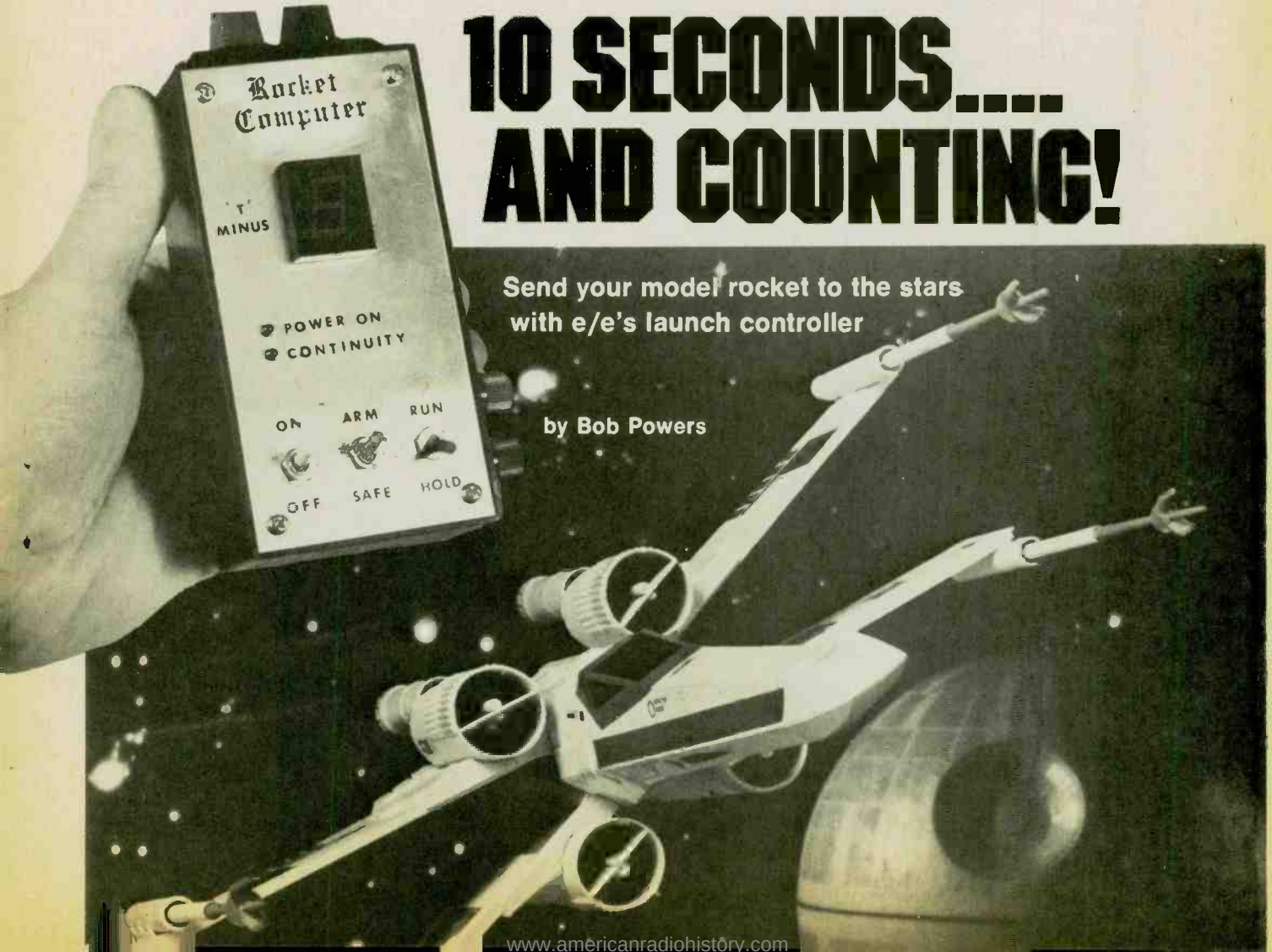
In closing. Let me recommend one particularly well written book on antennas where the mathematics have been done for you and the projects go up in the air with a minimum of problems: *Simple Low Cost Wire Antennas for Radio Amateurs,* by William I. Orr, W6SAI. This *Radio Publication, Inc.,* paperback is available directly from the publisher at *P.O. Box 149, Wilton, CT 06897,* for $4.95 ($5.95 in Canada) plus .50 postage.

Next time we'll finish discussing antenna accessories, and talk about code a bit. By the way, hang on to your straight key . . . ■

10 SECONDS.... AND COUNTING!

Send your model rocket to the stars with e/e's launch controller

by Bob Powers

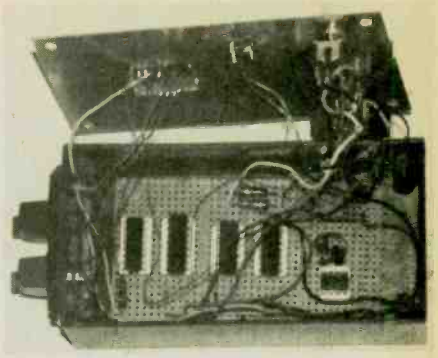


FOR YEARS, THOUSANDS of people have been building and launching small scale model rockets that propel themselves with miniature solid-core propellent engines. But no matter how much time, money, and effort a person put into his (or her) rocket, the launch has always been pretty much the same; a switch, a battery, and perhaps a light bulb to check continuity.

A Breakthrough! Thanks to lower Integrated Circuit (IC) prices, a hand-held, computer-like launch controller is new practical even for a "model rocketeer" on a budget. The Rocket Computer consists of a display that—when ordered—counts down from 9 to 0 and then, thanks to a SCR (Silicon Controlled Rectifier), fires current through an igniter to start the propellent engine. Two LED's tell you if power is on and also give continuity verification. It's simple to operate with only three switches. The whole project can be assembled, even at retail prices, for only $5 or $20, less case.

Construction. The circuit is quite stable, so any method of construction can be used. IC sockets should be used to protect the "chips" from soldering heat, and facilitate easy replacement—if necessary.

I built my Rocket Computer on perfboard, with IC sockets, and a wire-wrapping tool was used to wire it up. But, soldering the project with point-to-point wiring is just as easy and effective. Take care not to make any solder "bridges" between socket pins, as they are usually spaced pretty close together. The LED display pins must correspond with IC 3's output pins. Most manufacturers of these displays give sufficient data to make this an easy task; simply match the A-G lines together. A 15-ohm resistor on the common anode lead should be rated at least at a half watt. (The common anode lead is easily identified on the LED display data also.) In the parts list, I recommend a Radio Shack RS-1020 SCR, but any SCR that can handle 2 amps or more of current with a low gate voltage can be used. Use spring clip terminals like I did to make igniter hook-up quick and easy. I mounted my terminals for the igniter on top of the case. Then, I mounted the power input jacks on the side. Once again, use spring clip or screw type connectors here. It is an excellent idea to use jacks for the power input and igniter output that do *not* look similiar. This will avoid mistakes and possible damage. Finally, be sure to note polarity when wiring the input power jacks.



You can use perfboard construction to build your controller, as shown here. Parts layout is not critical, nor are any dimensions.

Testing and Blastoff! Give the circuit a complete bench test before taking it out to your "launch pad". Use only a 6 volt lantern-type battery on this circuit. Only a small or large lantern battery can insure that there will

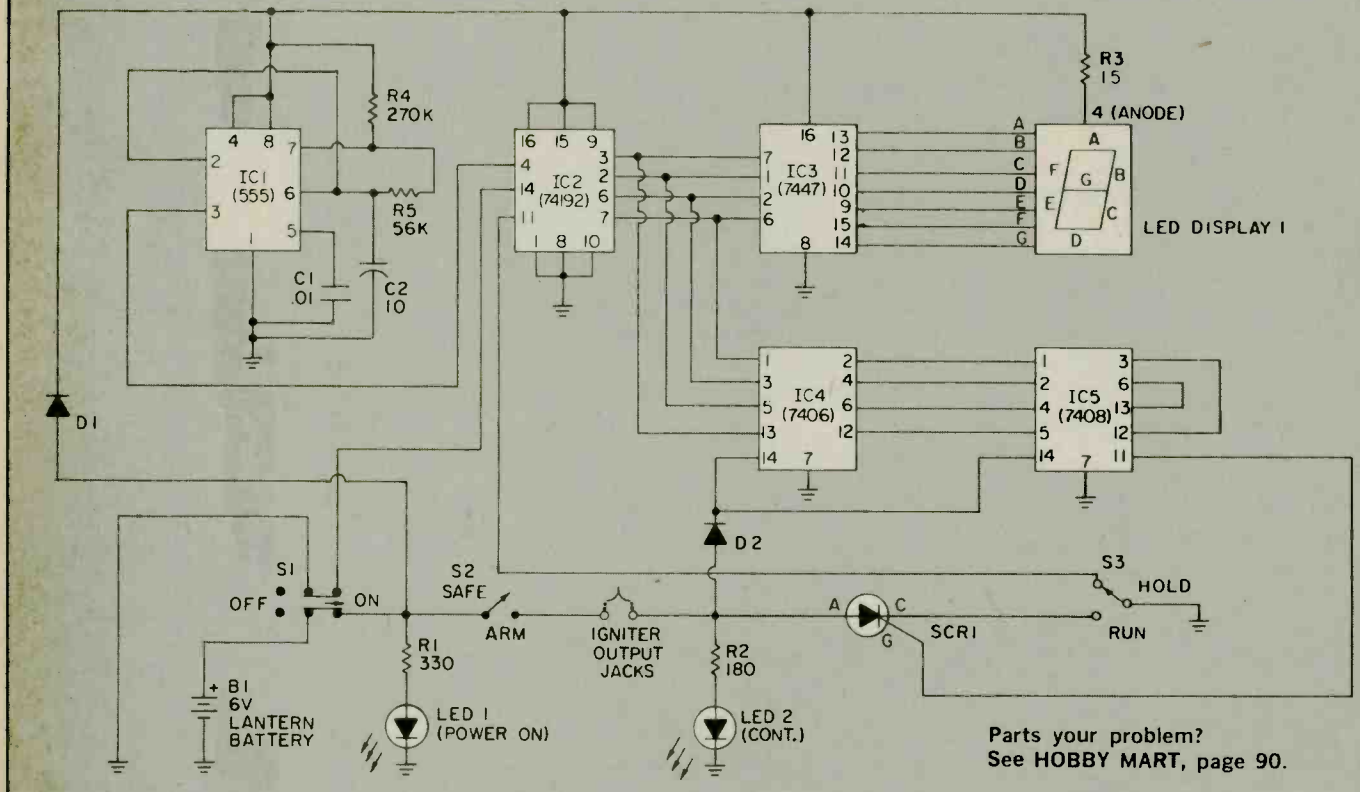
be plenty of current available to drive both the circuitry and igniter. Test the circuit first *without* using an igniter hooked up. Attach your battery to the proper jacks. Now, turn switch S1 (*off/on*) to the *on* position. LED 1 should light. So should the display light up a 9. If the display did not light or a 9 is not observed, correct the error before going on. Everything OK? If so, continue. Turn S2 (*safety/arm*) up to *arm*. LED 2 will not light yet because no igniter is in. Now, take a low current igniter (Estes #2301) and hook it up to the igniter output jacks. LED 2 should now glow, proving continuiny. (Polarity is not observed on an igniter.)

Now see if the unit can fire an igniter (not in an engine yet!!!) on your bench. Move the igniter away from anything inflammable as the igniter usually burns for a second at about the intensity of a match. Throw switch S3 (*hold/run*) to *run*. The display should count slowly down, and—get ready—at zero, the igniter should fire.

At all times, when using this unit, start your launching procedure with all switches in their "off", "safety", "HOLD" positions respectively. After

(Continued on page 87)

The model rockets our controller will let you launch are fun kits in themselves. Most have a parachute for a colorful "re-entry" and you can get everything from nearly exact scale models of the V2 and Saturn V to far-out spaceships of the far future!



Parts your problem?
See HOBBY MART, page 90.

PARTS LIST FOR THE ROCKET COMPUTER

B—6 volt lantern battery, Mallory F918 or equivalent.
C1- 01-uF Disc capacitor
C2—10-uF capacitor Electrolytic (10 VDC or better)
D1, D2—Diode, IN4148
LED1—LED (red)
LED2—LED (green)
IC1—555 Timer, 8 pin chip
IC2—74192 counter, 16 pin chip
IC3—7447 BCD to decimal decoder, 16 pin chip
IC4—7406 Hex inverter, 14 pin chip
IC5—7408 and Gate, 14 pin chip
LED Display 1—7 segment common anode display
R1—330-ohm resistor, ½ watt
R2—180-ohm resistor, ½ watt
R3—15-ohm resistor, ½ watt
R4—270,000-ohm resistor, ½ watt
R5—56,000-ohm resistor, ½ watt
S1—DPDT switch
S2—SPST switch
S3—SPDT switch
SCR1—Silicon controlled rectifier, 50 volt, 2A or better. (Radio Shack 276-1020 or similar)
Misc.—Input and output jacks, I.C. sockets, suitable enclosure, wire, solder, igniter (Estes #2301), etc.

e/e checks out the...

HEATHKIT H8 HOME COMPUTER

CIRCLE 1 ON READER SERVICE COUPON

Here's a personal computer you can build yourself for years of computing fun!

RAW, BRUTE COMPUTING POWER is about the best way to describe Heathkit's H8 computer. The H8 is unlike many other personal and hobby computers which leave you hanging in need of an advanced BASIC (or other software); or which turn out to be short on adaptable peripherals such as recorders and printers; or which provide little technical backup in the event you have assembly problems. The Heathkit H8 can meet almost any reasonable software need; can be almost instantly expanded to accommodate any peripheral; and has some very substantial technical backup. Besides, while this doesn't seem important at first thought, the H8 is built like a battleship—it's among the most rugged of personal computers in terms of industrial and/or school use.

The basic package ($375) includes the cabinet, a factory wired and tested 8080A CPU *card*, 10-position motherboard (of which two positions are used by the CPU card and a front panel/monitor), the power supply, a monitor speaker (which we'll cover later), and an *intelligent* front panel that is actually part of a *control circuit board*—which we'll call the CCB for brevity.

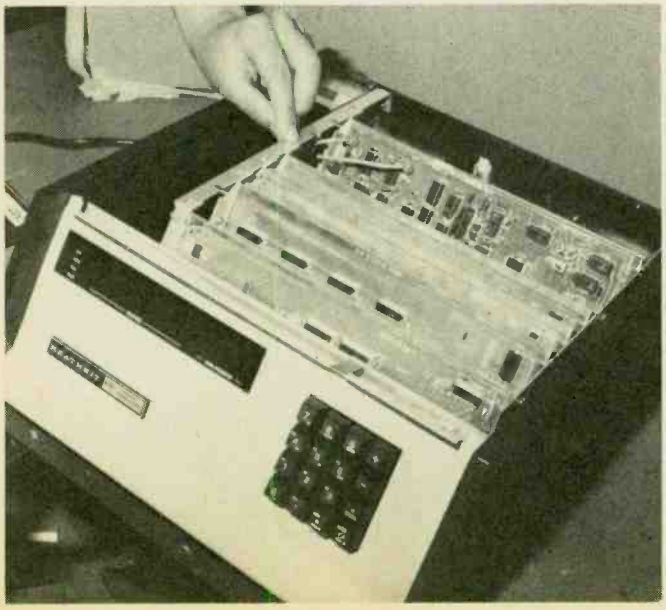
The CCB features a 9-digit LED readout. The readout occupies the front face of the computer and is highly visible. Just by keeping careful watch on the LEDs an H8 user can keep track of important items such as contents of memory addresses; register contents; Input/Output ports; type and condition of dumps and loads; there is even a *checksum* error which helps when you load the computer with software.

In conjunction with the readout is a 16-key pad, also on the computer's front, that provides dumps and loads at the touch of a button. The user can have almost instant selection and data alteration of any memory, register, or the program counter. The counter may be incremented and decremented under manual control; and I/O is under manual control.

Included in the basic package are cassettes with the following software: Benton Harbor Basic; a two-pass assembler (HASL-8); a text editor (TED-8); a console debugger (BUG-8). The resident program monitor (panel monitor) is in ROM (read only memory).

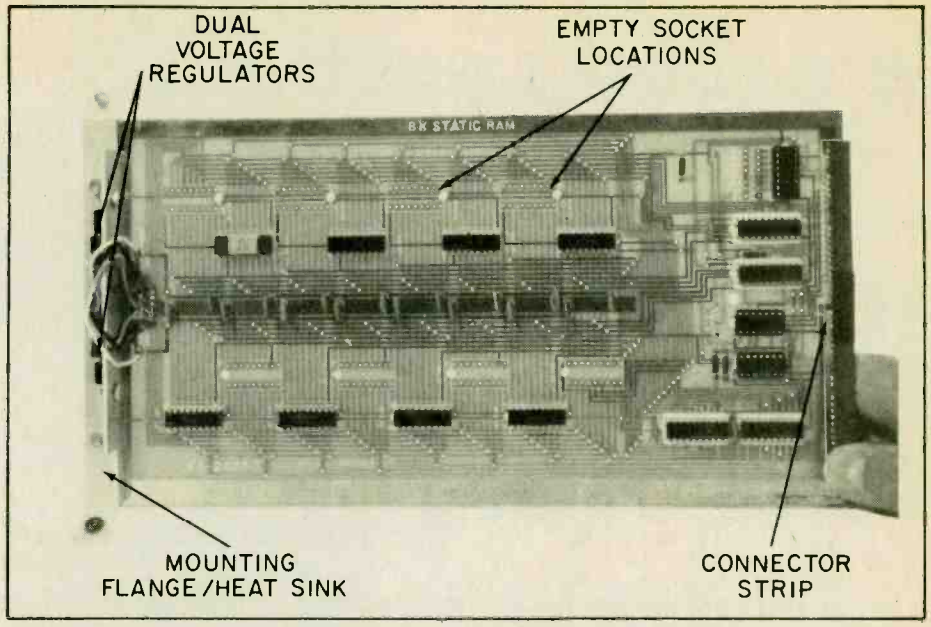
Obviously, you are going to want to use some form of cassette tape machine to feed the software into the computer. The interface for the cassette data system is part of the *optional* H8-5 Serial I/O and Cassette Interface. This cassettte interface operates at 1200 baud (four times faster than the common 300 baud rate used by many personal computers). A switch permits a teletype reader/punch to be used as the data storage device. User selectable baud rates from 110 up permit the use of either a standard teletype terminal or a high speed CRT terminal, such as the Heathkit H9 Video terminal. (We prefer the TTY because it provides a "hard copy.") The H8-5 kit is priced at $110 and plugs directly into the motherboard. (A parallel I/O card with three input/output connections is available for $150.)

Once you have the H8-5 serial I/O-cassette card you need a cassette re-

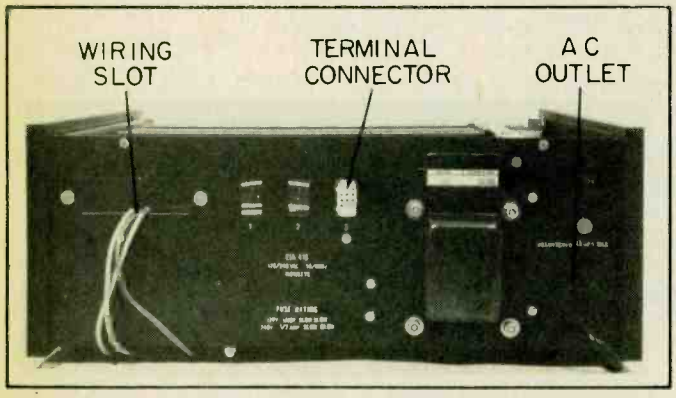


Heathkit's H8 computer will raise you into the elite circles of Personal Computing. Based on the 8080A chip the computer may be configured to fit just about any use in any small computer situation. The H8's intelligent front panel is a real treat to use.

corder. Here's where you can run into your first problem. Heathkit suggests a relatively inexpensive General Electric portable recorder they sell for $60. Don't waste time and effort by trying something else. We know, for we wasted three weeks looking for trouble that didn't exist. Figuring that "A cassette recorder is a cassette recorder," we tried to load Heathkit's software with everything from a $20 portable to a $500 cassette deck, and all we got for our efforts was the internal speaker going beep-beep-beep, indicating a bad load. (The speaker gives out with a single beep when the load is good.) Obviously the cassette interface was defective so we sent it back to Heathkit. It was returned within five days. Heathkit claimed our H8-5 assembly was perfect, that there wasn't anything wrong with the card. We packed up the card and recorder and took off for the local Heathkit store, whose technician instantly determined our recorder was not recording the 1200 and 2400 Hz interface tones in phase. As simple as that. We purchased a Heathkit ECP-3801 cassette recorder in the store and that was the end of our dump/load problems. Our recommendation: Save time and effort; get Heathkit's tape recorder at the same time you get the computer.



When you buy a 4K memory board from Heath, you're really investing in a full 8K. The 4K boards arrive completely designed for 8K. Just buy the extra chips with their sockets.



Interfacing the H8 to a terminal is a very simple matter once the proper PC board has been built and installed. All connections are right there. Circle number 1 for more information.

Okay. Now we have an H8 computer, an H8-5 serial I/O with cassette interface, and software. Other than a terminal, all we need is some memory.

Though many programs can run in 3K of memory, at least 8K is required for most software including BASIC. (The Extended BASIC requires 12K, preferably 16K—but more on this BASIC later.)

Memory card kits (4K) are available for $125. An expansion kit available as an option for the basic 4K kit takes it to 8K for an additional $85. (The basic card is for 8K memory though sockets and ICs for only 4K are provided. The expansion kit contains only the additional sockets and ICs to complete the 8K card.)

If you have been scared off building your own computer by stories of frighteningly close-spaced foil runs—fear not, for the H8 memory cards are an assembler's dream come true. Don't ask why, but the standard size solder pads for the inline DIP ICs used in the H8 seem very easy to solder. We had not one single solder bridge. We can attribute this to Heathkit's unusually thorough solder masking on the PC boards. Whatever, the PC assembly simply isn't difficult or "hazardous"; a major plus for the H8 as a hobbyist's project.

You Get What You Pay For. By now you have probably added up the cost of the basic computer, memory, I/O, etc., and realized you're fast approaching $1000. Actually, the very minimum, consisting of the computer, 8K of memory, a serial I/O-cassette interface, and a used KSR teletype terminal (which is available from some surplus dealers for about $300), will cost around $950. Add in another $210 if you want another 8K of memory (16K total). This is certainly not out of line with other "personal computers," and offers a heck of a lot more computing power in most instances.

For example, the H8 works in machine or assembly language, *or* BASIC. You can easily transfer control and entry back and forth between the terminal and panel monitor without bombing your program.

When running BASIC the panel readout keeps up continuous visual "chatter" about what's going on. You always know where you are in the memory (and Heathkit supplies a long list of BASIC routine locations). When loading from tape, the readout indicates the sequence of memory load and the top memory of the load; a value required if you want to make changes and then dump. When dumping a program the readout counts down to zero if the dump is clean.

Beep-Beep-Beep. Panel entries as well as dump and load functions are indicated by beeps from the internal speaker. A short or medium beep (depending on the particular entry) is sounded each time a panel key pad is pressed. If you enter a number or function and don't hear a beep you know you haven't pressed hard enough, or the computer didn't take the entry—do it again. A good load is signified by a single beep, as is the completion of a dump. A continuous string of beeps indicates a bad load: Repeat the load,

perhaps with the cassette's volume control set slightly higher, or check for a defective tape.

Brute Force Computing. The BASIC available from Heathkit has been updated several times. The *Benton Harbor BASIC* that is supplied with the computer kit is a floating point BASIC with the "transcendental math package." Its most serious limitation is lack of string variable manipulation. By itself, Bentor Harbor BASIC will meet the needs of almost all high school and general college students.

The *Extended Benton Harbor Basic* is in a class by itself when it comes to personal computers. It is a blockbuster of computing power. The most recent version, which was used for this month's Simply BASIC program, is at least equal to many of the best time-share BASICs and is better than most. It even permits a cheap cassette recorder to be used almost like a disk system.

This is not to imply there are no irritations. Heathkit BASICs have self-completion of several common commands and it cannot be turned off. If you enter PR on a terminal it will complete the command PRINT. Got any idea how many times we continued typing and got PRINT I, or INPUT U as the entry, to be rejected by the computer as an error? It's like being the sorceror's apprentice! We would prefer to do without self-completion of commands, or at least be able to turn it off.

Perhaps a more serious limitation is that an additional serial I/O card—with its attendant expense for an unneeded cassette interface—is required if you want to use a video terminal in conjunction with a TTY or serial printer. A separate parallel printer requires the even more expensive parallel I/O card. It would be convenient to have a single serial I/O card with two or more ports.

But these are really minor complaints in view of the fact the H8 system provides for extremely easy expansion, and Heathkit implies many accessories and peripherals will be forthcoming in the near future.

As it presently stands, the basic computer can accommodate up to four 8K memory cards, leaving one "motherboard slot" open for a connecting cable to an accessory cabinet housing more memory (up to the 8080A's limit) and peripheral controllers. Future memory cards may possibly utilize the most recent memory IC, which can provide 32K of memory in a single chip. All this is to come. The important fact is the H8 has been designed for easy expansion by the user.

Is It For You? We have skipped over a long list of technical features because you can read about them in complete detail in the Heathkit catalog. As for total kit construction, we cover that in a future issue. Here we mentioned construction of the memory and interface cards, which is the most difficult part of assembly in terms of soldering—one solder bridge and your computer is inoperative.

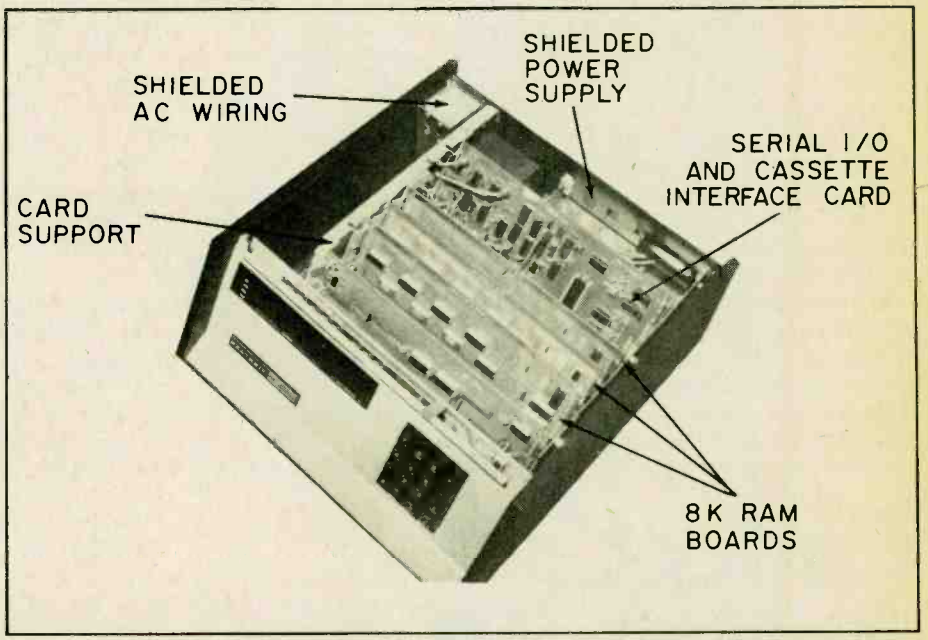
Now we come to the *documentation* —a fancy word meaning instructions or operating manual. It is so extensive, and has been handled by so many different writers, you must have some knowledge of computing just to know where to look for what you want. Including the outstanding Heathkit BASIC Programming Course (EC-1100, $29.95), which is a *must have* if you want to get the most out of the H8 or any other computer using the BASIC language, the complete documentation runs in excess of four inches thick. For example, the basic instruction for connecting a teletype is in one book, the patches (memory data change) for providing the required two stop bits is in a second book, and the real patch for the latest version of basic turns out to be on an addenda sheet. Another inconvenience is the operating guides. If you leave them in the binder and flip to the opposite side you find they are upside down.

What's really needed for the rank beginner at personal computing is a "Big Dummy's Guide To The H8 Computer," with all the most commonly used commands and patches listed under clearly defined headings. With a Big Dummy's Guide a child coould get the H8 up and running in minutes, it's really tha. easy. But as it now stands, with its four-plus inches of documentation, better ha/e someone around with a moderate knowledge of computers. (For example, while most of the world specifies the H8 type of readout as "octal," Heathkit calls it "offset octal." Got any idea how long it took us to figure out offset octal was plain, standard octal?)

Summing Up. Minor complaints and the confusing documentation notwithstanding, the Heathkit H8 is an outstanding value as a personal computer for the student, starting way down at the seventh grade level. With Extended BASIC it is superb for junior and senior high school math. For the student seriously interested in advanced programming and technology it's probably the next best thing to having access to a good time-share system with other languages such as Fortran, PL/1, etc. (It's possible Heathkit is considering other languages in the future, particularly since Bell Laboratories, C-language is coming into vogue.)

The H8 does, of course, lend itself ideally to small business use, but as with all equipments reviewed in ELEMENTARY ELECTRONICS, we look at it in terms of a student and/or hobbyist. In those respects it's a winner all the way. Combined with it s "industrial grade" construction the H8 is an ideal choice for schools at any level.

For additional information circle No. 1 on the reader's service coupon. ■



You may have heard a lot about buss structures. The fact is that Heath supports theirs, and so do other manufacturers, so H8 expansion is as simple as plugging in boards.

Collect Antique DX

Radio stations your grandfather might have logged.

by C. M. Stanbury II

OF ALL THE SHORTWAVE STATIONS on the air at the outbreak of World War II, in 1939, only 13 are still with us. This will probably surprise no one. But what the reader may not know is that almost all of these antique catches can be logged and QSLed on relatively simple equipment. All you need is plenty of listening time and patience.

Stations which take extreme political positions usually have short histories. Of the five oldest members of our group of thirteen, four have taken relatively moderate positions throughout the years. These stations are HCJB of Quito, Equador; the BBC; *Radio Nederland* and *Vatican Radio*. But these days there are tremendous pressures on all shortwave stations to take strong political positions. Early in 1975 HCJB (Quito, Ecuador), probably the most famous of all missionary stations, was being urged to carry the right wing program "Radio Americas Libre." In an exclusive statement, HCJB told us, "they have been sending the program to us for some time, although we do not use it. As HCJB is a guest in the country of Ecuador one of our policies of program content is to avoid political stance either of the right or the left . . . for that reason you have not heard the program, and in all probability will not hear it." There are only a few things in international broadcasting which aren't likely to change but HCJB is one of them.

As government stations, *Radio Nederland* (the oldest SW voice on our list, although others were on MW earlier) and the British Broadcasting Corporation are more political than HCJB. But both have established solid reputations for unbiased newscasts and perceptive commentaries. HCJB is heard on a variety of frequencies but easiest of all to hear is their evening transmissions to North America on 11915 and 9560 kHz beginning at 2000 EST (0100 GMT). *Radio Nederland* broadcasts in English to North America from their Bonaire relay at 2100 EST on 6165 kHz, and at Midnight EST (2100 PST) on 9715 and 6165 kHz. The BBC has more frequencies than you can count, and you can fiind the better ones listed on our table.

Vatican Radio is of course the official voice of the Roman Catholic Church. Although it is not as widely heard as the first three stations detailed, you really shouldn't have any trouble hearing their 15 minute English broadcast to North America at 2000 EST on 6165 and 9605 kHz.

The Exceptions. Two of the stations on our list have at one time or the other taken extreme political positions. Not too surprisingly one of these is *Radio Moscow* which began its shortwave career in the late 1920s shortly after *Radio Nederland* made its high frequency debut. Although *Radio Moscow* has never set up any overseas relays, it is nevertheless received on even more frequencies than the BBC. A few of the stronger ones beamed to North America can also be found on the table.

Radio Nacional at Guatemala city (also known as *La Voz de Guatemala*) is operated by the government of that Central American republic and expresses the political views of whichever regime happens to be in power. During the early 1950s, Guatemala had a Marxist president and at that time *Radio Nacional* was broadcasting some very strident propaganda, in both English and Spanish, to neighboring British Honduras (now Belize), which Guatemala claims. The Marxist government was overthrown in 1954. Today the government is right of center and continues to claim Belize. Currently *Radio Nacional* broadcasts only in Spanish and is best heard late evenings on 6180 kHz.

The gracious old city in Holland, Rotterdam, home of "Radio Netherland," also is the location of the famous Rijksmuseum, which contains many well-known paintings.

Four Commercial Stations. With the exception of HCJB, *Radio Clube de Pernambuco* at Recife, Brazil is the oldest shortwave broadcaster in South America. It broadcasts entirely in Portuguese and is heard from time to time in North America on 11865 kHz. There is occasional daytime reception but the evening hours, when much of the 25 meter interference has faded as a result of the present low sunspot count, are best. Those who like doing things the hard way might also try nightime reception of their 49 meter transmitter on 6015 kHz.

Which brings us to another pair of 49 meter collector's items. CFCX relays medium wave CFCF Montreal, Quebec on 6005 kHz. Traditionally, CFCF/CFCX has never been considered an overly political station but in 1975 they became involved in a battle with the Quebec provincial government over minority English language rights in this predominately French speaking Canadian province. As the whole structure of broadcasting in Canada may now be entering a state of flux, it might be a good idea to log CFCX as soon as possible.

Another 49 meter Canadian relay is CHNX, 6135 kHz, which carries the programs of CHNS Halifax, Nova Scotia. Those who live east of the Mississippi should try for both Canadians during daylight hours before interference builds up. Further west you'll just have to contend with nightime QRM.

HRN, *La Voz Honduras* at Tegucigalpa, is often heard evenings on 5875 kHz which is just below the edge of the 49 meter SWBC band. The Republic of Honduras, not to be confused with the former British Honduras, is experiencing a period of instability. It is badly split between the far right and militant left with a weak government. The situation is so chaotic that it has even caused the rebirth of the legendary *Radio Swan* which, according to the new *Radio Swan de Honduras,* has been aboard a ship, on Swan Island, and now at San Pedro Sula. The point of all this for antique collectors is that in the event of civil war or similar circumstances many commercial stations, including HRN, may wind up relaying government backed *Radio Swan* which would be a real coup for collectors. It's also within the realm of possibilities that the program rejected by HCJB, Radio Americas Libre, could turn up on major stations in Honduras.

Now Things Get Tough. The two

(Continued on page 85)

Control room in the British Broadcasting Company relay station in Antigua. Relays are commonly used to extend signal range.

This shot of the Bush House Control Room operating desk will give you an idea of the vast complexity needed to run the BBC system.

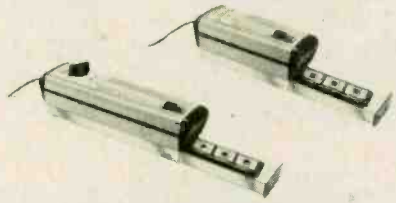
This old house in Reykjavik, Iceland was made of turf and stone around a wooden frame the way houses there were until recently.

Above is the Municipal Palace in Veracruz, one of Mexico's oldest and most interesting cities. The Gulf of Mexico is in the background. At the right is the City Hall in Montreal, Canada. The building is the waterfront district, and City Hall has a special commission to control every physical characteristic in the 100 acre district.

COMPUTER NEW PRODUCTS

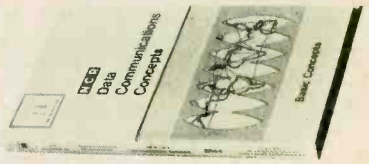
Here in one place each issue of e/e you will find product information on the newest hobby computers and accessories.

A Working Apple—Owners of the Apple II computer are being offered software including a universal Database and Text Editor from Darrell's Appleware House. The Universal Database is unique among many databases offered to hobbyists and businessmen as it is completely user definable. If the data you are storing requires anywhere from one to fifteen alphanumeric fields and two dollar fields in any combination, all you have to do is answer the program's self-prompting questions to define the base for your own use. Thus, you can store names and addresses under one definition, inventories under another, recipes, etc., all with just one program. The program will save your database to tape, and will join another database to it if needed so you can "chain" your data on tape giving you greater storage than your computer's memory alone could give you. The Database will work with either a CRT or printer. The Text Editor, called the Appl-E-ditor, is a word processor that can be user tailored to develop letters, documents, or any forms which will be changed often. Using the Appl-E-ditor an Apple II owner can format a letter, modify one word at a time, wordspace for margin evenness, search for words or phrases, replace lines, insert lines, etc. The user can also save the final document to tape. Darrell's Appleware House has other programs involving many different phases of business and home finance operations. The Database and Appl-E-ditor are both priced at $80.00. You can circle number 54 for more information.



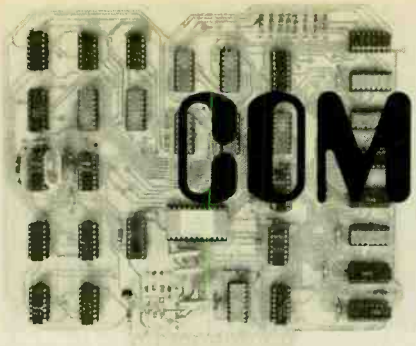
EPROM Erasing Lamps—Two new compact EPROM-erasing ultraviolet lamps are offered by Spectronics Corporation. The Spectroline PE-14 is a small, low-cost UV unit designed especially for small systems users and computer hobbyists. The model PE-14T is essentially the same, but has a 60-minute timer for automatic shut-off. Both lamps erase up to six EPROM chips at one time in as little as 14 minutes. They are said to be the fastest, most efficient personal-size lamps in the industry today, according to Spectronics. Both lamps feature a high-intensity, shortwave UV tube; also a specially designed specular reflector, and an exclusive V-shaped holding tray that maintains up to six chips at a constant exposure distance. These lamps are also claimed to be the safest in the industry with the high intensity tube fully protected within an anodized aluminum housing. A safety interlock prevents the unit from operating when the tray is not fully inserted. A conductive foam pad holds the chip in place during exposure and prevents electrostatic build-up while protecting the chip from possible static charge. Both lamps operate off 115-volt, 60 Hz power. Model PE-14 is priced at $59.50 while model PE-14T costs $84.50, F.O.B. factory, Westbury, NY. Circle 60 on Reader Service Coupon.

Computer Chess—Microchess 1.5, for use with the TRS-80 microcomputer, is offered by Micro-Ware Limited of Canada. Microchess is a 4K Z-80 machine language program utilizing every available byte of user RAM in the TRS-80. The program is designed to load using the CLOAD command. Standard algebraic notation describes the moves to the computer, and every move is verified for legality to prevent user error. A simple command allows temporary numbering of the squares to assist in move entry. The chess board is displayed using the TRS-80's graphics mode. The moving pieces flash before they move to simulate the gradual narrowing of attention on the moving piece as found in human chess play. There are three separate levels of play to challenge all players from beginners to experienced players. Microchess 1.5 is an expanded version of Microchess 1.0 which has been available for the 8080 and 6502 microprocessors. Price: $19.95, postage prepaid. Circle 56 on Reader Service Coupon.



Data Transmission Text—An introduction to the principles, characteristics, and testing of data transmission circuits has been added to the Bugbook Reference Series published by E&L Instruments. The 6 x 9 inch soft cover text contains over 220 pages of practical information for electronic data processing technicians, communications engineering students, and computer hobbyists. BRS-6 concentrates on the properties and limitations of real transmission lines, and explains the corrective techniques used to optimize data transmission performance. Discussed are such topics as filters, equalizers, and other corrective devices. The use and testing of modems and other terminal equipment are discussed. ASCII codes and detailed guides to interpretation of communications circuit specs are presented. The text is designed for classroom use and for home study. Review questions stress key concepts. Price of BRS-6, *NCR Data Communications Concepts* is $6.95. Circle 75 on Reader Service Coupon.

Semiconductor Reference Handbook—Stop guessing about what semiconductor to use in place of a hard-to-find defective component. The 1978 edition of the Archer Semiconductor Reference and Application Handbook, sold at all Radio Shack stores, lists the Shack's complete line of prime-quality Archer-brand semiconductors. It contains a cross-reference listing for replacement of more than 46,000 transistors, diodes and other interchangeable devices. The cross reference/replacement listings are totally computer cross-referenced for greater accuracy and are based on careful analysis of the important parameters of the listed devices. Application information, including actual circuit diagrams, is given for most of the listed IC's; schematics for all clock chips and modules, and detailed information on the 8080A CPU chip. Price: $1.95. Circle 31 on Reader Service Coupon. ■



COMPUTER READOUT

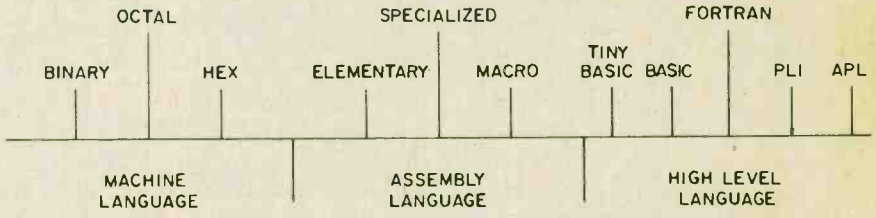
by Norman Myers, Computers Editor

How to speak in computer tongues

☐ OUR JOURNEY THROUGH the changing, progressive field of microcomputers over the last year has introduced us to many different computers and hardware items. But hardware is only half of what it takes to make a computer think, talk, and listen. Software —a word you have heard but may not fully understand—is the other half. True, hardware is the most visible part of any computer, so it is the easiest to talk about. Software is the inside part, the soul of the system. Race car drivers can talk about their engines, wheels, and transmissions on one hand, and talk about their strategy for winning and the way they plan to drive the car on the other. The former is the hardware but it is no-go for winning without the latter—the software. Let's take a good, close look at the basic principles behind software. We will see what the key elements are, and what you should look for in selecting software or selecting a system that uses certain software. When we finish you should be able to carry on a good software conversation with anyone.

Really Just Three. First, the shocker. If someone were to ask you how many different types of software exist for microcomputers, your answer would have to be "an uncountable number." That's right. While I can name a couple dozen program languages, someone else can name many I do not know about, and others can name some that are currently being developed. Each has its own claim to fame, perhaps less storage space required, or it is suited to a particular industrial application. But with so many specific languages, does this mean you cannot stand a chance of understanding what is going on? Not at all. The basic ideas are simple. There are, on the very ground floor of understanding, only three different kinds of computer languages. That is your first lesson—*three* types. The three are called, in order of complexity to use, machine language, assembly language, and high-level language.

Machine Talk. Let's start with the language of machines. How do you communicate directly with a computer? The idea is easy. A microprocessor, the brain part of a computer, is built to recognize "words" or "bytes" made up of 0's and 1's, where the latter are called "bits". A typical processor accepts 8 bit words. Here is the heart of all software.



The three basic types of computer languages are graphically represented here; machine, assembly and higher-level. Each of the three types can be further subdivided into various forms, dialects and subsets. However, the original three divisions will always remain.

Take a string of registers that can each store an "on" or an "off" state until asked to change, present them with an 8 bit word made up of 0's and 1's, then issue a command on a separate data line that says "interpret this word" and the processor compares that word to what it has in its instruction memory until it finds the associated command. With 8 bits per word, a processor can have 256 different instructions.

For each instruction the processor has been designed to perform a certain set of tasks. A typical situation is where one 8 bit word means pull the data out of memory, the next word specifies the memory location, the next word means put that data into the accumulator, and the next says add the value in the accumulator to some other value. So, we have talked *directly* with the processor because we know its language. Like foreign countries, however, different processors (and there are almost four dozen different manufacturers of microprocessors) use different instruction sets. The word 00010010 means *add* for one processor but means *subtract* to another. Companies do try to form a standard, but in a competitive market the object is to have new and better ideas and standardization of instruction sets does not help expand better ideas.

Fortunately, binary 0's and 1's are not the only machine language that can be used. Octal (base 8) and/or hexadecimal (base 16) are used by most computer manufacturers. Remember that in octal a number like 743 is translated to binary by microprocessor as 111 100 011. And a hex number like 3 A F 9 is translated to 0011 1010 1111 1001.

Why use machine code, and why have different types of machine language? First, a small home computer can be very inexpensive compared to a large industrial computer, but one has to expect less capability from it. This means, in some cases, the user has to do more of the work, especially in programming the computer. The luxury of being able to use English words, as with a high-level language, does not exist. Considerable memory, and therefore cost, can be saved in small computers by requiring machine language inputs. And the number code can be entered with nothing but a keypad—a teletype certainly is not required.

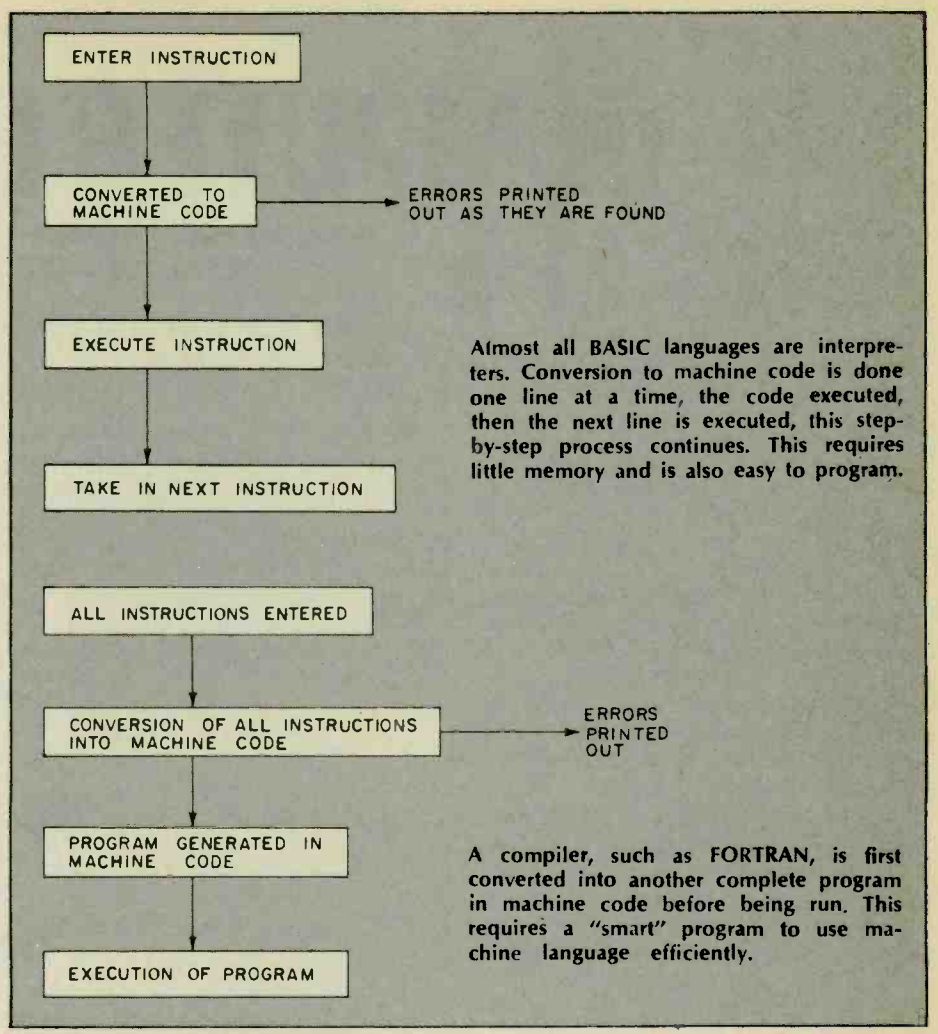
Another reason that such low level codes are still around is that in tough

programming situations a good programmer can "pack" his code very tightly. (Don't let the word "his" fool you here, many super programmers are women.) In other words, a programmer can do a better job of making the program work efficiently if he carefully arranges the machine code himself rather than letting the computer generate the machine code from a high-level language. And finally, there are different types of machine languages for different computer architectures and for different tasks. Drive that drill press, lift that bale, and run those rollers. Different jobs call for different programming problems.

Assembly Language. The first step up the programming ladder is a big one. With assembly language the user already begins using English-like phrases. Instead of writing 076 in octal, the term ACCA for "load contents of register A into the accumulator" can be used. A teletype or a typewriter keyboard is required to enter assembly language, so the terminal cost is fairly high. Is it worth it? Well, if you can memorize all of the octal combinations, then assembly language will not be easier for you to read, but most people want the English language associations with the instructions.

Further, with assembly language the programmer gets a step closer to an important facet of software—the subroutine. If you have a main program that calculates the amount of insulation that can be stuffed into the walls of any house when the outside dimensions and the number of windows are given, subroutines can be useful. The number of windows would logically go to a subroutine called WDWS that automatically calculated the insulation *not* needed due to the space consumed by the windows. That value, say 500 square feet of three inch insulation, would be held aside in memory until needed by the main program.

Subroutines are useful when a repetitious calculation is needed, or when the calculation is very complex and you don't want to complicate a simple program with the complex math. In either case the user just writes the name of the subroutine like WDWS, the program jumps off and does its thing, then jumps back to the main program. Assembly language lets you specify subroutines that are big or small. The really small ones are sometimes called macro-instructions. These are usually given names that look like assembly language, such as SINE for a routine that calculates the trigonometric sine of an angle (SINE 30° = ½) or ADDAB for a routine that adds A and B and leaves the result in the accumulator.



You need a translator to convert the assembly language you write into machine language. To do this the translator—which is actually called an "assembler" in this case—needs not one, but two looks at your program. The first pass through allows the assembler to note all of your symbols and variables. You might have X be your bowling score, Y someone else's, and W the weight of the bowling ball. Once all the symbols are found they are automatically stored by the assembler in separate memory locations. The second time through, the assembler converts the English-like code words into machine language and link-ups the symbols with the instructions where needed. During this conversion a good assembler will find errors in your program and print all of them out for you to correct. You may spell an instruction wrong, or try to add two numbers when you have fetched only one.

Just as there are dozens of microprocessors, there are literally dozens of assembly languages and assemblers. An assembler typically requires two to four thousand memory locations to convert a program and the super assemblers require more. The assemblers are available on punched paper tape, cassette tapes (the best for hobbyists), floppy discs, and ROMs. They range in price from around $20 to several hundred dollars.

The point is that when you choose a home-computer you should consider the types of software available. Assembly language is not for everyone. In fact, only about 15 percent of all microcomputer companies offer *only* assembly language. They know that users generally want more. But if you are planning a programming or scientific career you should become familiar with assembly language because it is a building block. References to get you further into the use of computer languages are listed separately here.

Higher-Level Language Spoken Here. High-level languages are definitely the most popular programming vehicle to-

(Continued on page 82)

DXing the BCB FRINGE

There's DX gold at both ends of the broadcast band rainbow

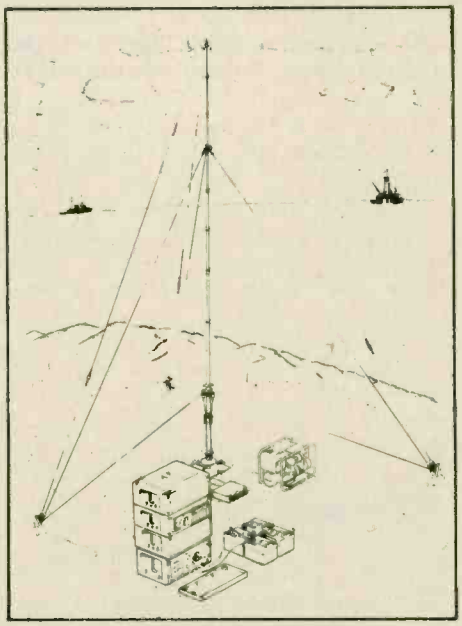
by C. M. Stanbury II

☐ It is now clear that major changes are in store for the standard AM band. Instead of beginning at 535 and ending at 1605 kHz, it will extend from 525 possibly as high as 1800 kHz. The power of U.S. BCB stations will also probably be increased. Million watt medium wave transmitters may even be licensed by the FCC—at least on an experimental basis. Of course none of these changes will effect ordinary listeners before the early 1980s but DXers can get in on the action now.

The Scenario. Although many listeners are unaware of it, the standard AM band has already been extended. We are of course referring to the flea powered Travellers Information Service (TIS) whose transmitters are now licensed to operate on 530 and 1610 kHz. However these tiny stations which keep motorists informed on traffic hazards, weather conditions and such are likely to be buried in the new plan. Just imagine what a million watt transmitter in the western U.S. on 530 kHz would do at night to the Los Angeles TIS already operating on that same frequency. On the other hand, TIS stations are virtually impossible to hear at a distance (they are designed that way) so DXers will certainly not miss them.

The occasion for all these changes is the 1979 World Administrative Radio Conference which will set new frequency and power limits for all bands, or at least all those bands where changes are deemed necessary. Medium wave frequency allocations are made on a regional basis. All regions of the world, except here in the Americas, are already carrying out major changes. We will wait until after that 1979 WARC. Chief backers of the new plan for this hemisphere are the Federal Communications Commission and the U.S. National Association of Broadcasters. The NAB originally saw the new frequencies as the place to begin super powered AM broadcasts in North America: already one such station has been tested (but within the present band). The FCC however wants broadcasters to share there new frequencies with land mobile services presumably including radio navigation systems and the TIS. The NAB, which has always opposed the latter, considers such frequency sharing impractical due to what they describe as uncontrollable interference problems.

Monitoring the New Frequencies. It is at this point that DXers can now get in on the action. How far away can these radio navigation systems be heard? Begin by trying to pick up radio beacon NB at North Bay, Ontario on 530 kHz and RAB at Rabinal in the northern Guatemalan jungle on 1613 kHz. Radio beacons do nothing but transmit their identifiers continuously in morse code. A2 modulation (tone) is used so a BFO (Beat Frequency Oscillator) is not required. And the code is sent so slowly that anyone can decipher the identifier with a little patience. In fact, both NB and RAB are heard in various parts of North America sometimes even on the simplest of AM receivers.



You may never hear this inhabitant of the upper BCB fringe except in certain rare situations. Decca Hi-Fix shore stations send signals that are used to position offshore drilling rigs and survey craft to 25-foot tolerances up to 200 miles offshore. They transmit 5 millisecond pulses of unmodulated 1600 kHz carrier from chains of transmitters.

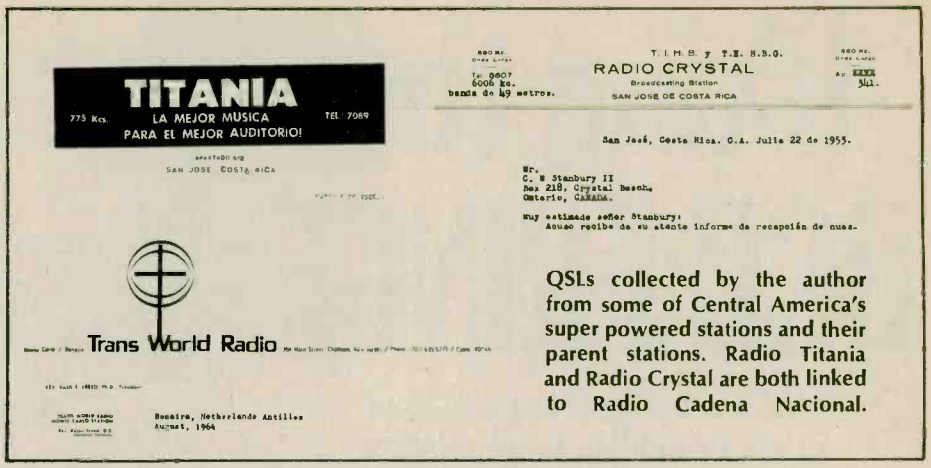
None of the U.S. radio navigation systems operating between 1610 and 1800 kHz are of the simple radio beacon type but instead are all variations on the Decca phase comparison system developed during World War II. Basically, a computer measures the phase differences between three carriers received alternately on the same frequency and from these differences (which are a function of the distance from each transmitter) the exact position of the receiver can be charted. The most common Decca type systems in this frequency range are HiFix (maximum power 40 watts) and the more portable MiniFix with 16 watt transmitters. These systems are used primarily for map and hydrographic chart making as well as harbor navigation.

Because HiFix and MiniFix do nothing but turn unmodulated carriers on and off, they don't necessarily make any sound at all. However if there is interference from another station on a nearby frequency the resulting hetrodyne will produce a beep effect. Other more sophisticated Decca systems, some of which use more than one frequency, will produce continuous tones, continu-

ous open carriers or assorted chirps and wails. In short, the frequencies between 1610 and 1800 kHz are filled with sounds one might expect to find in a science fiction movie. The majority of DXers would not be sorry to see any of these stations go as none of the systems ever identify themselves.

However if you have a receiver that will tune above RAB, there are other Latin American beacons which occasionally get through the sci-fi interference. These include MDE Medellin, Colombia on 1690 kHz, BGA Bucaramanga, Colombia on 1670 kHz, and ESM Esmeraldes, Ecuador on the same frequency.

Clandestine. Meanwhile whatever plans the FCC may have for this frequency range, it remains the favorite territory for North American pirates. And during the past couple years a new breed of pirate radio station has appeared on the scene—the phone freak. This type of clandestine operation features a phone-in format and involves tampering with the phone circuits so that the number announced on the air cannot be traced back to the pirate. The first such station, WCPR, broadcast from New York City beginning late in 1976. It was busted a couple months later but a similar pirate was noted back on the air from NYC in November 1977 on 1620 kHz. This time the call letters were WDDX.



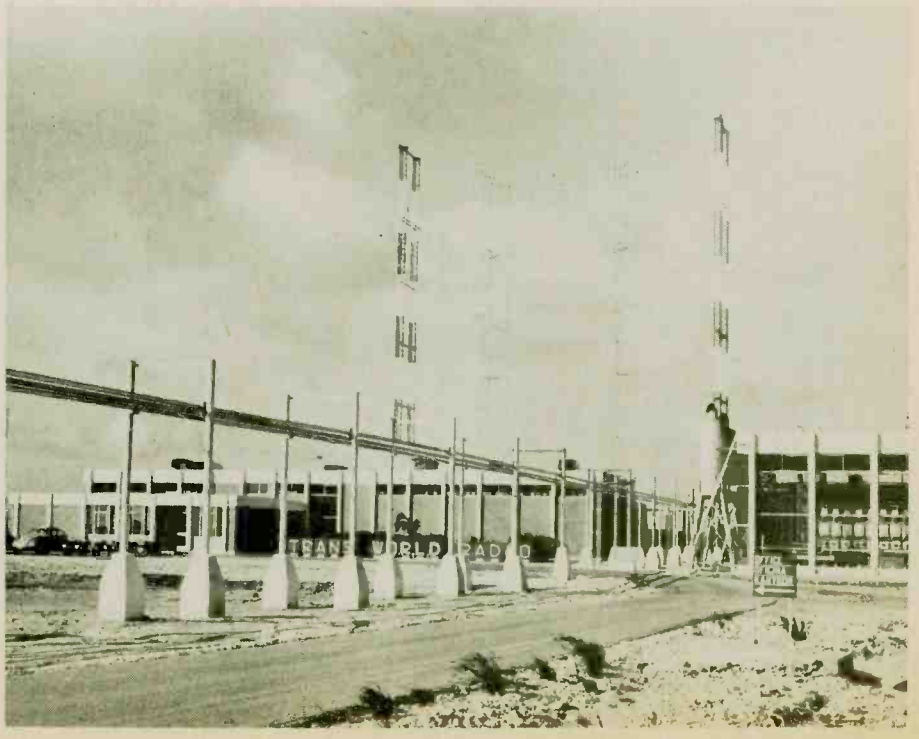
QSLs collected by the author from some of Central America's super powered stations and their parent stations. Radio Titania and Radio Crystal are both linked to Radio Cadena Nacional.

Of course fun and games from pirate transmitters is nothing new. One of the first bootleg operators the author logged above 1600 kHz, back in the 1950s, later told us that he had visited the Nibi Nibi area and regretted that he had been unable to later accompany a scientific expedition to the island during an eclipse. For the uninitiated, Nibi Nibi was the fictional home of an infamous hoax station.

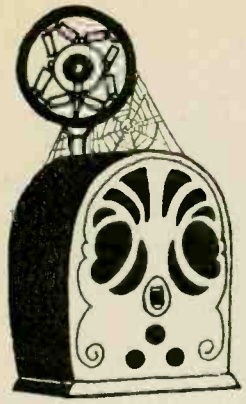
Costa Rica. As noted earlier, a million watt medium wave transmitter has already been tested in North America. That was from San Jose, Costa Rica on March 8, 1976 under the name Radio Million. The background of this test was previously detailed here in ELEMENTARY ELECTRONICS ("Secrets of Split Frequency DX," Sept.-Oct. 76 e/e). Subsequently that test developed into the bitterest controversy ever in DX circles (one major club has even banned mention of the station's name from its bulletin)—not so much as a result of technical issues raised by the power (although they certainly are important) but because of attempts by the station to prevent anyone from asking questions about the purpose of the test or about those connected with it. One spokesman for Radio Million, himself a very proficient DXer, even claimed that no DXer had the right to ask questions about secret aspects of any broadcast operation, and then went so far as to raise again the issue of the Bay of Pigs station, Radio Swan.

Needless to say we did ask questions and have now come up with some of the answers. Radio Million tested on 625 kHz which in 1976 was normally

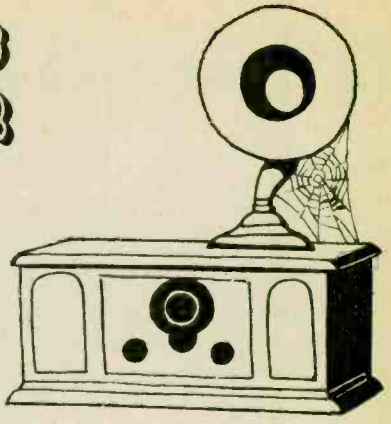
(Continued on page 98)



Trans World Radio's massive antennas beam 500 kilowatts medium wave and 250 kilowatts shortwave from the Bonaire, Netherlands Antillies station. This station also relays transmissions for Radio Nederland.



ANTIQUE RADIO CORNER



Atwater Kent—the man and his radios

By James A. Fred

☐ HELLO OUT THERE IN RADIOLAND. Before getting into the technical part of this column I would like to tell you about two radio collectors meetings that I attended this summer. At these meetings I was able to meet with a great many collectors and learn much about antique radios. I also learned about one of radio's great names: Atwater Kent.

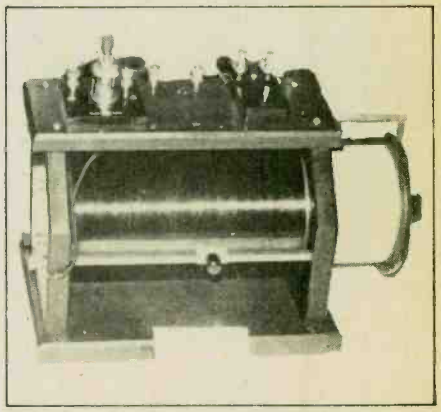
Get Togethers. The first meeting we attended was the Southeastern Regional Conference of the Antique Wireless Association held on June 9 and 10 at Winston-Salem, NC. All radio collector meetings follow nearly the same format: seminars, flea market, an old equipment contest and a banquet. I like to attend these meetings and drove over 1,250 miles getting there and back. This is how I meet my readers and find out what they like and dislike about my articles on antique radios. I also have the opportunity to see what is for sale and what the trend in prices is. It is needless to say that prices are up from 1977. One of the outstanding programs was a presentation by Ralph Williams, Wayne, PA, titled "Atwater Kent Radios Speak for Themselves." I well tell you more about this later.

The second meeting we attended was the annual conference of the Antique Radio Club of America, held at King of Prussia, PA, on June 15, 16, and 17. Most of the people attending this conference were different from the ones in Winston-Salem so the seminars, programs, etc., were different. The flea market was much larger and was held outdoors. On Saturday evening Ralph Williams once again presented the Atwater Kent radio program.

Atwater Kent. I think some background information on Atwater Kent's early life will be interesting to most collectors before we get into a discussion of Mr. Williams presentation.

Arthur Atwater Kent was born on December 3, 1873 in Burlington, VT, and died in his home in Los Angeles, CA on March 4, 1949. He showed an early interest in mechanics and electricity and in the fall of 1895 he enrolled in the Worcester Polytechnic Institute in Worcester, MA. He apparently didn't attend classes long enough to earn a diploma, but he returned in 1926 to receive an honorary Doctorate degree.

In 1895 he founded the Kent Elec-



This crystal radio receiver won first place in its class at this Winston-Salem, NC, event.

tric Manufacturing Company. Some of the products he made were electric fans, electric motors, and generators.

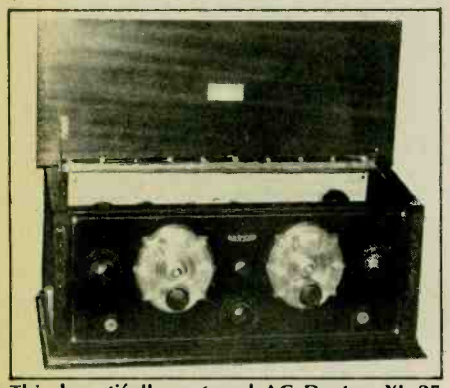
In 1902 he founded his second company, the Atwater Kent Manufacturing Works in Philadelphia, PA. He made batteries, battery testers, and inter-office telephone systems. One of my collector friends, Alan Douglas, has a 1902 Monoplex telephone which may be the only one now in existence.

Purchasing one of the early automobiles led to Atwater Kent becoming a millionaire. His automobile was plagued with ignition troubles which led him to a series of inventions related to gasoline engine ignition systems. During WWI he manufactured ignition systems for cars and trucks as well as many items for the Ordinance Department.

After WWI ended he anticipated a

At an IHRS collector club meeting at Auburn, IN the auction attracted a large number of buyers. Auctions are one of the most popular features of radio collector club meetings.

boom in the automobile business which never materialized. Since radios were becoming popular he started to make headphones and then decided to make a complete line of radio components. Experimenters began to build home made radios with these parts and after Atwater Kent made his first home made radio he realized the potential in radio manufacturing. His first factory assembled radio set was the Model 5. It was made with the components mounted on a polished wooden mahogany board. He made 100 Model 5's which he sent to his wholesale auto parts dealers as demonstrators to gauge



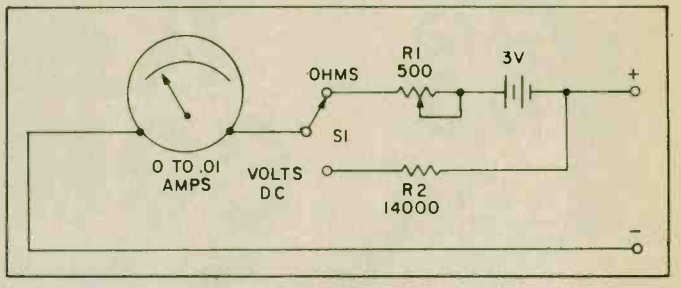
This beautifully restored AC Dayton XL 25 radio receiver was built in Dayton, Ohio in 1926. It cost over $125 even back then.

the public reaction to his radio receivers.

One Channel. His first sets were simple in design because all the stations were on the same frequency, 360 meters, which corresponds to about 840 KC on our present broadcast band. Stations shared time with each other to prevent interference with each other. This soon proved to be impractical as more stations went on the air so a band of frequencies were made available and each station was assigned its own frequency. It became necessary to build radios that would tune in and separate all the stations. The result was a five-tube radio, the Model 10, with three-dial tuning. This radio was so popular that it soon reached volume production. He also produced the Model 9, a four-tube set, and the Model 12, a six-tube set. There were also horn speakers to match the radio sets. These radio receivers were called "Open Sets" because the components were mounted on a wooden board without a cabinet; now they are called "Breadboard Radios."

Mr. Williams had a Model 5 and horn speaker, a Model 9 and horn speaker, and a Model 10 with a type "E" magnetic cone speaker. Now the housewife was asking for an enclosed radio because she was afraid to dust the breadboard radio. This point in time was represented by a Model 30, table model in a cabinet, battery operated radio with a magnetic cone speaker. Next the housewife wanted to do away with spilled battery acid from the storage battery that lit the filaments and the expensive "B" batteries that last only three to six months. It was at this time the AC line operated radio made its appearance. The first AC operated radios used the same type magnetic speaker that the last battery sets used. Soon, however, the dyanamic speaker with its superior tone quality and power handling ability made the magnetic speaker obsolete. There were also new developments in vacuum tubes such as the screen grid tube that had more gain than the older three-element triode tube. Mr. Williams had a model 55, metal cabinet, table model with screen grid tubes to illustrate this trend. Finally the superhetrodyne radio proved to be far superior to the previous Tuned Radio Frequency (TRF) radio and so the last radio shown was a superhetrodyne, wooden cabinet, table model, with shortwave bands. This set was made a year or so before Atwater Kent closed his factory forever in 1936.

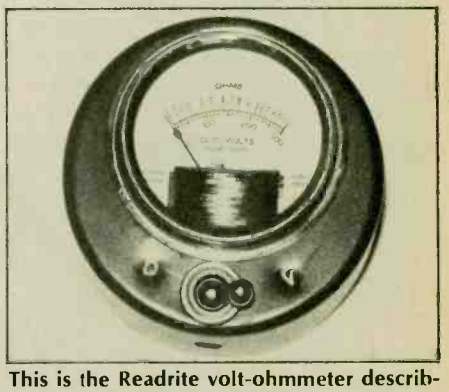
This ultra-simple antique volt-ohmmeter can read from zero to 5000 ohms and from zero to 300 volts DC. An SPDT toggle switch selects the appropriate range on the meter.



Radio programs from the period each radio represented were assembled on tape. A tape player then fed the program into a wireless oscillator that broadcast each program into the antenna circuit of each radio so the complete radio was operative just as it was when new. I am very interested in the history of radio from 1920 to 1942 so I was quite pleased with this new insight to Atwater Kent and his radios.

Amateur Radio Antiques. Many radio collectors are Amateur Radio Operators too, and they are now building replicas of the transmitters used in the 1930's. There are even some amateur collectors who still have the 1930's transmitters they once used. There are and transmitters. Any collector who is interested in building this type equipment need only look into the 1930's radio handbooks or magazines to find designs he can use. There are still plenty of copper tubing coils, old tubes, tuning condensers, meters, etc., for building these replicas. If you are a radio ham (amateur slang) why don't you get busy and build your old time transmitter? You will have a lot of fun with it.

More Meters. In our last Antique Radio Column we introduced you to electrical meters and told you how to build your own Ohmmeter. In the meantime I found an old (possibly 1923 to 1925) Readrite Combination DC voltmeter and Ohmmeter. It is shown in one of the photos. All that was left was the metal case and meter movement. Based on past experience I reconstructed the tester and show it here as an example of how simple the equipment used by the old time radio repairman was. If any reader has a similar tester or the picture, advertisement, or



This is the Readrite volt-ohmmeter described in the text. The test leads haven't been attached yet. They will come out through the hole under the switch on the panel.

literature of a similar one, I would enjoy seeing a copy of the material.

So long for now. If you have any questions or suggestions for this column just send them in. Send the letter to me in care of ELEMENTARY ELECTRONICS magazine. Be sure to include a stamped, self-addressed envelope unless you live in Canada. I cannot mail a letter with a Canadian stamp on it. ■

e/e checks out the...

PERCOM CIS-30+

Peripheral peace-maker ends computer/recorder mismatches

☐ Owning a bunch of interconnecting computer devices is like being the parent of 4 or 5 unruly children. Monitors, printers, and other assorted computer add-ons are notoriously incompatable, but the biggest trouble maker in most computer families is the cassette recorder. This innocent looking device never seems to be able to get along with anything unless its computer has a built-in cassette recorder interface. If it doesn't have one using an external computer/recorder interface can be a test of patience, skill, and the ability to bear failure after failure.

The biggest problem with computer/recorder interfaces is level control. If the recorder's input level to the interface isn't too high then it's too low; if the output from the computer to the recorder isn't so low that it allows tape noise to produce "trash" on the playback, then it is often so high that it distorts and produces harmonic "trash." When, after many trials and errors, you finally have it going right, it turns out that you didn't flip the correct switch the correct way, or the recorder didn't start, or any of a host of possible problems caused the system to break down.

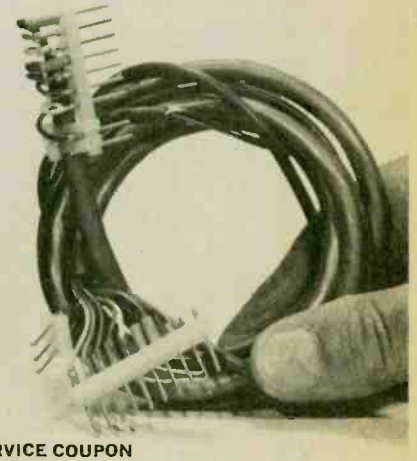
In short, until we got our hands on the PerCom CIS-30+ cassette interface for 6800 computers—in particular the SWTP 6800—we were less than thrilled with the add-on Kansas City cassette interfaces systems. But the PerCom CIS-30+ has changed all that. It is a remarkable device; extremely easy to use and set-up, and most important, virtually goof-proof.

Operation. The PerCom unit is housed in a cabinet 4.25-in. wide by 2.1-in. high by 5.25-in. deep. It is completely self-contained except for the +5 and −12 VDC power sources which are provided by the host computer. It contains essentially two I/O interfaces in a single cabinet: for a data terminal and a cassette. The cassette I/O has independent record/playback circuits, thereby permitting dual cassette operation—playback from one recorder while recording on the other.

Unlike other Kansas City interfaces which provide for only the standard 300 baud rate, the PerCom has switch-selected rates of 300 (allowing interchange of recordings with other Kansas City systems), 600, and 1200. The 1200 baud rate is really a biggie if you can use it because it allows 4K of core to be dumped or loaded in only 40 seconds. Doing the same thing at 300 baud seems to take forever. Unfortunately, the *mikbug* monitor in the SWTP 6800 computer cannot load at 1200 baud, but PerCom provides a listing for software that permits dumping and loading in binary format at 1200 baud.

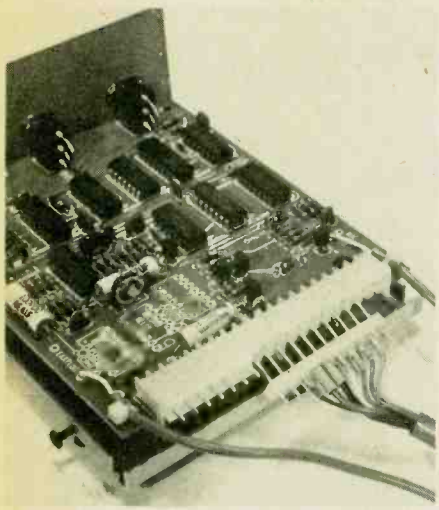
But assuming you don't want to get involved in 1200 baud operation because the data terminal must operate at the same baud rate as the recorder (if you don't want additional work and effort), let's stick to the 300 baud standard.

Note from the photographs that the PerCom has only three switches and a LED indicator between the *Terminal*



CIRCLE 58 ON READER SERVICE COUPON

As far as operating controls are concerned the PerCom-30+ recorder interface is the least confusing and easiest to use. Unlike other Kansas City interfaces, which are limited to the rather slow 300 baud rate, the PerCom can be used at 300, 600, and 1200, though 1200 requires some software adaptation with most 6800 based computers. For these owners an optional prewired connecting cable is available for $11.95. You save a lot of time, effort, by using the cable. Order the cable at the same time as the interface. For more information Circle No. 58 on the reader service coupon.



To connect the PerCom to your 6800 computer you plug one end of the connecting cable to the computer's I/O and the other end into the PerCom's Molex connector. That's the whole bit. There are no adjustment or alignment procedures other than making sure the playback level from the recorder causes the LED on the front panel to flicker as data is fed from the recorder; the LED should be neither off nor full on—the level that produces the flicker is the correct adjustment for the unit.

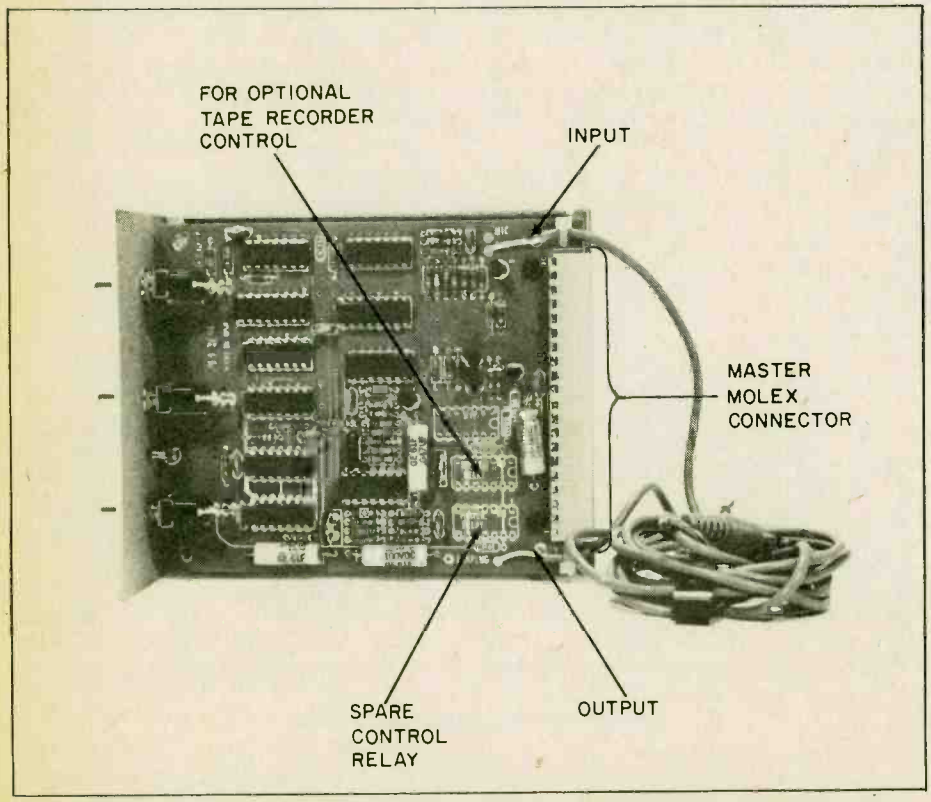
and *Tape* switches. These are the only switches you'll use if the *Rate* switch is set to 300 baud. When the *Terminal* switch is set for *Local* the associated terminal connects to the cassette recorder and vice versa—allowing the cassette data to be displayed on the terminal. When the switch is set to *Line* the terminal and the recorder are connected to the computer. When the *Tape* switch is set to *Auto* the computer can automatically switch the interface between the data terminal and the cassette input (for recording). For playback, the *Tape* switch is set to *On* (the cassette recorder is manually started), allowing input from both the data terminal and cassette. Proper level from the recorder to the interface is attained when the recorder's playback level control is adjusted so the LED on the PerCom flickers as the data is transmitted. The LED should neither be out, nor permanently on. There is no problem loading any K.C. tape if the lamp flickers (which cannot necessarily be said of other interface systems).

For those so inclined, the PerCom can be easily adapted with inexpensive optional components to provide remote control via the computer for two recorders; one for play, the other for record. (More on this later.) For the user who doesn't want to get involved in wiring and software, you can simply flip the recorder on and off manually to record (save) and load programs. The most you'll have to do is move the *Tape* switch from *Auto* (record) to *On* (play). Nothing could be easier.

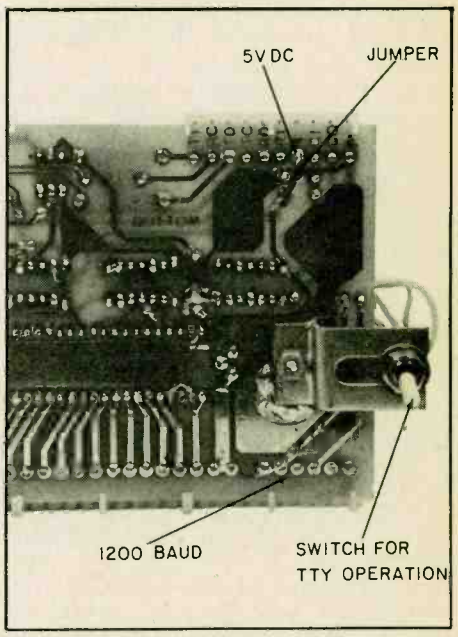
Installation. All connections to the interface are made through the Molex connector strip on the rear. Connection to the SWTP computer is made by plugging in to the MP-C or MP-S interface card in the SWTP computer. (Detailed instructions are provided for connecting to other 6800 CPU based computers, such as the MITS 680b.) A set of optional cables for the SWTP computer is available; we suggest you order them because they save a lot of cable preparation and eliminate the possibility of wiring errors.

Power is obtained from the MP-C interface card. The −12 VDC is already on the connector strip. The 5 VDC is obtained by adding a wire jumper from the regulated 5 VDC source on the MP-C card to the "dead" index

(Continued on page 83)

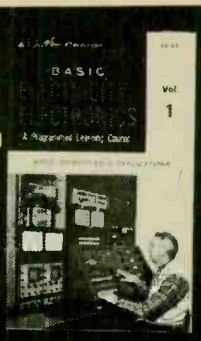


If you want computer-control of the tape recorders you simply install the components of an optional kit where indicated on the PerCom's PC board. There are no kluge connections or outboard wiring; all control components fit right on the board with the control circuits available on the "master" Molex connector on the back of the PC board. The shielded cables shown are the factory installed input and output for the recorder(s).



The −12 VDC voltage for the interface is already on the SWTP's I/O connector. The +5 VDC is attained by using what is normally the index pin. A jumper puts +5 VDC on this normally "dead" pin. The cable to the PerCom 30+ picks up the ..5 VDC along with the −12 VDC. The 1200 baud clock required for all three interface rates is obtained by cutting through the PC wiring to the 300 baud clock terminal going to the I/O's Molex connector and soldering a jumper from the 1200 baud clock (available on the Molex even though not normally used) to the PC wiring. The switch mounted on a bracket is a modification not for the PerCom) that shifts the I/O for TTY operation. (It replaces several jumpers normally used on the MP-C interface card.)

E/E BASIC COURSE IN ELECTRICITY & ELECTRONICS



E/E shows you how to be your neighborhood's Alexander Graham Bell. This issue's course teaches you the theory of operation behind this society's most ubiquitous tool of communication—the telephone. Understanding the electrical principles behind phone operation need not be hard and our editors make it as easy as dialing a digit!

This series is based on material appearing in Vol. 1 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. 36268.

HOW YOUR TELEPHONE WORKS

Everyone knows how to use a telephone—but do you know what makes it work? A telephone is really a simple electric circuit. Parts of the circuit convert sounds into electrical signals and other parts change the electrical signals back into sounds. This process enables us to transmit and receive messages for extremely long distances and with great reliability. You already are familiar with the different parts of a telephone (mouthpiece, earpiece, etc.) but by the time you finish this article you will have gained an understanding of how these parts work. You will also learn how they are all connected together into an operating system!

THE MECHANICAL TELEPHONE

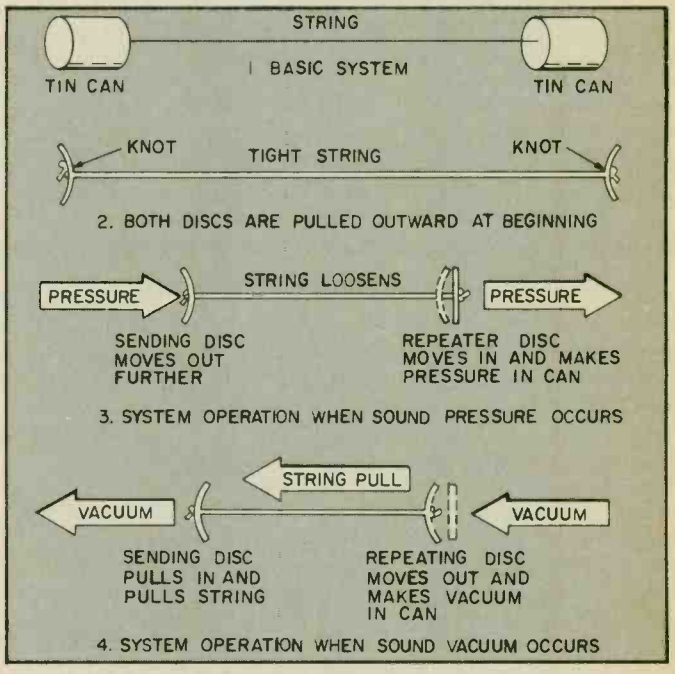
Have you ever built a mechanical telephone using a pair of tin cans and a length of string? If you have, you know sound can be transmitted through a string. As crude as this mechanical system is, it demonstrates many of the principles used in the modern telephone.

The figures in the box below illustrate how a mechanical telephone system operates.

Note that the key part of the mechanical telephone system is the flexible metal disc at the bottom of each can. Speaking into the can causes sound waves to strike the disc and make it vibrate.

The vibrations from one disc are carried to the other disc by a tightly stretched string. The second disc repeats the in-and-out motions of the sending disc and develops varying air pressures in the can. These are sound waves which are crude reproductions of the original sound waves.

SIMPLE MECHANICAL TELEPHONE



QUESTIONS

1. **Vibrations, representing sound, travel down the string of a(an) ..... telephone system.**
2. **....., representing sound, travels down the wires of an electrical telephone system.**

ANSWERS

1. Vibrations, representing sound, travel down the string of a **mechanical** telephone system.
2. **Electricity** (or electrical signals), representing sound, travel(s) down the wires of an electrical telephone system.

Principles of sound

A study of the basic principles of sound reveals how a mechanical (or electrical) telephone system works. Sound is made up of vibrations. Differences in sound are determined by their **frequency**—the number of times per second a sound vibrates. A high tone (a shriek) has a frequency of only a few hundred vibrations in a second.

Each tone has a specific frequency. A tuning fork, for example, vibrates and creates a sound tone at the frequency for which it was designed. The same is true of piano or violin strings, the skins of a drum, or your vocal cords.

Air consists of a large number of extremely tiny particles, several million per cubic inch. When sound causes these particles to vibrate, they alternately pack together and fly apart at the frequency of the sound. Packing together creates instantaneous areas of high pressure and flying apart develops a condition of less-than-normal pressure (approaching a vacuum).

As the areas of changing air pressure strike other adjacent air particles, the process is continued. This is the manner in which sound travels through air. When

the changes in air pressure strike a flexible disc (or **diaphragm**), it vibrates. The vibrations are at the same frequency as the original sound.

In the mechanical telephone, the sending disc transmits its vibrations to a tightly streched string which, in turn, sets up the same vibrations in the receiving disc. In the modern telephone, proper design and the use of electricity result in excellent reproduction of sound.

QUESTIONS

3. Frequency of a sound indicates the number of times it will ..... in a .....

4. Sound vibrations set up corresponding changes of air .....

ANSWERS

3. Frequency of a sound indicates the number of times it will **vibrate** in a **second.**
4. Sound vibrations set up corresponding changes of air **pressure.**

THE ELECTRICAL TELEPHONE SYSTEM

The basic telephone system consists of a **mouthpiece** connected to an **earpiece** by electrical wires. This system permits conversation in one direction only. For two-way conversation, each end of the system requires a mouthpiece and an earpiece.

Sound Into Electricity

There are two basic methods of converting sound into electrical signals. One method causes current already flowing in a circuit to vary in accordance with the frequency of the sound. The other method converts sound into a varying voltage which, in turn, causes a varying current to move through the circuit. How each method is accomplished will be discussed further.

When the current signals (varying at the rate of the sound) arrive at the earpiece, the process is reversed. If the signal is the type superimposed on an existing current, the variations are received by a material that expands and contracts with the signal frequency. If the mouthpiece develops a voltage to cause a fluctuating current, the current develops a similar voltage in the earpiece.

Basic Parts of a Telephone

The working parts of a telephone mouthpiece (often called a **transmitter**) and an earpiece (sometimes called a **receiver**) are usually identical. The mechanism or material used to produce a varying current depends on the method used. Since all vibrations enter or leave the telephone as changes in air pressure, the transmitter and receiver both contain a diphragm. Other parts of the mouthpiece include wires, terminals, and materials to hold the parts together.

Connections

In a large telephone system, several lines are connected through a switchboard.

QUESTIONS

5. A(an) ..... connected to a(an) ..... by wires is the simplest telephone system.

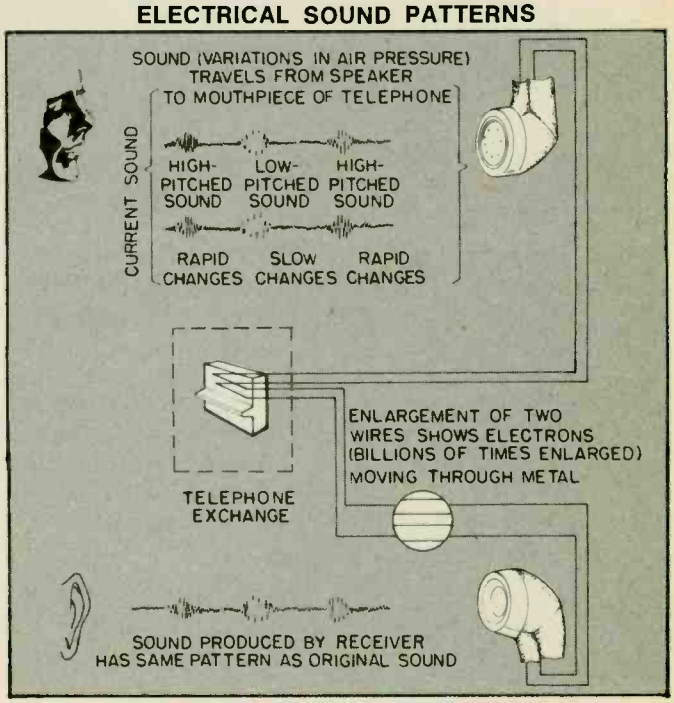
6. ..... in a telephone line varies at the frequency of the original sound.

7. Vibrating air pressure strikes a(an) ..... in the (mouthpiece, earpiece)

ANSWERS

5. A **mouthpiece** (or transmitter) connected to an **earpiece** (or receiever) by wires is the simplest telephone system.
6. **Current** in a telephone line varies at the frequency of the original sound.
7. Vibrating air pressure strikes a **diaphragm** in the **mouthpiece.** The earpiece diaphragm causes vibrating air pressure.)

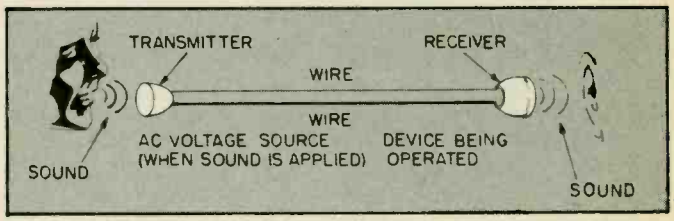
ELECTRICAL SOUND PATTERNS



COMMERCIAL TELEPHONES

As you can see in the illustration, a telephone system is actually a simple circuit.

THE BASIC TELEPHONE CIRCUIT



In most commercial (home) telephones, the mouthpiece and earpiece are contained in a single handset. An exploded view of the main parts of a handset is shown.

The transmitter contains a diaphragm resting against **carbon granules** (grains). The granules are loosely packed with enough freedom to expand and contract in volume.

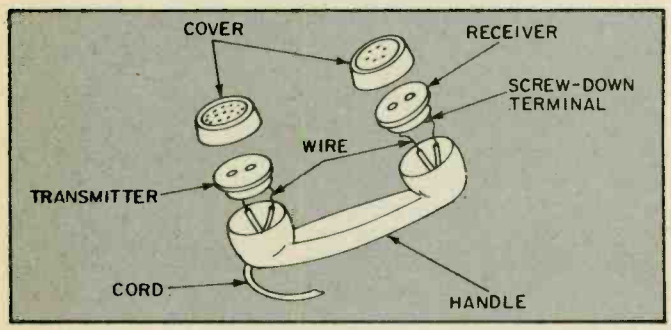
Transmitter Operation

Part A in the illustration shows a drawing of the transmitter with no sound applied. Part B demonstrates what happens when sound strikes the diaphragm.

When the handset is lifted from its cradle, a steady current from the phone system starts to flow through the carbon granules. Sound striking the diaphragm

places a varying pressure on the carbon. When the granules are packed tightly, current in the circuit increases. When the diaphragm releases its pressure, the granules become loose and less current flows.

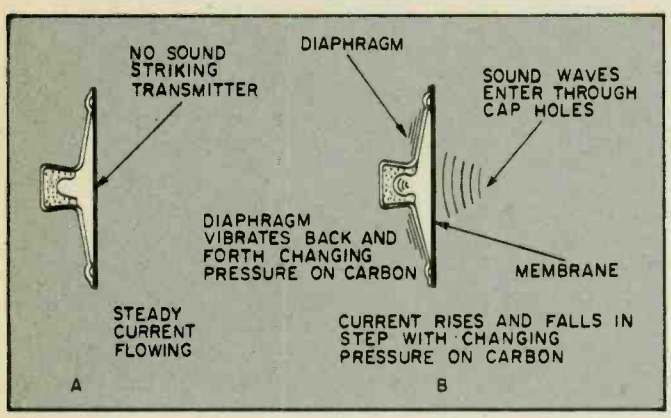
A BASIC TELEPHONE HANDSET



The transmitter diaphragm vibrates in response to the frequency of the sound. Packing and loosening of the carbon follow the vibrations of the diaphragm, and current in the phone line varies with the density of the carbon. Therefore, the current varies at the same rate (frequency) as the original sound.

In a commercial system, the varying current is routed to the desired receiver through a central telephone office.

TELEPHONE TRANSMITTER OPERATION



QUESTIONS

8. When a commercial telephone handset is lifted from its cradle, a(an) .... flows through the transmitter.

9. When the carbon granules in the transmitter become more densely packed, (more, less) current flows.

10. At what rate does the current vary in the phone line during a conversation?

ANSWERS

8. When a commercial telephone handset is lifted from its cradle, a **steady current** flows through the transmitter.

9. When the carbon granules in the transmitter become more densely packed, **more** current flows.

10. **During** a conversation, **current varies at the same rate, or frequency, as the original sound.**

Receiver Operation

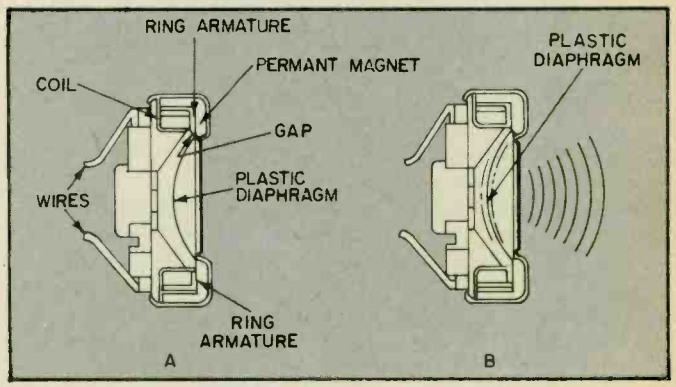
The method of converting the current back into sound is slightly different. Part A in the illustration shows a typical receiver used in a commercial phone system.

Part B shows that the diaphragm vibrates when a sound-varying current passes through the receiver. The current passing through the coil develops a magnetic field which varies in strength and the changes in current. Thus, the field developed by the current periodically repels and attracts the steady magnetic field of the permanent magnet, causing the magnet to which the diaphragm is fastened to move back and forth. This action reproduces the original sound.

SOUND-POWERED TELEPHONES

Another application of a simple electrical circuit is the sound-powered telephone system. It is used only for short distances because of its limited range.

TELEPHONE RECEIVER OPERATION



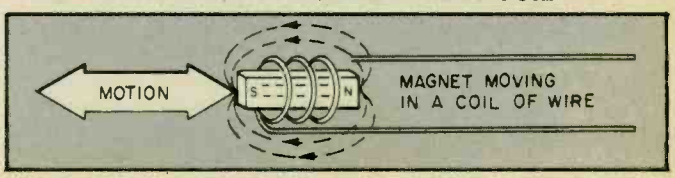
Induced Current

Transmission takes place in sound-powered phones because of the ability of a magnet to **induce** current in a coil of wire. A bar magnet has a north (N) and a south (S) pole. Actually, when the magnet is suspended in air, the north end of the magnet points toward the north geographic pole. Such a magnet has a magnetic field existing in the space surrounding it, with the lines of magnetic force taking the directions shown.

The next illustration shows a bar magnet being moved back and forth inside a wire coil. As the magnet moves, its magnetic lines of force cut across the turns of the coil. This causes an induced current which will actually flow if the ends of the coil are connected to a circuit.

The current reverses direction each time the motion of the magnet changes direction. The amount of current that flows depends on the strength of the magnetic field, the number of turns in the coil, and the speed at which the magnet is moving. Increasing any of these factors increases the amount of current.

INDUCING A CURRENT IN A COIL



QUESTIONS

11. Current flowing in phone lines at the time when no sound is present is (DC, AC).

12. **Current flowing during sound transmission is (DC, AC).**
13. **What causes a receiver diaphragm to vibrate?**
14. **A magnet is surrounded by magnetic ..... of .....**
15. **A magnet moving inside a coil ..... current in the coil.**

ANSWERS

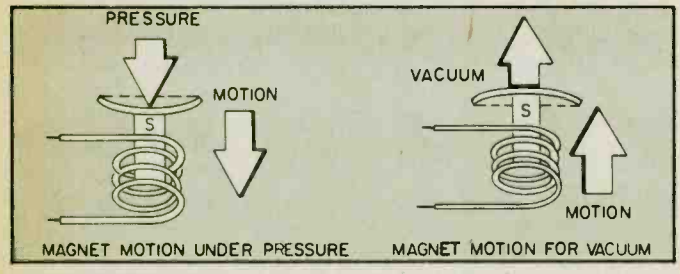
11. Current flowing in phone lines at the time when no sound is present is **DC.**
12. Current flowing during sound transmisison is **AC.**
13. A varying current develops a changing magnetic field which repels and attracts a magnet connected to a diaphragm.
14. A magnet is surrounded by magnetic **lines of force.**
15. A magnet moving inside a coil **induces** current in the coil.

The transmitter of a sound-powered phone makes use of the induced-current principle.

As shown, a bar magnet is fixed to the center of a diaphragm. The diaphragm is fastened to the transmitter in such a way that the magnet is over the center of the coil.

As in other phones, this diaphragm vibrates at the frequency of the sound waves striking it. As it vibrates, the bar magnet moves back and forth within the coil. This induces a current which changes direction at the same frequency as the sound. If the transmitter is connected to a sound-powered receiver, current will flow back and forth through the circuit.

A DIAPHRAGM-OPERATED MAGNET



QUESTIONS

16. **The amount of current induced in a coil can be increased in two ways. Describe them.**
17. **A sound-powered phone system (does, does not) have current flowing in the connecting lines during a silent period.**
18. **Why will the induced current in this system change at the same frequency as the sound?**

ANSWERS

16. Induced current can be increased by **adding more turns to the coil or increasing the magnetism of the magnet.**
17. A sound-powered phone system **does not** have current flowing in the connecting lines during a silent period.
18. Induced current changes at the rate of the moving bar magnet. Since the magnet is fastened to the diaphragm, the induced current will change at the same frequncy as the sound.

Sound-Powered Receiver

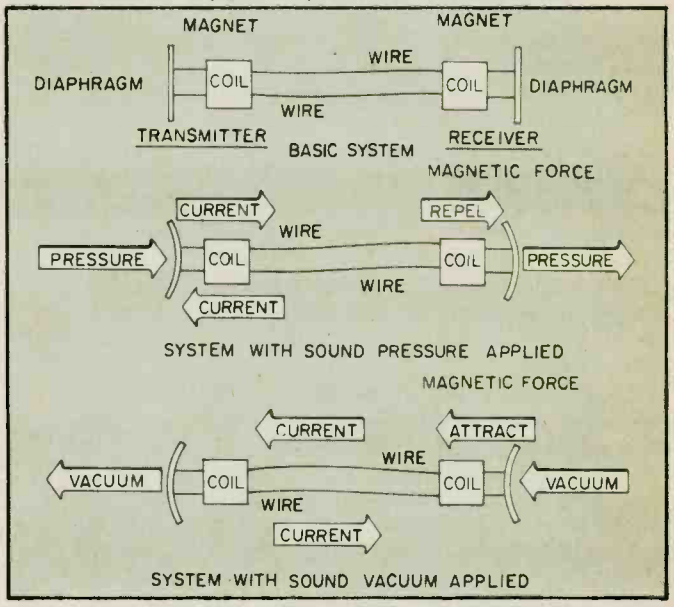
The mechanism in the receiver is identical to that in the transmitter—a coil, a magnet and a diaphragm. Current flowing back and forth in the receiver coil develops a changing magnetic field. The bar magnet responds by moving back and forth at the same frequency as the current, causing the diaphragm to reproduce the original sound.

Sound-Powered System

The illustration shows the transmitter and receiver connected together as a working system.

The two bottom figures demonstrate how the induced current changes direction with the motion of the transmitter diaphragm. The corresponding effect upon the receiver diaphragm is also shown.

BASIC SOUND-POWERED TELEPHONE



WHAT YOU HAVE LEARNED

1. A basic telephone system uses all the principles of a simple circuit.
2. The operating principle of any telephone system is the ability of the transmitter and receiver diaphragms to vibrate in unison. The transmitter is the cause and the receiver is the effect.
3. Sound vibrates at a frequency determined by its pitch.
4. Sound vibrations cause changes in air pressure.
5. Changes in air pressure cause a thin metal or plastic diaphragm to vibrate. A vibrating diaphragm also cause changes in air pressure, producing sound.
6. In a commercial phone system, a steady current flows through the circuit during periods of silence. This current is varied when sound waves strike the diaphragm, the resulting vibrations exerting and releasing pressure on carbon granules.
7. At the receiver end, the changing current produces a varying magnetic field which repels and attracts a magnet connected to a diaphragm. This action reproduces the original sound.
8. Another type of phone is the sound-powered system. This type uses induced current for signal transmission.
9. An alternating current is induced in a coil by the back-and-forth motion of a magnetic field.
10. A sound-powered transmitter develops an induced current caused by the vibrations of a diaphragm. ■

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!

Top-of-the-Line CB

Midland's top-of-the-line 40-channel mobile CB, Model 77-889 features an innovative direct reading, high-intensity fluorescent signal/power/SWR meter which replaces conventional needle and pin meters. The 77-889 also features dual pushbutton electronic channel changers—channel "up," channel "down" buttons on both the mike and the face of the unit—plus channel 9/19 priority switching. Channels are displayed with a large-scale LED digital 40-channel indicator. Transmit gain is offered for maximum transmit clarity, eliminating the need for a power mike. RF gain adjusts receiver sensitivity. In addition, the 77-889 offers a built-in SWR bridge and calibrator to aid in matching

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antenna to transceiver for best performance. An Antenna Warning Indicator (AWI) warns of antenna failure or mismatch. Priced to sell at $259.95. For further information on Midland's Model 77-889 and the full line of Midland CB radios, write to Irv Kalick, Midland Communications Division, P.O. Box 1903, Kansas City, MO 64141.

CB Duster

Chemtronics recently introduced Micro-Duster, a new product that permits compressed-gas dusting of delicate instruments and assemblies. It works particularly well on CB sets that have been under the dash for a long time, or in some other dusty and dirty environment. Micro-Duster contains pure, moisture-free, non-flamable and non-toxic filtered gas, providing controlled removal of dust, lint, oxide particles, etc.,

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without depositing harmful contaminants. A single, 15 oz. can of Micro-Duster produces over 1800 one-second compressed-gas bursts, or 25 to 30 minutes of continuous dusting. Spraying in short bursts until contaminants are dislodged is recommended for most efficient utilization. Spray will not dislodge components mounted on printed circuit boards. Micro-Duster comes with a 6-in. extension tube for pin-point applications that clean switch contacts and get into tight corners. Suggested retail value of $2.50. Sold only through Chemtronics distributors. For more information, including the location of local distributors, contact Chemtronics, Inc., 45 Hoffman Avenue, Hauppauge, NY 11787.

Mini-UHF Plug and Jack

Miniature UHF plugs and jacks with instant-on FCP-type termination feature are now available to CBers from Amphenol. The new, low-cost Amphenol mini-UHF connectors, designed to replace standard size UHF connectors used with RG-58/U coax cable is roughly one-half as large as their conventional counterparts. They are ideal as an in-

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line splice to repair damaged coax cable, or to facilitate installation of base and mobile CB rigs. Their miniature size makes it easy to snake cable through tight automobile compartments or other restricted passages. Amphenol 81 Series mini-UHF plugs and jacks are available through a nationwide network of general line distributors in either bagged or blister-packaged form. Complete assembly instructions are included with each purchase. Suggested retail price is $1.10 for plugs and $1.36 for jacks.

New CB Filter Technology

RMS has a new solid-state low pass filter designed for use with mobile and base station Ciitzens Band equipment. Unlike ordinary filters that have coils and other components that are affected by heat, cold, humidity, and vibration of a vehicle, the RMS CB-400F has a completely solid-state network. The filter prevents CB transmissions from interfering with nearby television and FM sets. The filter passes the desired output, CB signal while filtering the unwanted transmissions. It connects easily between the CB set and antenna and is designed for all 50-ohm output equipment. The filter lists at $11.25. The new solid-state low-pass filter

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is just one of a large family of interference filters available from RMS Electronics, Inc. The complete RMS line of filters, MATV systems equipment, TV and FM antennas and accessories, replacement set antennas, and CB and sound accessories are on display at independent electronics dealers throughout the nation. For more info, write to RMS Electronics, Inc., 50 Antin Place, Bronx, NY 10462.

Does it All

Mura's new Model CBT-35 top-of-the-line dual-meter antenna-impedance matcher now includes modulation as well as SWR and power readings. The dual meter design simultaneously monitors RF power and either SWR or modulation. The antenna tuning controls permit adjustment to a near perfect

CIRCLE 50 ON READER SERVICE COUPON

1:1 SWR for maximum radio output. The CBT-35 has backlight meter scales and a permanently attached two-foot coaxial connector cable. The CBT-35 also incorporates a special mounting bracket, permitting easy attachment either above or below the transceiver. The CBT-35 is intended to retail at $59.95. For further information contact, Mura Corporation, 177 Cantiague Rock Road, Westbury, NY 11590.

Economy Hump Mount Speaker

CB enthusiasts know that the safest place to hide a transceiver is in the trunk. That's why it pays to install your CB rig on the Krikett hump mount speaker. It contains a slot pattern to accommodate mounting any CB transceiver. Now, transceiver and speaker are combined into a single unit that simply rests on the transmission hump. Specially designed teeth hold the unit firmly in place

CIRCLE 47 ON READER SERVICE COUPON

while driving. To remove the Krikett transceiver/speaker unit, simply unplug antenna and power leads, lift the entire unit off the floor and place it in the trunk. With the CB sitting at a 45-degree angle, operating it is much safer than the typical under-dash installation location. The unit is easy to reach, the dials easy to see. The new Krikett 3½-in. loudspeaker provides clarity and intelligibility across the entire voice range. Suggested retail price is $14.95. Complete mounting instructions and hardware included. Get all the facts direct from Acoustic Fiber Sound System, Inc., P.O. Box 50829, Indianapolis, IN 46250. ■

Antique Radio Corner

(Continued from page 74)

As you can see from the circuit diagram and meter dial scale there is one resistance range and one DC voltage range. By using a 3-volt battery you can read up to 5,000 ohms, you can read up to 300 volts DC. A SPDT toggle switch is used to select either volts or ohms.

Any DC milliammeter can be made to measure voltage by using a suitable series resistor called a "Multiplier" resistor. For instance suppose we have a 0 to 10 milliammeter (.01 amperes full scale) and want to read 100 volts. Using ohms law we find that volts divided by amperes equals ohms. Our unknown quantity is ohms, so dividing 100 by .01 we find that we need 10,000 ohms of resistance in series with this meter to be able to measure 100 VDC. The Power Equation tells us that power equals amperes times volts so we can find the wattage rating of our multiplier resistor: 0.01 amperes times 100 volts equals 1 watt. If you want an ample safety factor use a 2-watt resistor. The meter will read voltages linearly and you can simply multiply the scale markings by 100 to arrive at a true reading. The Readrite meter shown here needed 14,000 ohms to read 300 volts.

It was necessary to determine what battery voltage and zero set rheostat would be necessary to connect to the Readrite meter so the resistance scale would read correctly. By using a resistance decade box I found that two 1.5 volt batteries in series with a 500 ohm rheostat would allow me to read the resistance printed on the dial scale. It was surprisingly accurate for being over 50 years old. To measure resistance with this meter simply short the test leads together, adjust the zero set rheostat until the meter reads full scale which is zero resistance. Any resistance within the ohmmeters range will then decrease the current through the meter and indicate the resistance value on the meter scale. A meter such as this one only cost a few dollars back then so it wasn't too accurate. The stated accuracy was probably 10%. However the battery sets made between 1921 and 1927 weren't very complicated either. In our next column we will explore the voltmeter more thoroughly and look at some of the voltmeters used by radio repairmen during the 1920's.

The brochure on replacing the WD-11 tube with the 864/VT24 is still available from Antique Radio Parts, P.O. Box 42, Rossville, IN 46065. You can buy new bases that are exact replacements for the WD-11 with a four-prong socket mounted in it. This will allow you to use a type 30 with 2 volts on the filament, a 199 tube with 3.3 volts on the filament, or an 864 with 1.1 volts on the filament in any socket made for the WD-11 tube.

So long for now. If you have any questions or suggestions for this column just send them in. Send the letter to me in care of ELEMENTARY ELECTRONICS magazine. Be sure to include a stamped, self-addressed envelope unless you live in Canada. I cannot mail a letter with a Canadian stamp on it. If you live in Canada send 15¢ in coin. Although it may take up to four weeks I personally answer over 95% of the letters I receive. ■

Computer Readout

(Continued from page 68)

day and hundreds of millions of dollars go into refinement and new development of this type of software every year. A decade ago the chief scientific language—the one designed and used to manipulate methematical formulas—was FORTRAN. Then came various versions of FORTRAN and even today it is used but it has been nearly replaced on the second and third generation of industrial computers—the IBM 370 series for example—by Programming Language I (usually called PL I). The improvement in PL I is the ease and flexibility of being able to manipulate large blocks of data. COLBOL is used in business-oriented programs where names and character-strings have to be stored and moved around. Then there is APL (yep, it stands for A Programming Language) which lets the user define a whole block or table of data as a single letter, like A. That can also be done with FORTRAN, but APL lets the user multiply two tables of numbers together, like A x B. You ask how does that make sense? Well, in mathematics, multiplication of two tables together is a defined function that turns out to be very handy in physics and engineering problems. But you would not want to do too many by hand or even write the program to do it. With APL the software is already done. Just write A x B. This simple example should give you a big clue into what high-level language is all about. Remember our discussion of macro-instructions and subroutines? That's what high-level languages are. You write READ or PRINT and each of those is really calling up a subroutine of many machine-level instructions that result in your single command being met.

The most popular language for microcomputers is BASIC. It was first developed over a decade ago as a simpler, less costly alternative to FORTRAN by Kemeny and Kurtz at Dartmouth College, but it really did not catch on until the microcomputer was developed about four years ago.

The main feature of BASIC Language is that when it is converted to machine code that conversion is done one line at a time, the code executed, thrown away, and the next line converted. This step-at-a-time conversion is called an "interpreter" and has the advantage of requiring little computer memory as well as being fairly simple to write. The result is that at least two dozen versions of BASIC exist today

In contrast to an interpreter is a "compiler" which is what FORTRAN requires. Here the program in high-level code is converted to another complete program written in machine code. Needless to say, a compiler has to be a smart program that can see the most efficient ways to squash down the high-level program into a fast running, error free machine-level programs. Writing compilers is a big effort in industry and an important one. But for small home computers a simple BASIC interpreter does the trick. In the next issue we will look closer at BASIC and will discuss a version called NIBL ■

Simply Basic

(Continued from page 32)

created by leap years, but it avoids extensive software within the program and works well for newcomers to personal computing. Line 230, which is keyed by the leap year variable, selects the correct data set.

Personal computers cannot handle a 365/366 exponent, and therefore cannot run the standard compound interest equation. We get around this limitation by using the LOG and EXP functions in lines 490 and 500. To explain, consider x=2↑4 (2^4). X can also be expressed as EXP (LOG [2] *4). Since some personal computer BASICs cannot handle this either, is it broken into two parts: lines 490 and 500.

This program has lots of room for changes and modifications specifically tailored to your personal requirements, so feel free to experiment. It's almost impossible to go wrong as long as you take care with lines 490 and 500.

With no exceptions I know of, bank interest is calculated to three decimal places and then rounded off to two places. To check correct entry of the program into your computer, a savings bank interest of 5.25% for 365 days should result in an effective yield of 5.47% (after round off). ■

Hi-Fi Reports

(Continued from page 16)

this means that the speaker reradiates the sound off the back of the speaker cone and directs it forwards, in phase with the driver's audio. In an acoustic suspension speaker most of the sound from the back of the cone is absorbed in the box to keep out-of-phase sound from detracting from the audio.

Koss CM-1010 Speaker

CIRCLE 105 ON READER SERVICE COUPON

The CM-1010 is what might be called a 2½-way speaker. There are two driven elements and the passive element which reradiates the back waves. The relationship of all these elements has been calculated by complex computer programs based on some formulas developed by a couple of Australian engineers. The driven 8-inch woofer and the passive 10-inch radiator seem to do an excellent job. The deep bass is real solid especially when you attach a small, factory supplied weight to the center of the passive radiator. This lowers the element's natural resonance from 42 Hz down to 35 Hz. The 8-inch woofer has excellent response up to the 3500Hz crossover point.

In the high frequencies a one-inch acoustically loaded, dome tweeter provides excellent dispersion and quick, sharp response.

Overall the reproduction was very natural. You aren't overly aware that the sound is coming from a "box," the way some speakers sound.

The people at Koss say that one of the biggest advantages of a vented speaker is its inherent efficiency, and listening to the CM-1010 seems to bear this out. It seems to deliver more sound at similar volume levels than some other speakers. The CM-1010 is rated for a maximum input of 100 watts per channel at 8 ohms and has a minimum recomended amplifier power rating of 15 watts per channel. For more information about the Koss CM-1010 speaker system circle number 57 on the readers service coupon. The CM-1010 carries a suggested retail price of $185. ■

Per Com CIS-30+

(Continued from page 76)

pin of the connector strip. (The optional cable set has full length pins in all locations on the computer end so it picks up the 5 VDC for the PerCom.) Two other minor modifications (jumpers) must be added to the MP-C card. (Separate instructions are provided for the MP-S card which can be used with the later SWTP computers.) One of the modifications changes the 300 baud clock on the MP-C card to 1200 baud. The conversion back to 300 (and 600) baud is made by the PerCom; this is how the PerCom can record and handle data at 300, 600, and 1200 baud while other interfaces are limited to only 300 baud.

For remote control an optional set of DIP-packaged relays and other hardware is available ($10.95). The remote control kit is installed directly on the PerCom's printed circuit board and becomes part of the interface. All necessary wiring and connections to the Molex strip are part of the PC board. You simply place the components into the clearly indicated locations and solder.

The PC board has some other prewiring that can prove an attractive convenience for many hobbyists. For example, the output wire can be moved so it provides a lower level suitable for a recorder's microphone input; your recorder might not have an *aux* (high level) input. Similarly, there is a connection that permits bridging a small earphone across the input connection so you can monitor the data transmission from the recorder to the interface.

Instructions. If there is one truly outstanding aspect of the PerCom interface it is the instructions and engineering notes. Quite often, personal computing equipment comes with the absolute minimum in instructions, which also assume you're an expert to start with. Other times the instructions refer you to books and references which require even greater computer expertise.

The PerCom CIS–30+ on the other hand, comes with outstanding documentation, a virtual standard of excellence. Every detail is spelled out in sequence, with almost every contingency taken into account. Best of all, it assumes the user is a hobbyist, not a computer expert. And if this weren't enough, there are the Technical Memos. The president of PerCom must be an enthusiast who likes nothing more than sharing his knowledge with others. He periodically issues Technical Memos (engineering notes) concerning better utilization of PerCom products. For example, there are memos on connecting the CIS–30+ to other 6800 computer systems, selecting a cassette recorder with specific recommendations on available brands, adapting for a parallel I/O using a UART, and modification of the SWTP coresident Editor/Assembler for high speed operation using the CIS–30+ and a standard ASCII printer.

These memos are some of the best hobbyist-level material we've seen, and they are available at minimal cost (25¢ and 50¢). Many were supplied with the CIS–30+.

Kit or Wired. The PerCom CIS–30+ is available in kit ($69.95) and wired ($89.95) form. If you build the kit you should use a socket kit, which costs an additional $4.95. We suggest you forget about the kit and go the factory-wired route. The $15 difference in price is well worth not having to align the unit, and possibly troubleshooting unfamiliar circuits if you make an error, or have a defective component. The optional remote control kit (which you can install yourself in the kit and wired units) costs $10.95, and it's really only needed for automatic control of two recorders.

For additional information on the PerCom CIS–30+ cassette interface write to PerCom Data Co., 4021 Windsor, Garland, Texas, 75042; or circle No. 58 on the reader service coupon. ■

Computer Readout

(Continued from page 68)

day and hundreds of millions of dollars go into refinement and new development of this type of software every year. A decade ago the chief scientific language—the one designed and used to manipulate methematical formulas—was FORTRAN. Then came various versions of FORTRAN and even today it is used but it has been nearly replaced on the second and third generation of industrial computers—the IBM 370 series for example—by Programming Language I (usually called PL I). The improvement in PL I is the ease and flexibility of being able to manipulate large blocks of data. COBOL is used in business-oriented programs where names and character-strings have to be stored and moved around. Then there is APL (yep, it stands for A Programming Language) which lets the user define a whole block or table of data as a single letter, like A. That can also be done with FORTRAN, but APL lets the user multiply two tables of numbers together, like A x B. You ask how does that make sense? Well, in mathematics, multiplication of two tables together is a defined function that turns out to be very handy in physics and engineering problems. But you would not want to do too many by hand or even write the program to do it. With APL the software is already done. Just write A x B. This simple example should give you a big clue into what high-level language is all about. Remember our discussion of macro-instructions and subroutines? That's what high-level languages are. You write READ or PRINT and each of those is really calling up a subroutine of many machine-level instructions that result in your

Five Ways to QSLs

(Continued from page 42)

it anymore. Their cards contain a printed message saying that your report was correct.

So, if you've been thinking about going after QSL Cards, maybe you ought to get started while there is still time. If you can tune to all the stations on our three "freebie" lists, 42 colorful QSL cards can be coming to your mail box! ■

THE FAST RESPONDING COUNTRIES

COUNTRY	STATION
Austria	Austrian Radio
Belgium	BRTV
Brasil	Radio Nacional
China	Radio Peking
Denmark	Radio Denmark
Ecuador	HCJB—Voice of the Andes
Great Britain	BBC
Iran	Radio Iran
Japan	Radio Japan
Kuwait	Radio Kuwait
Neth. Antilles	TransWorld Radio
Monaco	TransWorld Radio
New Zealand	Radio New Zealand
Portugal	Radio Portugal
Sweden	Radio Sweden
U.S.A.	Voice of America

Returned QSL Cards in less than a month

REASONABLY FAST RESPONDING COUNTRIES

COUNTRY	STATION
Bulgaria	Radio Sofia
Cuba	Radio Havana
Czechoslovakia	Radio Prague
East Germany	Radio Berlin Int.
Finland	OYAB Radio
Holland	Radio Nederlands
Hungary	Radio Budapest
Norway	Radio Norway
Papua New Guinea	New Guinea B.C.
Spain	Radio Nacional Espana
USSR	Radio Moscow
Vatican	Radio Vatican

Returned QSL Cards in 1-2 months

THE SLOW RESPONDING COUNTRIES

COUNTRY	STATION
Albania	Radio Tirana
Argentina	RAE
Australia	Radio Australia
France	Radio Paris
Greece	Radio Athens
Haiti	La Voz Evangelique
Italy	Radio Rome
Iraq	Radio Bagdad
Luxembourg	Radio Luxembourg
Lithuania	Radio Vilnius
Malta	Radio Mediterrean
Romania	Radio Bucharest
Switzerland	Swiss Broadcasting
West Germany	Deutsche Welle

Returned QSL Cards in from 2½-4½ months

THE COUNTRIES THAT REQUIRE RETURN POSTAGE

COUNTRY	NO. OF IRCS
Cuba	1
Ecuador	1
Haiti	2
Iraq	2
Luxembourg	1
Malta	3
Monoco	2
Netherlands Antilles	2
New Zealand	2
Papua New Guinea	2
Vatican	1

single command being met.

The most popular language for microcomputers is BASIC. It was first developed over a decade ago as a simpler, less costly alternative to FORTRAN by Kemeny and Kurtz at Dartmouth College, but it really did not catch on until the microcomputer was developed about four years ago. BASIC is easy to learn and understand yet allows the curious and innovative programmer lots of room for expansion. We will discuss BASIC with the kind of detail it deserves next issue

The main feature of BASIC Language is that when it is converted to machine code that conversion is done one line at a time, the code executed, thrown away, and the next line converted. This step-at-a-time conversion is called an "interpreter" and has the advantage of requiring little computer memory as well as being fairly simple to write. The result is that at least two dozen versions of BASIC exist today and more are coming. Tiny BASIC, for example, only requires two thousand (2K) memory locations and is therefore popular even though it can only handle integer numbers and not decimal point numbers.

In contrast to an interpreter is a "compiler" which is what FORTRAN requires. Here the program in high-level code is converted to another complete program written in machine code. Needless to say, a compiler has to be a smart program that can see the most efficient ways to squash down the high-level program into a fast running, error free machine-level programs. Writing compilers is a big effort in industry and an important one. But for small home computers a simple BASIC interpreter does the trick. In the next issue we will look closer at BASIC and will discuss a version called NIBL developed by National Semiconductor for industrial control that is suited perfectly to small home computers. ■

Collecting Antique DX

(Continued from page 65)

oldest shortwave stations in Mexico are both at the Gulf port of Vera Cruz. XEUW (a relay of medium waver XEU 930 kHz) is licensed on 6020 kHz and XEFT La Voz de Vera Cruz is assigned 9545 kHz. Both transmitters operate on a very irregular basis. Your best bet for the elusive XEFT would be during the midday period when 31 meter trans-Atlantic and trans-Pacific interference is at a minimum. If the reader lives in the southwest, he or she should also watch for XEUW during daylight hours. Otherwise it's a nighttime catch, if you can catch it at all.

In 1939 TFJ was a shortwave broadcast station at Reykjavik, Iceland. TFJ is still on shortwave from the same location but is now used primarily as an international telephone link with only an occasional program (in Icelandic) intended for general reception usually on a Sunday. TFJ is heard from time to time on 12170 kHz; often with a test tape which makes them a little easier to identify.

History is alive and well on the airways. It's at your fingertips, waiting to be captured. ■

FREQUENCIES FOR ANTIQUE HUNTERS

KHZ	STATION	TIME (EST) & NOTES
5875	HRN, Tegucigalpa, Honduras	Evening
6005	CFCX, Montreal, Quebec	Daytime or evening (relays CFCF)
6020	XEUW, Vera Cruz, Mexico	Irregular (relays XEU)
6135	CHNX, Halifax, Nova Scotia	Daytime & evening (relays CHNS)
6165	Radio Nederland	2100 & 2400 (studio at Hilversum, transmitter at Bonaire)
6165	Vatican Radio, Vatican City	2000
6175	BBC, London, England	1800-2330 (Sackville relay)
6180	Radio Nacional, La Voz de Guatemala	Late evenings
7150	Radio Moscow	1800-2100, 2300-2400
9510	BBC, London, England	1800-2230 (Sackville & Greenville relays)
9545	XEFT, La Voz de Vera Cruz	Irregular (affiliated with Radio Juventud)
9560	HCJB, Quito, Ecuador	2100
9605	Vatican Radio, Vatican City	2000
9715	Radio Nederland	2400 (see 6165)
9780	Radio Moscow	2000-2200
11700	Vatican Radio, Vatican City	Daytime (various languages)
11865	Radio Clube de Pernambuco, Recife, Brazil	Daytime & evening
11915	HCJB, Quito, Ecuador	2100
12050	Radio Moscow	1800-1930
12170	TFT, Reykjavik, Iceland	Irregular (usually Sunday's)
15070	BBC, London, England	Daytime

For GMT add 5 hours. For UST subtract 3 hours.

Disco King

(Continued from page 45)

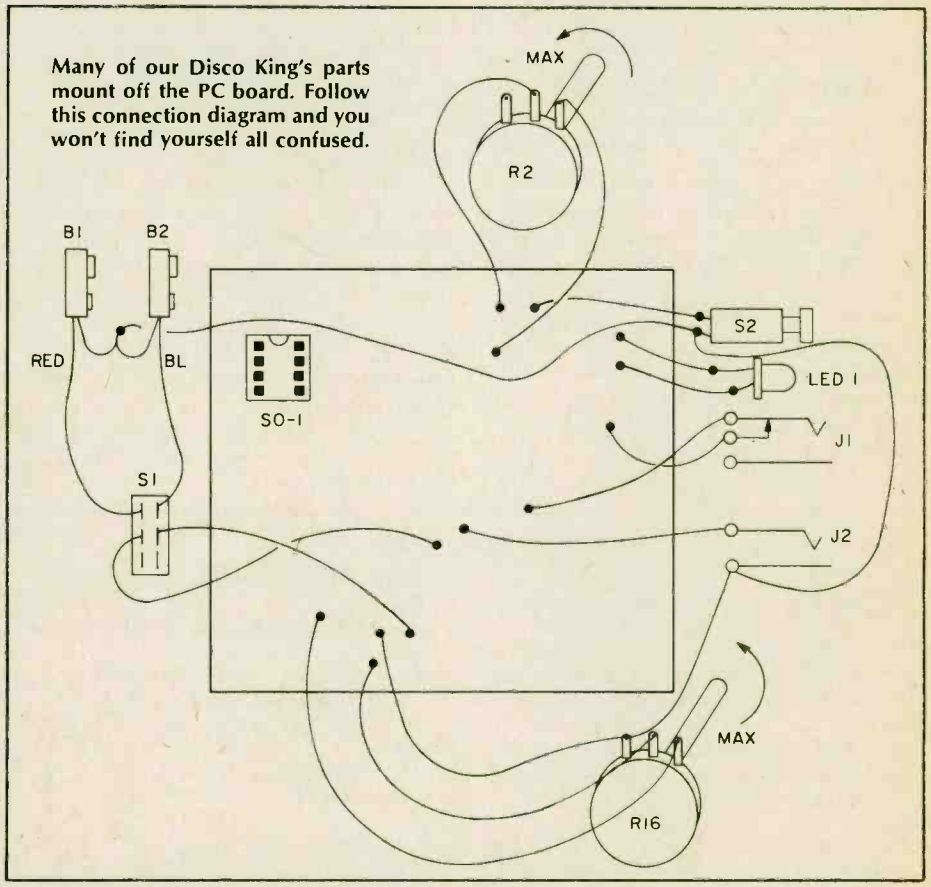
R2 varies the Tempo from extremely slow to very rapid and that LED 1 lights each time the base drum is heard. Depress and hold S1 and note that the sounds stop. Release S1 and note that the sounds restart with the base drum. If you plan to use the manual base drum triggering facility, you may construct a simple footswitch. Connect the footswitch to J1 (*Base Drum Trigger*) and note that the base drum sound is heard each time the footswitch is pressed.

Drum Up a Storm. Once adjustment and checkout have been completed as indicated above, operation of the unit should be clear. The most common Disco percussion pattern is obtained with the jumper connecting SO-1 pins 4 and 5 (note that SO-1 pins 1 through 4 are wired together). The other three pattern variations are obtained by connecting pins 1 & 8, 2 & 7 or 3 & 6. Removing the jumper disables the cymbal generator. To use the unit as an electronic base drum you can either set R16 to minimum or remove the jumper from SO-1. Always turn the unit off when not in use to prolong battery life.

You may wish to substitute a push on-push off switch for the momentary switch S1. This will allow sustained off periods without having to keep S1 depressed. You may also wish to substitute a rotary switch for the socket and jumper method of pattern selecting. A wiring diagram for this substitution is shown.

You'll find that Disco King is quite a conversation piece. All your friends will ask how you fit Ringo Starr into such a small box! ■

Many of our Disco King's parts mount off the PC board. Follow this connection diagram and you won't find yourself all confused.



Kathi's CB Carousel

(Continued from page 56)

the adjustment of the microphone gain.

If I have any complaints about the DAK Mark IX it concerns the mike. None is supplied. Either the user selects his own, or he can purchase a DAK model DM100 as specified in the instruction manual.

Overall Performance. It is outstanding. The sound quality from the built in speaker is excellent—extremely pleasing. Perhaps it's due to the use of a power tube as the amplifier/modulator. Whatever, the received sound is notably "clean". As for transmitting, the "talk power" is also exceptionally clean. Just about everyone commented on a "tree top tall" signal.

In short, the DAK Mark IX is a winner all the way. The DAK Mark IX is priced at $359.95. For additional information circle No. 88 on the reader's service coupon. ■

Elec-Tac-Toe

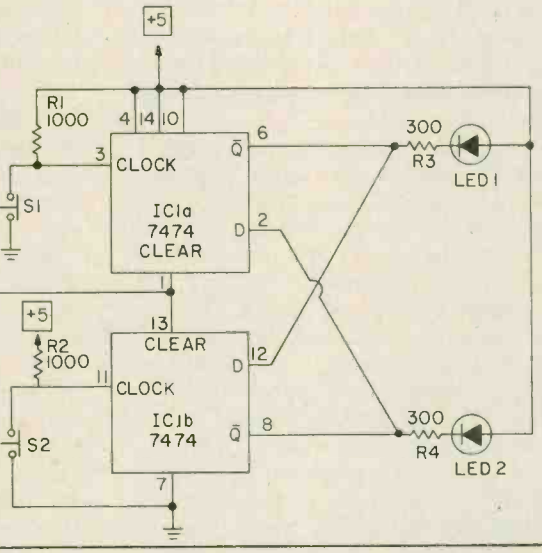
(Continued from page 55)

pin 1 of IC3 that happens to be capable pushing buttons that have already been pushed. Clearly, a solution that becomes evident after only a few steps is easier to spot than one requiring more steps because there is less to remember (or forget).

In general, is there anything that can be said about the amount of information necessary to reach a decision? Well, each press of a button yields one bit of information to each player; all solutions require two or more bits. The maximum possible number of bits necessary for logical players (with perfect memory) reasoning with information from randomly chosen cells is six. If the cells are chosen in an intelligent sequence, the solution can always be reached with four or fewer bits of information (again assuming the players are logical and have perfect recall). Can you spot how this would be done? Real games are likely to be longer than the ideal ■

PARTS LIST FOR PRIORITY LATCH OPTION

IC1—7474 dual flip-flop
LED1, LED2—light emitting diode
R1, R2—1000-ohm resistor, ½-watt
R3, R4—300-ohm resistor, ½-watt
S1, S2—pushbutton switch, normally closed



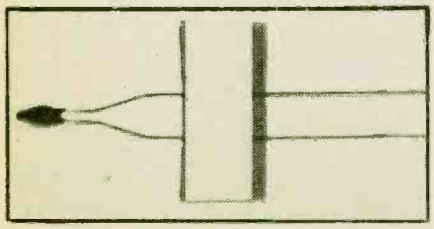
You might like to build this option into your Elec-Tac-Toe game. It will help stop arguments as to who called out the right answer first!

Rocket Countdown

(Continued from page 60)

the launch *always* pull S2 and S3 down to their safety and hold positions. Failure to do so can result in premature liftoff of the next rocket. Remember, safety in rocketry always comes first!

In the Firing Room. The heart of this circuit is the 74192 IC counter. This amazing little chip takes the clock pluses generated by the 555 timer IC



This igniter wire fits into the back of a model rocket engine. Once fired by our rocket computer it burns with the intensity of a match. This sets off solid-fuel engine.

and counts them in binary code. The 7447 IC receives the binary numbers and changes them into a form we can shows us the numbers as they are understand—decimal. The LED display counted. IC 7406 and IC 7408 "watch" the count and when they sense a zero, they send a pulse to the SCR, triggering it into conduction and thus firing the igniter. ■

Count Capacita

(Continued from page 35)

When wiring the circuit, be careful to install all polarized devices in the correct orientation. This applies to all the semiconductors, meter M1, the batteries, and electrolytic capacitors C1 and C3. Basing diagrams for all the semiconductors may be found elsewhere in the article. Lead identification for transistor Q1 applies *specifically* to a 2N2646. If you use a Radio Shack RS2029 for Q1, note that it uses a different lead orientation, which is clearly illustrated on the package in which it is sold. Though their lead orientations are different, these two transistors are electrically equivalent and interchangeable.

Although it is not absolutely necessary, the use of a socket is advisable for IC1, especially if you haven't had much experience soldering integrated circuits. The socket, as well as most of the other components in the parts list, is available at Radio Shack. Two of the components, S1 and the case, may be purchased by mail from Circuit Specialists (see the parts list for their address). Circuit Specialists carry a tremendous assortment of electronic devices, and they cater to the experimenter by not imposing a large handling charge on small orders. You can obtain their catalog by writing to the address in the parts list.

Under the Lid. During construction, do not substitute for meter M1 unless the device you intend to use has a full-scale sensitivity of 50 microamps and an internal resistance of about 1500 ohms. As usual, you should make all connections with a 25-watt iron and resin-core solder. When wiring S1, make sure that the rotor of S1b engages R8 in the fully CCW position, and R5 in the CW position. Also, S1a's rotor must contact R16 when fully clockwise, and R14 in all other positions. You may then label S1 according to the diagrams provided here, with the lowest range in the extreme CCW position. Finally, be certain to label BP1 with a "+" and BP2 with a "–".

When construction is complete, there are two calibration adjustments that must be made. In order to make these adjustments, you will need two accurate reference capacitors. The first, which will be used to calibrate the highest range, should have a value between 2 and 5 microfarads—the higher the better. Commonly available capacitors in this range are generally mylar or electrolytic. The mylar is your best choice; pick a unit with the tightest tolerance you can find. In this capacitance range, that means about ±10%—sometimes better. If you must go with an electrolytic, choose a tantalum device and avoid the aluminum electrolytics, which tend to be leaky and have poor tolerances. Common tolerances for tantalums run about ±20%, so you can see why the mylar is the better choice.

For calibration of the lower four ranges you will need another reference capacitor; since calibration can take place on any of the four ranges, you have some leeway in your choice of a calibration capacitor for these lower ranges. One especially good choice is a 5000 picofarad polystyrene capacitor, available from just about all of the large electronics retailers. This particular capacitor is cheap but precise (±5% tolerance). The steps that follow will use this capacitor, but remember that you can use any capacitor as long as it is accurate and its nominal capacitance falls at the high end of one of the scales.

Begin calibration of the lower ranges by connecting the 5000 picofarad polystyrene capacitor to BP1 and BP2. Set trimmer R13 to the midpoint of its range of adjustment. Make sure that S2 is in its *capacitance* position, and that *range* switch S1 is set to PF. X 100. Press S3 and adjust trimmer R13 for a full-scale indication of "50" on M1. This completes calibration of all four lower ranges.

Calibration of the top range is similar to the above. Hook up your capacitor, and set R15 to its midpoint. Make sure that S2 is set to *capacitance*, and that S1 is fully clockwise. Press S3 and adjust trimmer R15 until your meter indication corresponds to your capacitor's marking. This finishes the calibration.

Use of Count Capacita is fairly obvious; nevertheless, here are a few odds and ends that you might find helpful: The maximum voltage appearing across any capacitor under test is about 4.2 volts, which is well below the rated working voltage of almost any capacitor that you are likely to encounter. Because battery current drain is intermittent and moderate, the cells will last a long time—possibly for years. However, it might be a good idea to replace batteries once a year, even if they indicate more than "33", in order to prevent the possibility of a battery leak inside your meter.

Whenever you make a measurement, start on a range high enough to accommodate the capacitor being tested. If you have no idea of the capacitor's approximate value, always start on the highest range. Should a capacitor be opened up internally, it will provide a reading of zero on all scales.

(Continued on page 93)

Bit Bucket

(Continued from page 22)

While there is usually a winner and a loser, they are often "played" just for the amazing way they simulate the nearly ballet-like interplay of strategy and tactical movement. The fun is in using your head to control a vast tapestry of forces within an antagonistic environment.

Simulations Publications Inc. has been a wargame industry-leader for years, and they publish well over a hundred games.

Many of the games require much dice rolling and many repititious mathematical calculations. It was only natural that computers should sooner or later be utilized—and SPI is now bringing out the first mass-market wargame that is available not only as a boxed game but as a *program* for a home computer.

The game is titled *NATO Division Commander*. It will first be marketed as a normally packaged game. Then, if you would like, you may send for the computer program (TRS-80 cassette for about $12.00 or a BASIC listing for around $9.00).

Once your computer has digested SPI's program it will set the variables of the game; such as, both Allied and Warsaw Pact units' combat effectiveness, capabilities of individual leader units, intelligence reports and the like. The gamer will keep track of the action on the *NATO* gameboard, using it as the computer's display.

You can circle number 72 on our Reader Service card for more information or write directly to Simulations Publications Inc., 44 E. 23rd St., New York, N.Y. 10010. ■

Space Com Gas Computer

(Continued from page 50)

space to provide maximum accuracy.

Using AutoComp. After the installation, the fun begins. If the directions are closely followed, there should be no difficulty in getting the system operational.

In conclusion, the AutoComp is the first of a new generation of microprocessors that will probably be used to revolutionize the auto industry. The Autocomp is fun, it is accurate, reasonably easy to install, and adds an additional interest to the monotonous task of driving on our modern freeways. For more information circle number 95 on the Readers Service Card. SpaceKom, Inc. is located at 212 East Gutierrez St., Santa Barbara, CA 93101. ■

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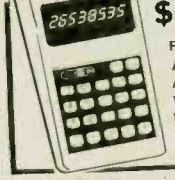

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☐	1-ITT 6 DIGIT COUNTER, 110VAC, with mounting flange	(5392)	1.95	2 for 1.96
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☐	40-AXIAL ELECTROS, asst'd values & capacitance.	(3227)	2.00	80 for 2.01
☐	40-UPRIGHT ELECTROS, asst'd values & capacitance.	(3226)	2.00	80 for 2.01
☐	150-RED DISC SPECIAL, Erie, mostly marked, pop values	(5341)	2.00	300 for 2.01
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1N4000 Epoxy Rectifiers

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Cat. No.	Type	Volts	Sale	1¢ SALE!	Type No.
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☐ 2378	1N4002	100	10 for .85	20 for .86	• 1.5 Amp!
☐ 2379	1N4003	200	10 for .95	20 for .96	
☐ 2380	1N4004	400	10 for 1.19	20 for 1.20	
☐ 2381	1N4005	600	10 for 1.39	20 for 1.40	• Mini
☐ 2382	1N4006	800	10 for 1.49	20 for 1.50	ature!
☐ 2383	1N4007	1000	10 for 1.59	20 for 1.60	

10 AMP POWER TABS

1730 - SCR's
1448 - TRIACS
1590 - QUADRACS

PRV	Sale	2 for
☐ 50	$ .55	$ .56
☐ 100	.69	.70
☐ 200	1.19	1.20
☐ 400	1.60	1.61

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Order by Cat. No. 60B84 and voltage

1.5 AMP

			2 for 1.50
☐ 50V	10 for $.59	20 for $.60	
☐ 100V	10 for .69	20 for .70	
☐ 200V	10 for .79	20 for .80	
☐ 400V	10 for .89	20 for .90	

CERMET TRIM POTENTIOMETERS

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(m) multiturn (s) single turn

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Order No. 5336 and value

FULL WAVE BRIDGE RECTIFIERS!

10 AMP	PRV	Sale	2 for		1.99	2.00
Order by Cat. No.	☐ 50	$1.29	$1.30	☐ 400	2.25	2.26
2447 & voltage	☐ 100	1.49	1.50	☐ 600	2.50	2.51
	☐ 200	1.69	1.70	☐ 1000	2.75	2.76

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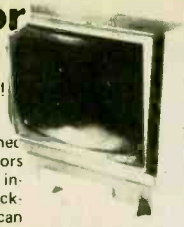

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With New CRT!

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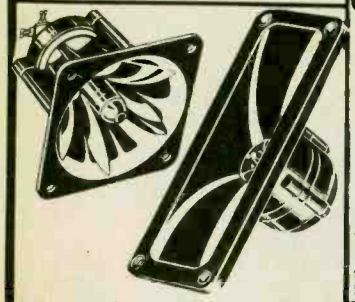

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8 oz./pack . #8V20305 . $8.00/pack

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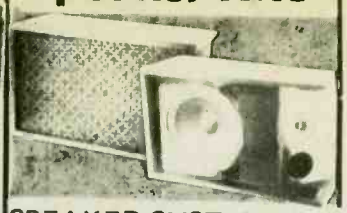

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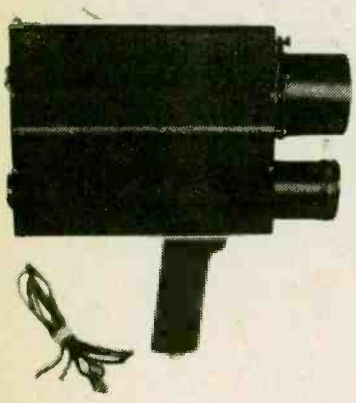

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IR viewer complete ready to operate. Guaranteed by the manufacturer. Portable, runs on lantern battery. New, see in total darkness. No shipments to Calif. Comes complete with built in IR source and adjustable focus lens. SPL-21 $199.00

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Memory is 512X5 produces 64 five by seven ASCH characters. New by National, w/specs $6.00

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HAWKEYE RADAR SPEED TRAP alarm.
Runs from cigar lighter outlet. New $30

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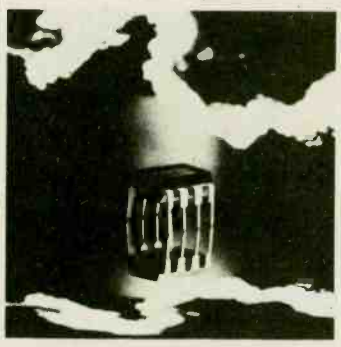

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CIRCLE 64 ON READER SERVICE COUPON

AMAZING DEVICES

((((PHASERS))))

PPF-1 *PHASER PAIN FIELD* — This device recently developed and patented in our labs is being evaluated by law enforcement agencies for riot and crowd control. It is now available but soon will come under the jurisdiction of weapons and infernal machine control making it unavailable to the public. The device is hand-held and looks like a BUCK ROGERS ray gun. It is hazardous if not used with discretion.

PPF-1 PLANS **$10.00**

IPG-1 *INVISIBLE PAIN FIELD GENERATOR* — This amazing, simple hand-held device is about the size of a pack of cigarettes and generates a directional field of moderate to intensive pain in the lower part of the head up to a range of 50'. Device is simple and economical to make.

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IPG-10 ASSEMBLED & TESTED FOR ANIMAL CONTROL **$44.50**

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CIRCLE 36 ON READER SERVICE COUPON

Count Capacita

(Continued from page 88)

If the capacitor is leaky, its measured capacitance will be considerably larger than the value stamped on its case. This is because capacitor leakage is equivalent to having a resistor in parallel with the capacitor. This leakage resistance siphons off capacitor current, so the capacitor takes longer to charge, and monostable IC1's output stays high for a longer time. The result is an erroneously high capacitance reading. By the same token, you can expect an internally shorted capacitor to pin the meter's needle on all scales, since a short is, in effect, just a case of complete leakage.

Now, let's return to an important topic that was introduced earlier; stray capacitance between the binding posts. The construction details already presented should help to keep strays at a minimum; however, you can never completely eliminate stray capacitance or the errors it may cause. Fortunately, it is very simple to compensate for such errors.

After your meter is calibrated, turn to the most sensitive range: Picofarads x 10. This is where the effects of stray capacitance will show up. Without any external capacitor between the binding posts, press the pushbutton and note meter M1's indication. On the prototype, a reading of 30 picofarads was obtained. This represents the value of the stray capacitance in parallel with any capacitor under test. It also represents the amount by which any capacitance reading will be in error. To compensate, simply subtract the residual capacitance from any given meter reading. For example, a reading of 480 pf. on the prototype meter would be corrected to 450 pf. (480 pf. minus 30 pf.). Such corrections are significant and necessary only on the most sensitive scale. Finally, since stray capacitance can obviously affect accuracy on the most sensitive scale, it is preferrable that you *not* calibrate there, but on one of the higher scales, as outlined previously.

So, on the next dark night, why not sit yourself down and, to the strains of some Transylvanian music, acquaint yourself with the inner workings of our Count Capacita? You have nothing to lose but your fear—fear of choosing the wrong capacitor! ■

Lab Test Elementary Electronics For Yourself

Get switched-on with - the magazine for electronics fans and hobbyists

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

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

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

ELEMENTARY ELECTRONICS knows the kinds of projects you like—and we bring 'em to you by the truckload!

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

WHEN IT COMES TO REPAIRS E/E can save you time, trouble and a pile of money!

Has your sound system gone blooey just when the party's going great? Do you shudder when your friendly neighborhood electrician hands you the bill? E/E can help.

Of course, we can't make you a master electrician overnight. But we can show you the fundamentals of repair plus maintenance tips.

IF YOU'RE NEW TO ELECTRONICS YOU GET A "BASIC COURSE"!

That's right! It's a regular feature. And it gives you the complete, ground-floor lowdown on a variety of important electronics subjects. For example—Understanding Transistors . . . How Radio Receivers Pull in Signals . . . Cathode Ray Tubes Explained . . . How Capacitors Work . . . Using Magnetism in Electronics. And more!

ENJOY GREAT ARTICLES LIKE THESE

- How to Build Your Own Transformer
- How to Select the Right Shortwave Receiver
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- Quickdraw Rickshaw—The Electric Car that Really Gets Around
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- How to Power-Up Your Antique Radio
- The Vanishing Vacuum Tube
- How to Customize Your CB Antenna
- Those Incredible TV Sets of the Future
- Listening in on the Forgotten Continent
- DXing Endangered Species
- Sandbagging—CB Fun Without a License
- The World's Worst Hi-Fi Components

TRY A FEW ISSUES AND EVALUATE OUR . . .

▶ **GREAT PROJECT IDEAS.** Simulate space flight with our computer analog project. Build your own audio/visual darkroom timer. Restore your old car radio. Construct a see-through crystal radio.

▶ **HOW-TO-DO-IT HELP.** Tips and pointers that add up to money saved. For example—tuning up your tape player . . . all about radios . . . whys and hows of turntables . . . care and feeding of speakers.

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LITERATURE LIBRARY

301. Get the '79 *Eico* Catalog and see their do-it-yourself kits and factory assembled electronic equipment. Specialties are test equipment, burglar/flre alarms, hobbyist and auto electronics.

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.

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

310. *Turner* has two catalogs on their CB microphones and antennas. They give individual specifications on both lines. 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.

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

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

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

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

322. *Radio Shack's* 1979 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" 1979 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 1979 catalog listing project builders' parts, popular CB gear, and test equipment. It features semiconductors—all from *Circuit Specialists*.

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

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.

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* has a new 1979 full line product catalog. The 40-page, full-color catalog contains their entire new line of 40-channel AM and SSB CB transceivers, hand-helds, marine communications equipment, and antennas 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.

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. *Continental Specialties* has a new catalog featuring breadboard and test equipment for the professional and hobbyist. Descriptions, pictures and specifications aid your making a choice.

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.

361. "Solving CB Noise Problems" is published by *Gold Line* and tells you how to reduce the noise and get a clearer signal. In discussion and diagram you can find out about the kinds of noise, their sources, and the remedies.

362. *B&F Enterprises'* Truckload Sale catalog offers 10% off all merchandise: (military or industrial surplus) speaker kits, TV games, computer terminals, tools, TV components, lenses, and more.

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

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

366. Send for *Poly-Packs'* new catalog featuring hundreds of bargains: new Barrel Pack kits, hobby computer peripheral parts, fiber optics, solar energy chips, digital clocks, and more.

367. *Optoelectronics'* new catalog features their new Frequency Counter, a 6-digit clock calendar kit, mobile LED clock, biorhythm clock, digit conversion kit, and many others.

368. *Cherry Electrical Products* has a handbook describing their new "PRO" keyboard for personal computer, hobbyist and OEM users. Included are instructions on how to customize it on-the-spot, schematics, charts, and diagrams.

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

372. See how you can save with *Olson's* "Erector Kit" Computer System; also their factory wired version which includes a 2-volume Bell & Howell instruction course. Send for information.

373. *ETCO* has a Grand Opening Catalog which anyone in the electronics field shouldn't miss. Full of all kinds of products from surplus and warehouse sales, they claim everyone is a bargain.

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

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

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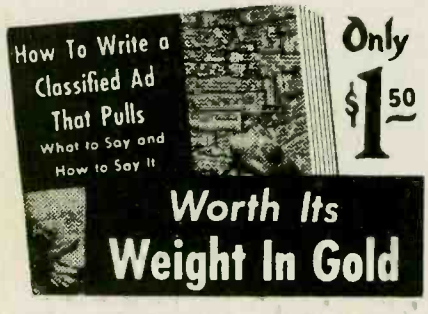

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DXing BCB Fringe

(Continued from page 70)

used by a 50 KW station calling itself Radio Omega. Omega is owned by ELCOR who was the local subcontractor involved in the original construction of the million watt station back in the mid 1960s. But Radio Million did not use Omega's mailing address. Instead they announced the San Jose post office box belonging to Radio Cadena Nacional S.A., the largest broadcast group in Costa Rica. RCN was put together in the early 1970s during the second administration of (now former) Costa Rican President Jose "Pepe" Figueras—a well known and sometimes controversial Latin American political figure who has been linked to the Bay of Pigs by Howard Hunt. It is axiomatic in Latin America that when a single broadcast giant exists, its true ownership is tied to the party in power. In addition to the Radio Million link, RCN is made up of 7 stations listed under 4 different owners.

One of the other RCN stations, all of which transmit from San Jose, is Radio Cucu which at the time of the Radio Million test broadcast on 575 kHz. Approximately a year before becoming Radio Million, the megawatt transmitter reportedly tested on Radio Cucu's 575 kHz channel. In the summer of 1977 Radio Cucu disappeared from 575 and the channel was taken over by ELCOR's Radio Omega. About the same time sources connected with Radio Million began distributing reports that the station had "ceased to exist" and the transmitter had been shipped to Venezuela. Shortly thereafter the author picked up Radio Cucu on Radio Million's former 625 kHz frequency.

South America. It is ironic that the web-like world of Costa Rican super power experiments finally led to Venezuela because the only other super powered Medium Wave transmitter presently operating in the Americas is a 500 KWer on the Dutch island of Bonaire just off the Venezuelan coast. Owned by Trans World Radio, and broadcasting on 800 kHz (where it is well heard in many parts of the U.S.), it still also relays Radio Nederland programs during the early evening hours however this arrangement may be dropped for economy reasons.

Both Radio Million's and Trans World Radio's powerhouses were built by Continental Electronics of Dallas, Texas. A third Continental customer which, listed as 400 KW, can almost be classified as super powered is Radio Rumbos at Villa de Cura, Venezuela. This station is occasionally heard by U.S. DXers on 570 kHz but there is some question as to whether it is actually using full power. This is a frequency worth watching. ■

e/e's BEACON GUIDE

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ELEMENTARY ELECTRONICS INDEX TO ADVERTISERS

IF YOU'RE WAITING FOR SOLDERLESS BREADBOARDS TO BE FASTER, EASIER, MORE VERSATILE AND LOWER-PRICED...

Incredibly inexpensive. EXPERIMENTOR solderless sockets begin at $5.50* ($4.00* for the 40 tie-point quad bus strip). A spool of solder costs more.

Mix and match. Use large and small chips in the same circuit without problems. There are two sizes of EXPERIMENTOR sockets with 0.3" and 0.6" centers.

Full fan-out. A CSC exclusive. The only solderless breadboard sockets with full fan-out capabilities for **microprocessors** and other larger (0.6") DIP's.

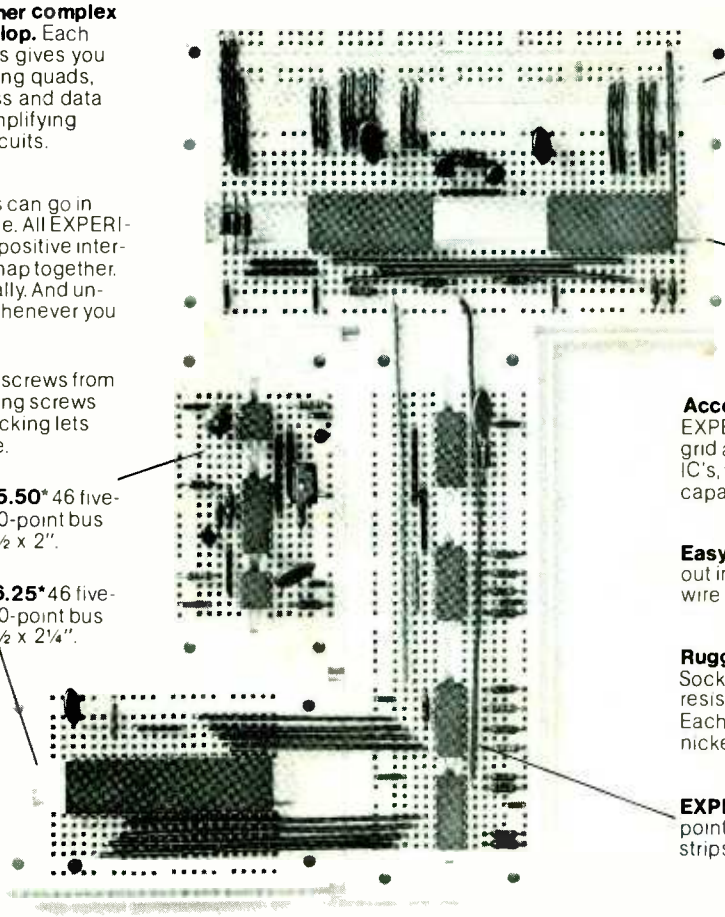
Microprocessors and other complex circuits are easy to develop. Each EXPERIMENTOR quad bus gives you four bus lines. By combining quads, 8-, 12- and 16-line address and data buses can be created, simplifying complex data/address circuits.

Infinitely flexible. Circuits can go in any direction, up to any size. All EXPERIMENTOR sockets feature positive interlocking connectors that snap together. Horizontally and/or vertically. And unsnap to change a circuit whenever you wish.

Easy Mounting. Use 4-40 screws from the front or 6-32 self-tapping screws from the rear. Insulated backing lets you mount on any surface.

EXPERIMENTOR 350. $5.50* 46 five-point terminals plus two 20-point bus strips. 0.3"centers; ⅜ x 3½ x 2".

EXPERIMENTOR 650. $6.25* 46 five-point terminals plus two 20-point bus strips. 0.6"centers; ⅜ x 3½ x 2¼".



EXPERIMENTOR QUAD BUS STRIP. $4.00* Four 40-point bus strips. ⅜ x 6 x ¾".

Designated tie-points. Simplify translation from breadboard to PC-boards or wiring tables.

EXPERIMENTOR 600. $10.95* 94 five-point terminals plus two 40-point bus strips. 0.6" centers; ⅜ x 6 x 2¼"

Accepts all standard components. EXPERIMENTOR sockets conform to an 0.1" grid and are DIP compatible. Also accept IC's, transistors, diodes, LED's, resistors, capacitors, transformers, pots, etc.

Easy hookup. Components push in and pull out instantly. Use #22-30 solid AWG wire for jumpers.

Rugged, dependable construction. Sockets are constructed from abrasion resistant materials and withstand 100°C. Each one features non-corrosive nickel-silver contacts.

EXPERIMENTOR 300. $9.95* 94 five-point terminals plus two 40-point bus strips. 0.3" centers; ⅜ x 6 x 2".

WHAT ARE YOU WAITING FOR?

Discover today how solderless breadboarding can save time and money on every circuit you build. Get acquainted with EXPERIMENTOR™ sockets† and how they simplify circuit design, assembly and testing. Eliminate the hassles and component damage of soldering. No special hardware or jumper cables required, either. And the price is so low, it's hard to believe.

"Order today. Call 203-624-3103 (East Coast) or 415-421-8872 (West Coast): 9 a.m.-5 p.m. local time. Major credit cards accepted. Or see your CSC dealer. Prices slightly higher outside USA."

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CIRCLE 11 ON READER SERVICE COUPON

The Realistic SCT-30 tells it like it is:

Why 3 heads are better than 2. Why 2 capstans are better than 1. Why double Dolby* is better than single.

3 Heads.

Two independent record and play heads eliminate the compromises of one combined r/p head, and the head assembly is integrated to eliminate azimuth error. The result: cleaner sound. The third head lets you monitor

your recording an instant after it's made, without interrupting the program. SCT-30 *has* 3 heads!

2 Capstans.

Dual capstans (instead of the usual 1) reduce wow and flutter to an inaudible 0.06% WRMS or less, and extend the audio frequency response. SCT-30 *has* dual capstans!

Double Dolby.

You know the single Dolby system cuts noise and adds dynamic range. But let's examine double Dolby. You get Dolby on *both record and monitor* so you know exactly what your tape will sound like. You get a decoder for recording superb Dolby FM stereo. And you get simultaneous listening enjoyment of the decoded broadcast on receivers with tape monitoring. The Realistic SCT-30 *has* double Dolby! About $380.

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To go with 3 heads, 2 capstans and double Dolby, you need a cassette tape that will enhance — not degrade — performance. That's why we design and manufacture Supertape Gold in *our own* Fort Worth factory. Like SCT-30, it's a playmate you can believe in at a price you can afford.

Why Realistic®?

Because Radio Shack has delivered quality audio at sensible prices since 1921, its Realistic tape and recorder line can point to over 5,000,000 customers as living proof of these claims. Add after-sale service that isn't lip service. Add in-house engineering and manufacturing of much of the Realistic line. And add the convenience of neighborhood shopping where you get "sound talk" from a specialist. That's Realistic!

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