DEALING WITH DIPOLES - our basic course
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elementary Electronics

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COOL PROJECTS FOR A HOT SUMMER

✓ Super Sound Synthesizer
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DXing Cyprus & Cuba

TEST LAB TIP-OFFS

- B&K-Precision DP-50 Logic Probe
- Anixter-Mark Mobile Heliwhips
- Apollo Systems Antenna Transmatch

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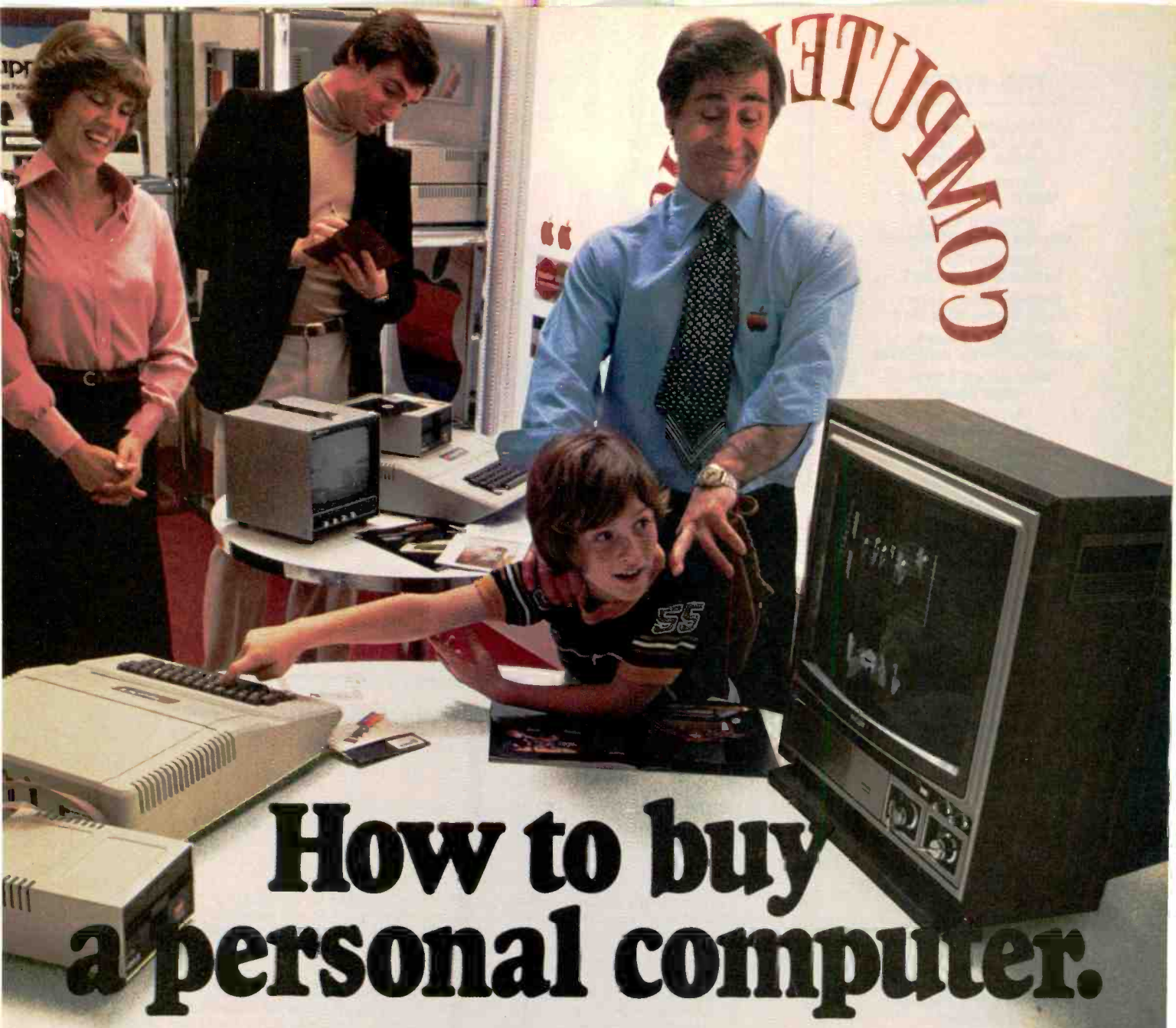

How to buy a personal computer.

In California, a store owner charts sales on his Apple Computer. On weekends though, he totes Apple home to help plan family finances with his wife. And for the kids to explore the new world of personal computers.

A hobbyist in Michigan starts a local Apple Computer Club, to challenge other members to computer games of skill and to trade programs.

Innovative folks everywhere have discovered that the era of the personal computer has already begun—with Apple.

Educators and students use Apple in the classroom. Businessmen trust Apple with the books. Parents are making Apple the newest family pastime. And kids of all ages are finding how much fun computers can be, and have no time for TV once they've discovered Apple.

Visit your local computer store

The excitement starts in your local computer store. It's a friendly place, owned by one of your neighbors. He'll show you exactly what you can use a personal computer for.

What to look for

Your local computer store has several different brands to show you. So the salesman can recommend the one that best meets your needs. Chances are, it will be an Apple Computer. Apple is the one you can program yourself. So there's no limit to the things you can do. Most important, Apple's the one with more expansion capability. That means a lot. Because the more you use your Apple, the more uses you'll discover. So your best bet is a personal computer that can grow with you as your skill and involvement grow. Apple's the one.

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Grab a piece of the future for yourself. Visit your local computer store. We'll give you the address of the Apple dealer nearest you when you call our toll-free number. Then drop by and sink your teeth into an Apple.

800-538-9696. In California, 800-662-9238.

CIRCLE 22 ON READER SERVICE COUPON

apple computer

elementary electronics

July/August 1979
Volume 20, No. 4

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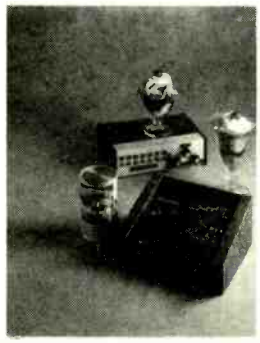

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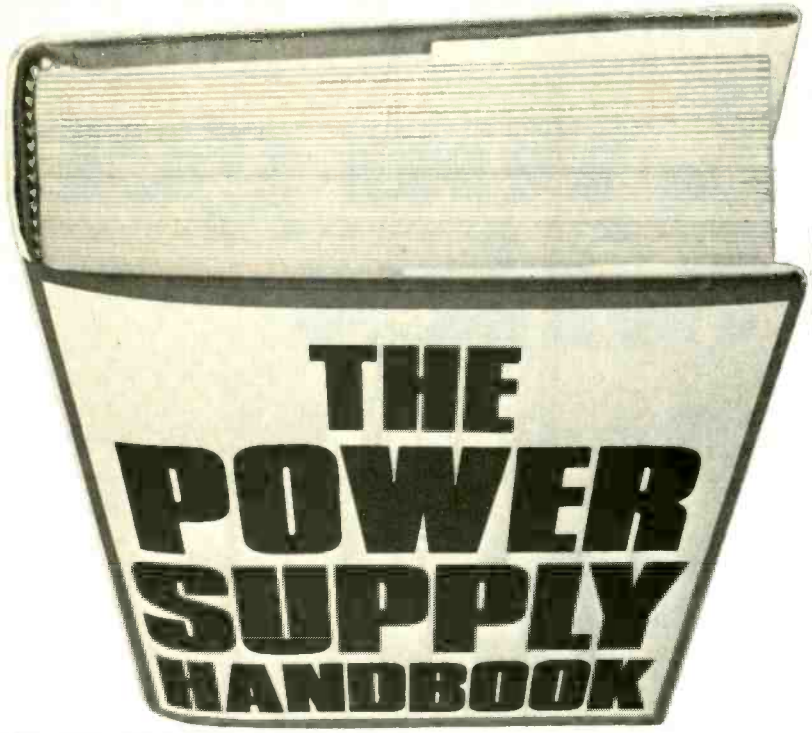

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The Power Supply Handbook

A broad, rich, and varied collection of ready-to-build power sources for electronics technicians, hams, engineers, and hobbyists!

This is THE complete power supply book...the all-in-one Answerbook with ALL the data you need to build, design, test, and customize virtually any power supply system you want—from AC-to-DC converters to linear amplifier filament transformers, from simple dual-voltage systems to hefty 3000V DC powerhouses, from low-voltage units to precision 10.000V DC references, from sine wave inverters to failsafe superchargers! It contains 420 pages of solid how-to info, stripped clean of irrelevancies, packed with practical instructions on how to create just the unit you need for that special application. You get a brief course in power supply theory, some basic schooling in testing, a thorough guide to power supply design, and section after section of pretested power supply circuits you can build and modify. Projects like 13V mobile systems, 12V 20A brute supplies, voltage sextuplers for SSB, 115V 60 Hz sine wave inverters, regulated nicad chargers, precision 10.000V DC references, adjustable low-voltage regulated supplies, 117V AC to 24V DC converters, and lots of special-purpose AC supplies. And precisely because this manual is so comprehensive, you'll be able to build PS systems that are as good as any you can buy, systems that meet your specifications.

Probably the most remarkable thing about this volume is the sheer variety and quality of the projects it offers...each one is reliable, pretested, easy to build, and you can construct most of them from inexpensive salvaged or surplus parts. It would have to be a very unusual PS indeed not to be covered in this manual, for here you'll find everything from simple get-the-job-done units to highly refined adjustable supplies. Step-by-step instructions tell you how to put together voltage doublers for MOS LSI, super low-voltage supplies, 78MG voltage regulators, 13V supplies for mobile equipment, 110V 600 Hz inverters, polarity changers, 12V to 300V converters, solid-state car alternator/regulators, silver-zinc cell battery chargers, zero to 30V lab supplies, simple four-voltage bench supplies, and many more. The projects come with all the data you need to insure flawless no-hitch construction—concise analyses of special circuits, easy-to-follow directions, detailed schematic diagrams, complete parts lists, and special discussions of construction safety precautions.

The scope of this handbook is broad—broad enough to include construction info on tested circuits that'll help you make the most of any power supply you put together—circuits that'll allow you to interface, modify, and test your own PS designs. The authors show you how to construct voltage splitters, IC protection circuits, smoke testers, two-terminal current limiters, voltage limit sensors, active voltage dividers, microfarad multipliers, capacitor rejuvenator-leakage testers, and many, many others. 420 pps., 292 illus. Hardbound. List $12.95.

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John E. Cunningham

Special Projects Director
Cleveland Institute of Electronics

My father always told me that there were certain advantages to putting all your eggs in one basket. "John," he said, "learn to do one important thing better than anyone else, and you'll always be in demand."

I believe he was right. Today is the age of specialization. And I think that's a very good thing.

Consider doctors. You wouldn't expect your family doctor to perform open heart surgery or your dentist to set a broken bone, either. Would you?

For these things, you'd want a specialist. And you'd trust him. Because you'd know if he weren't any good, he'd be out of business.

Why trust your education and career future to anything less than a specialist?

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We have to be good at it because we put all our eggs in one basket: electronics. If we hadn't done a good job, we'd have closed our doors long ago.

Specialists aren't for everyone.

I'll tell it to you straight. If you think electronics would make a nice hobby, check with other schools.

But if you think you have the cool—and want the training it takes—to make sure that a sound blackout during a prime time TV show will be corrected in seconds—then answer this ad. You'll probably find CIE has a course that's just right for you!

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Waldom is offering two Molex Nylon Connector Designer Kits. The WM-50 Standardized Series Nylon Connector Designer Kit, priced at $29.95, uses .093-inch mating-diameter pin terminals (up to 12 amps per circuit). The kit contains specially selected parts to easily assemble male and female connector housings from single-circuit to 15-circuit connectors or a total of 45 finished connectors. The WM-50 also contains a heavy-duty crimping tool and a pin terminal ejector tool. All are cased in an attractive and rugged compartmentalized storage case. The WM-72 Miniature Series Designer

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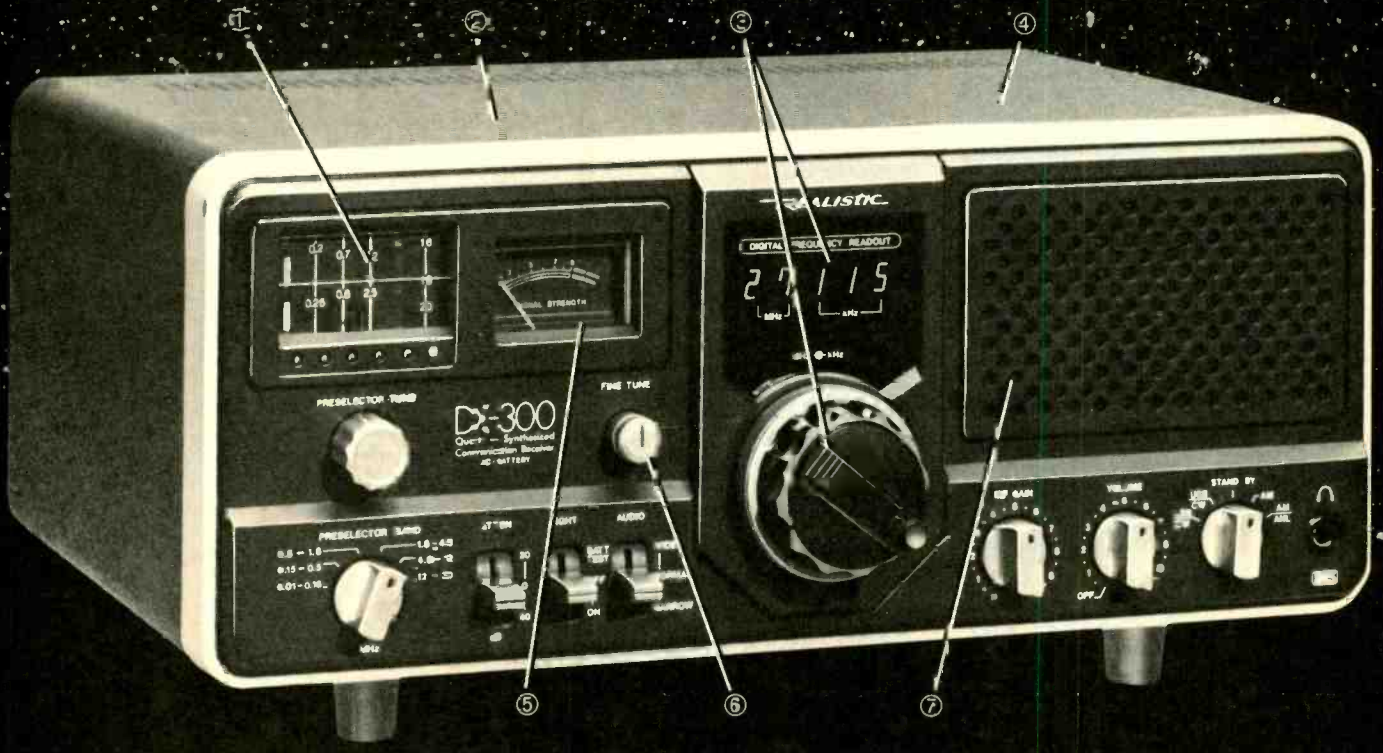
Kit features polarized nylon housings and .062-inch mating-diameter pin terminals (up to 5 amps per circuit). This kit contains a special number of parts to assemble male and female connector housings from single-circuit to 36-circuit complete connectors for a total of 56 connectors. Also included are a crimping tool and pin ejector tool. The WM-72 is priced at $34.95. All parts and tools are housed in an attractive compartmentalized plastic case. There are no other extras to purchase, except if you wish to assemble more connectors for other projects as time goes by. For the complete story on this and other Waldom products, contact your local Waldom Electronics distributor, or write to: Waldom Electronics, Inc., 4301 West 69th St., Chicago, IL 60629.

18 Channel Programmable Scanner

The new Electra Bearcat 211, crystal-less scanner radio with 18 channels can be

(Continued on page 10)

NOW! An Affordable Digital LED Readout Receiver that Brings You Exciting Global News, Action and Entertainment, from 10 kHz to 30 MHz Continuous, in 30 Bands!



Tune in the world with the Realistic® DX-300, the general coverage receiver that gives you features never offered at this low price. Enjoy English as well as foreign-language shortwave broadcasts from world capitals and every corner of the globe. Pick up aviation weather and marine SSB. Get WWV time signals and the Voice of America. Hear CB and worldwide Amateur radio conversations and listen to standard AM stations from all across the USA. Accuracy, resetability and ease of tuning are incredible. Just set the dial to the exact frequency of the station you want — 105 international SW stations are listed in the owner's manual alone. For finest reception from any station, the DX-300 has a 3-step RF attenuator, audio bandwidth and RF gain controls, and two antenna inputs. And what versatility: terminals for remote receiver muting, tape recording, screw-on whip antenna for portable use, built-in oscillator and key jack for code practice. U.L. listed, of course. Step up to great listening at a great price. Only 379.95* buys you the world!

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HEY LOOK ME OVER

(Continued from page 8)

programmed with push-button ease. The Bearcat 211 features direct channel access, which allows the user to manually select channels directly, without the need to step through other channels. In the radio's automatic scan mode, the 18 channels can be scanned at either 5 or 15 channels per second, permitting closer monitoring of desired frequencies. Also included is a patented Selective Scan Delay which permits a 2-second delay to be programmed for any channel, allowing reply calls on the same channel

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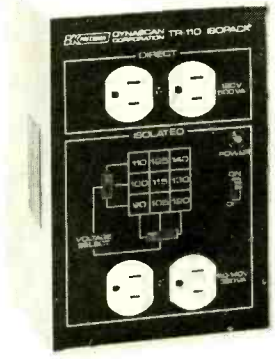
to be picked up. It also has a built-in digital clock. Another feature, built-in Automatic Squelch, allows the convenience of selecting a factory pre-tuned squelch level, eliminating the need for manual squelch level adjustment. Thousands of frequencies in six bands include public safety, marine, government, transportation, and amateur communications. In the "Search" mode, the radio will seek out active frequencies between the limits selected by the user. Sells for $329.95. Complete details on the new Bearcat 211 scanner are available from Bearcat scanner suppliers or by writing to Electra Company, P.O. Box 29243, Cumberland, IN 46229.

AC/DC Sets Safe for Testing

The B&K-Precision TR-110 Isopak isolation transformer eliminates shock hazard



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in the testing of transformerless equipment and AC/DC radios. The TR-110 Isopack featuers both direct voltage and dual isolated outputs to ensure user safety during testing. The unit also reduces the possibility of damage to AC-powered test instruments due to improper ground connections. The TR-110 Isopack has an isolated AC output adjustable from 90 to 140-volts in nine steps, an important feature for uncovering voltage-sensitive and intermittent faults in TV, radio and audio sets. In addition, the adjustable output feature allows the user to select a specific line voltage required for standard procedure testing. The isolated output function has a power rating of 350 VA continuous. The TR-110 is available immediately from electronics distributors for $75. For further information on the TR-110 and other precision test instruments, write to B&K-Precision, 6460 W. Cortland Street, Chicago, IL 60635.

60-inch Antenna Line

The new Antenna, Inc. Persuader CB antenna line features a 60-inch stainless steel tapered whip, and a hand-wound, hand-tuned coil in the cup. Though the Persuader antenna has been designed primarily for performance, it also includes popular mounting features that give it added appeal, with a choice of magnet or trunk lip mount. For easiest installation, the preassembled, pre-tuned an-

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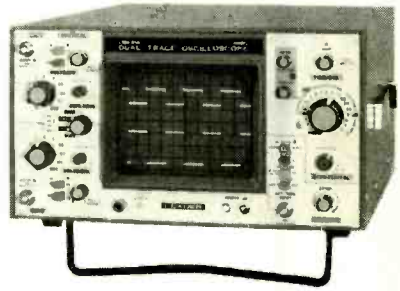
tenna comes with a magnet mount. The mounts are available in colors coordinated to the most popular late model car finishes. The suggested retail price of the Persuader antenna is $34.98. For further information on the Persuader antenna series and for other Antenna Incorporated products, write to Antenna Incorporated, 26301 Richmond Road, Cleveland, OH 44141.

High Sensitivity Oscilloscopes

Two 10 MHz oscilloscopes recently introduced by Leader Instruments feature up to 1-mV sensitivity, a capability until



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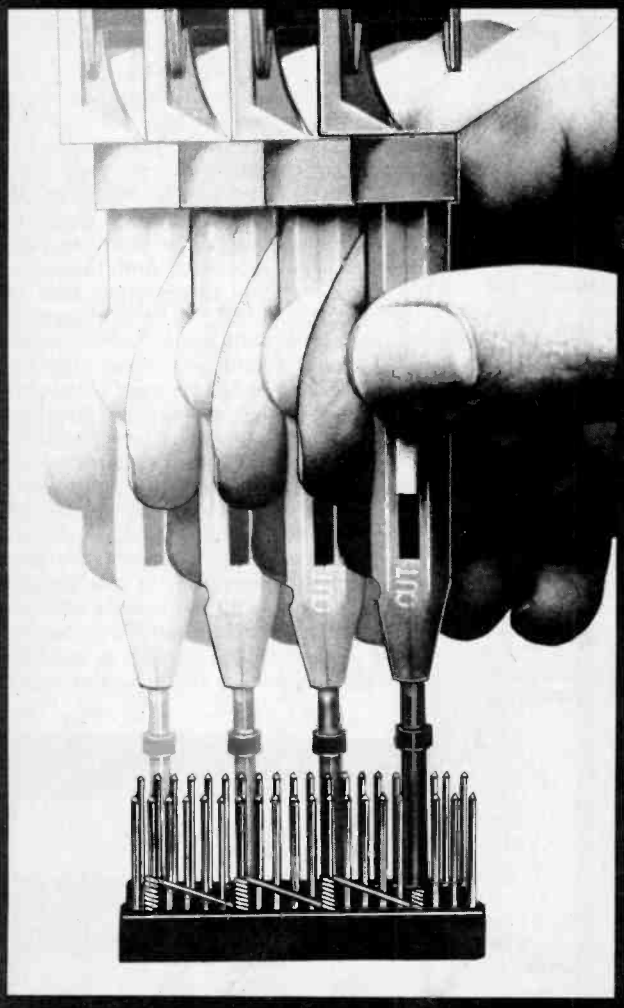
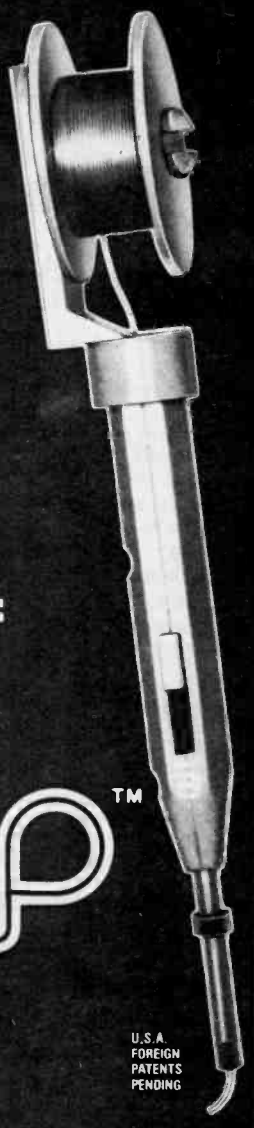
now unavailable in low cost instruments. The LBO-513 Single Trace and LBO-514

(Continued on page 12)

NEW!





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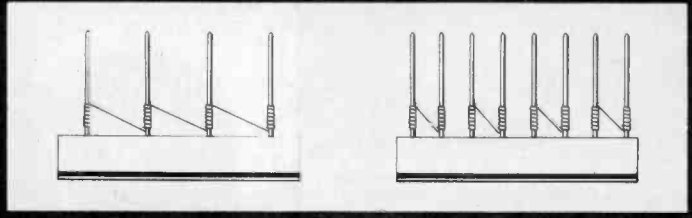

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HEY, LOOK ME OVER

(Continued from page 10)

Dual Trace Oscilloscopes are both equipped with 8 by 10 cm displays, Z-axis modulation, 5X magnifier, and complete trigger controls. The LBO-508 Dual Trace unit also provides front panel x-y operation, CH-1/CH-2 trigger selection, and alternate or chopped display modes. The LBO-513 Single Trace 10 MHz Oscilloscope will be priced at $499, and the LBO-514 Dual Trace 10 MHz Oscilloscope will sell for $649. All Leader Instruments carry a 2-year warranty. For information, write to Leader Instruments Corp., 151 Dupont St., Plainview, NY 11803.

High-Performance CB Antenna

American Antenna has introduced a totally new CB mobile antenna designed to outperform all other mobile antennas on the market, with a *money back guarantee* if it doesn't. The K40 features the largest machine-wound loading coil in the industry with a quarter-turn quick-release feature. It comes factory assembled with 18-feet of coax cable and standard connectors, and with a trunk-lip/roof-top mount included. An optional accessory, "Uni-Mount," permits easy installation on gutter, luggage rack, mirror, or motorcycle. The K40 is available exclusively at

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professional CB dealers, and is priced at $38.50 completely assembled with coax, connectors and mount. For further information, contact: American Antenna, Customer Service Department, 1945 South Street, Elgin, Illinois 60120.

Car Speaker With Rain Guard

A small, but powerful new air-suspension car stereo speaker, designed especially for door installation in both foreign and

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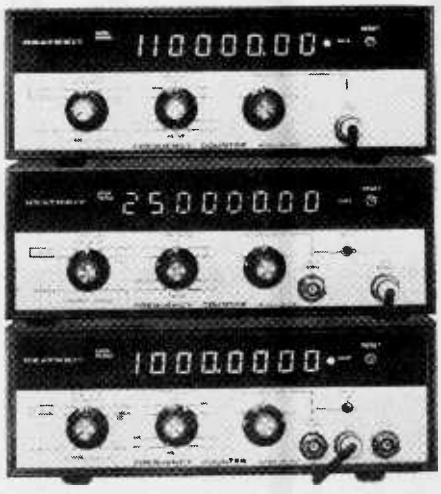
domestic cars, is the Fujitsu Ten SSB-8G11 speaker system. It features a unique detachable rain guard that shields the installed speaker against moisture from window leakage that could otherwise cause corrosion and mildewing. Just four-inches in diameter and 1½-inches deep, the 8-ohm speaker handles a full 20-watts RMS, and delivers a frequency response from 90 to 15,000 Hz. Its magnet weight is 6.6 ounces. The Fujitsu Ten SSB-8G11 is available at Fujitsu dealers throughout the country and carries a nationally advertised price of $42.95 per pair. For complete information, write Fujitsu Ten, Dept. P, 1135 East Janis Street, Carson, CA 90746.

Trio Counters

Heath Company has introduced three new frequency counter kits; the IM-4110, the IM-4120 and the IM-4130. Input frequencies of the three counters are 5 Hz to 110 MHz, 5 Hz to 250 MHz (in two ranges) and 5 Hz to 1 GHz (in three ranges) respectively. The new counters offer excellent accuracy and resolution for a wide variety of counting jobs including: CB, AM and FM, hi-fi equipment, marine and aircraft radio, military applications, land mobile and more. Additionally, the counters can be used for events, period and period averaging. Eight digit LED readout indicates the frequency counted. A switchable attenuator on the 110 MHz input divides the input signal by one, ten or one hundred to facilitate measurement of large amplitude signals. The time base switch selects the gate time and the resolution of the display. The 4120 and 4130 time bases are controlled by a TCXO (temperature compensated crystal oscillator) with a temperature stability of ± 1ppm and an aging



CIRCLE 1 ON READER SERVICE COUPON

rate of <5ppm/yr. (The 4110's crystal oscillator has temperature stability of ± 10ppm and an aging rate of <10ppm /yr.). The IM-4110 is priced at $189.95, the IM-4120 at $329.95 and the IM-4130 at $529.95. The counters are also available fully assembled and tested at slightly higher prices. For complete details on these frequency counters and other Heath instruments, write Heath Company, Dept. 350-24, Benton Harbor, MI 49022, for a free catalog.

(Continued on page 14)

Lab Test Elementary Electronics For Yourself

Get switched on

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

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

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

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!

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- How to Customize Your CB Antenna
- Those Incredible TV Sets of the Future
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- The World's Worst Hi-Fi Components

TRY A FEW ISSUES AND EVALUATE OUR . . .

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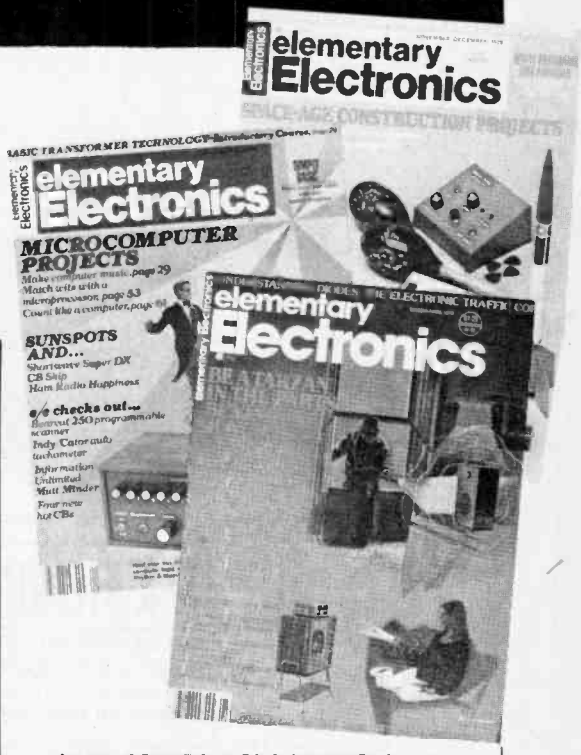

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HEY, LOOK ME OVER

(Continued from page 12)

CB Price Reductions

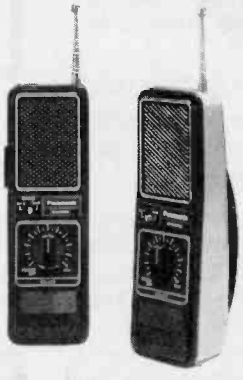
Suggested retail prices of Johnson CB radios have been reduced by up to 22%, with the average suggested retail price cut by $20. For instance, the Viking 270 model (see photo) with dual channel scan has had its suggested retail price dropped from $199.95 to $179.95. The Johnson 4360 trunk-mounted remote CB with telephone-type handset, which formerly carried a retail price of $229.95, now also has a $179.95 suggested price. Prices for the other models have been reduced to $149.95 and $129.95. Johnson is also introducing the new Viking 200 model, which will carry a $99.95 retail price. The US-made radio features an LED channel display with a bright/dim switch, illuminated S/RF meter, switchable noise limiter, public address function and built-in speech compressor. Complete details on the new Viking 200 model and the new pricing on other Johnson CB radios is available by writing to Johnson American, Inc., 299 Tenth Avenue, S.W., Waseca, MN 56093.

CIRCLE 53 READER SERVICE COUPON

Walkie-Talkie

Panasonic has introduced a walkie-talkie, the Model RJ-78 which is a powerful, 49 MHz unit featuring two channel operation and built-in crystals. The RJ-78 walkie-talkie has a 2¼-in. speaker which doubles as a microphone and comes complete with a carrying case, two crystals, three "A" 1.5 volt batteries and a convenient hand carrying strap. Sells for $49.95 per pair. Available from electronics stores and Panasonic dealers nationwide. For further info, write to Panasonic, One Panasonic Way, Secaucus, NJ 07094.

CIRCLE 49 ON READER SERVICE COUPON



Economy Terminal Kit

Vaco's new economical terminal kit No. 89950 comes with a molded tray with separate compartments for the Vaco 1963 crimping tool and 18 each of 20 of the most popular insulated terminal styles. Included is a handy folder that locates each terminal and explains the uses of the crimping tool. Sells for $35.00. Vaco products are found wherever professional hand tools are sold. Can't find a dealer? Then write to Vaco Products Company, 1510 Skokie Blvd., Northbrook, IL 60062 or call (312) 564-3300. ■

CIRCLE 51 READER SERVICE COUPON

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

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FROM OUR MAIL BAG

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

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

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CIRCLE 26 ON READER SERVICE COUPON

BOOKMARK
BY BOOKWORM

Facts for Kids. An all-new and updated edition of Radio Shack's popular educational "comic" book, *"The New Science Fair Story of Electronics . . . the Discovery that Changed the World!"*, is available for free distribution to schools, clubs, youth groups and interested individuals. The 24-page, full-color booklet traces the development of electronics from ancient times to the present, focusing on the human interest side of science. Important discoveries and the people who made them are described in

An introduction to electronics in an ingenious format.

CIRCLE 32 ON READER SERVICE COUPON

the easy-to-read narrative. Topics included are magnetism, ancient use of batteries, electricity in nature, the development of "wireless" communications, TV, radar and the transistor, electronics in aviation and space exploration, the computer age, plus much more. Included within the new edition are coupons which may be used to request additional copies, a membership in Radio Shack's free battery club, and a $1 gift certificate that can be used toward the purchase of any Science Fair or Archer kit at participating stores. The New Science Fair Story of Electronics is available free from participating Radio Shack stores.

Keep the Home Safe. The latest addition to R.M. Marston's series of electronics project books is entitled *110 Electronic Alarm Projects*. This guide brings together 110 useful alarm circuits for the home and industry. The operating principle of each circuit is explained in concise but comprehensive terms, and brief construction notes are given where necessary. The first five chapters cover alarm circuits for home and

110 ways to protect your castle.

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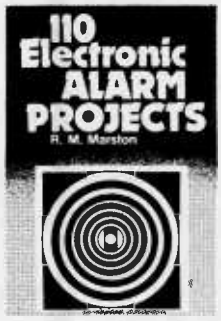

industry, including contact-operated alarms, burglar alarms, temperature alarms, light-sensitive alarms, proximity and touch alarms, power-failure alarms, and sound and vibration alarms. Chapter 6 describes automobile alarm circuits and details immobilizers and anti-theft alarms, ice-hazard alarms, overheat alarms, and low-fuel-level alarms. The final chapter is devoted to instrumentation alarm circuits, and shows alarms that can be activated by AC or DC currents or by voltage or impedance changes. Published by Hayden Book Co., 50 Essex St., Rochelle Park, NJ 07662.

Power Saving. Take a good hard look at your energy equation—the energy you really need, the energy you may be wasting, the energy you can produce yourself. *How to Cut Your Electric Bill & Install Your Own Emergency Power System*, by Edward A. Lacy, tells you how to balance that equa-

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CIRCLE 42 ON READER SERVICE COUPON

tion logically and economically. The text is actually programmed to help you find hundreds of cost-effective solutions without affecting your comfort or life-style. And if you're looking for energy independence, this manual tells you in plain English how to plan, buy, install, and operate your own electrical power plant for standby and emergency operation. Step-by-step directions tell you how to execute expert, well-thought-out installations; from simple gas-powered generators to paralleling engine sets and uninterruptible battery-powered sources like those used in computer systems. Loaded with useful statistics, filled with practical energy-saving ideas, packed with solutions to many of the common energy-saving pitfalls, this book will guide you through the complex world of energy efficiency in terms that you can understand. Published by Tab Books, Blue Ridge Summit, PA 17214. ■

DX central reporting

A world of SWL info!

BY DON JENSEN

SHORTWAVE LISTENING—chances are that makes you think of far away places, lands across the seas, distant stations. Well, SW DXing is that, of course. But it is also tuning in some interesting stations that aren't so far away. In fact, there are some interesting—and perhaps not so well known—shortwave stations right in our backyard. I'm talking about the shortwave voices of Canada.

Of course, every SWL is familiar with Radio Canada International, the powerful international shortwave service. And many of you readers also know the programs of the Canadian Broadcasting Corporation (CBC) Northern Service, transmissions to the remote and isolated regions of northern Canada.

Not so well known is the fact that there are seven other Canadian shortwave stations—all operating in the 49 Meter band—that you can hear. Two of them are regional outlets of the CBC; the other five are private SW stations. The purpose of all of them is to relay programs of a sister medium wave station to more distant listeners than could be reliably reached by the BCB outlet.

Let's look at the two CBC stations first.

CKZN, St. John's, Newfoundland, and CZKU, Vancouver, B.C., both operate on the same frequency, 6,150 kHz. The former runs only 300-watts and relays medium wave station CBN. The Vancouver station is operating with 400-watts of power and relays station CBU.

On the eastern seaboard of North America, CKZN will be, of course, the easier of the two to log. The reverse will be true west of the Rockies, where you will be more apt to log the Vancouver outlet. It may be easier to hear CKZN from California, for example, than it is to tune CKZU from, say, West Virginia, because the St. John's station has a somewhat longer daily schedule. Still, under the right conditions, with patience and careful tuning, you should be able to log both—though not at the same time, of course.

Now for the private shortwave outlets in Canada, let's begin in the east, across the continent. CHNX on 6,130 kHz, relays medium wave CHNS from Halifax, Nova Scotia. This shortwave outlet runs 500-watts of power on a 24-hour-a-day schedule. The programming is just what you would expect from a commercial medium wave broadcaster either in the U.S. or Canada. The same can be said of the rest of these shortwave stations. Remember they are relays, and so you can expect to hear the BCB call letters announced—in this case, CHNS. Washington, D.C. DXer Pitt McNeil tells us that a particularly good time to try for this one is between 2330 and 0000 GMT when there is no other interfering station on the frequency.

A good bet for most SWLs is Montreal's CFCX on 6,005 kHz. It relays the medium wave CFCF, using 500-watts. In the eastern part of the United States and Canada, this station can be heard even during daylight hours, although for longer range reception, 49 Meters is usually "in" during the late afternoon, hours of darkness and early morning periods.

A similar situation applies to CFRX, 6,070 kHz, in Toronto. It too can be heard during daylight hours in the east and northeast. This station relays the MW outlet, CFRB. The station runs a kilowatt of power on a 24-hour-a-day basis. The question is, though, for

(Continued on page 22)

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DX CENTRAL

(Continued from page 17)

how long? There are reports that CFRX will be phased out by this fall or early 1980. So if you want to log one of this dwindling number of private SW broadcasters before it vanishes forever, do it now!

Out on the Canadian prairie, at Calgary, Alberta, is CFVP, on 6,030 kHz. This 100-watt station relays its BCB partner CFCN.

CFVP is a curious critter. Several years can pass without a report turning up on this station. Then, as was the case last winter, suddenly the station is heard quite widely—especially around dawn in the east and midwest—for a while.

Finally, there is the lowest-powered shortwave station in North America, CKFX, 6,080 kHz, at Vancouver, B.C. This one runs only a measly 10-watts of power, relaying medium waver CKWX.

Until the winter of 1978, this one was hardly ever heard more than a couple of hundred miles from Vancouver. However the station engineers gave the tiny transmitter a good going over and—suddenly—CKFX was getting out! It's still 10-watts, but apparently a mighty efficient little operation, since it reportedly put rather decent signals into the midwest, into Ohio, and even to New England. You might look for this one in the coming months, especially around 0800 to 1100 GMT. Its program format is country and western music. You see, you really don't have to look very far to find some interesting and challenging DXing targets.

The New Breed. Many of you have been asking about the new generation of shortwave receivers featuring electronic digital readout. Well, the news is good, and getting better.

It wasn't too very long ago that in order to buy a receiver with digital readout, you had to pay a staggering amount of dollars. Now it is possible to purchase a receiver with digital readout for under $300. And if you're willing to pay a hundred or several hundred dollars more, your choice increases significantly.

What is digital readout? Electronic digital readout means that you "read" the frequency to which your receiver is tuned by means of an illuminated digital display. If you're tuned to 9,575 kHz, those four little numerals 9-5-7-5 blink out at you from the front panel of your receiver. There is no more old fashioned dial pointer, no more guesswork, no charts or whatever to help you determine the frequency.

Don't get me wrong. Many of the older type receivers—and some are still on the market today—were and are top notch DX machines. They did everything we could wish of them *except* make it super-easy to read the tuned frequency.

There are a number of important factors to consider when it comes to buying a shortwave receiver, selectivity being one of the most important; the ability of a receiver to "separate" signals in a crowded band. Readout isn't the sole factor to consider when buying a set, but for many listeners it is an important one. So the availability of receivers with digital frequency readout at an affordable price is good news indeed.

Currently, at a suggested retail price of about $280, the least expensive receiver offering electronic digital readout is Panasonic's RF-2900, which is an upgraded version of the RF-2800 model.

The major improvement of the RF-2900 over the 2800 model is that the digital readout now functions on the medium wave AM and the FM bands as well as shortwave. The digital display is now a green fluorescent, rather than the little red LEDs of the older model. Panasonic also has a more expensive big brother, the RF-4900, which replaces last year's RF-4800.

Yaesu-Musen, which had a real hit on its hands ever since it introduced its FRG-7 shortwave receiver—dubbed

(Continued on page 88)

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

ANIXTER-MARK'S HELIWHIPS

—a new twist in mobile antennas

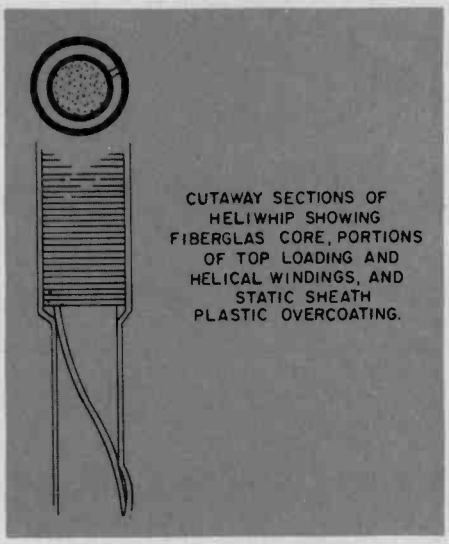
THE ANIXTER-MARK HELIWHIP series of Amateur Radio antennas must be one of the least appreciated top-quality products in the entire amateur radio industry. The first of the Heliwhips, for Ten Meter operation, appeared in the late 1950s. This writer used one on one of the Plymouths of the time and, even though it was virtually buried by tail fins, it managed to work the world with ten watts. Since then, the HW series has been expanded to include models for all bands from Ten to Eighty Meters, in both 100-watt rated versions and 1000-watt (the KW series) models. A recent addition is the HW-3, an automatic band-switching Ten-Fifteen-Twenty Meter model. All of these antennas are superb performers.

Looking Under the Surface. The antennas put through the rigors of our test lab are the HW-10 through HW-80 series. The series includes a separate unit for each band, which can be purchased individually, as well as an assortment of bases featuring the sturdy HWM-1 Molded Antenna Mount (requiring a ⅝-inch mounting hole), and a very heavy duty trunk lid mount. The Heliwhip is made of a fiberglass core, a helical winding, and a special dielectric plastic covering (called "Static Sheath") which the manufacturer claims acts as an electrical insulator, eliminating all static interference from the precipitation effect, and improving signal-to-noise ratio and therefore receiver sensitivity up to 20 dB.

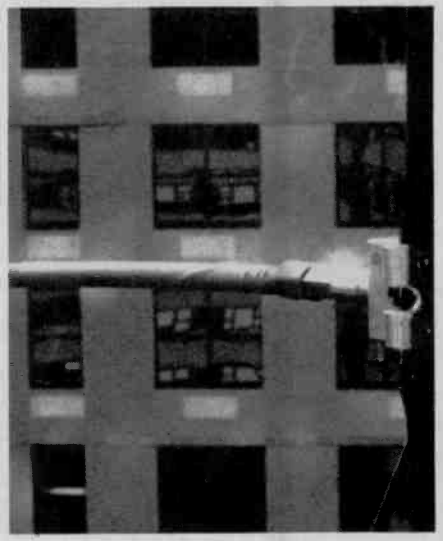
The Heliwhips are helically wound—continuously—in a special configuration which concentrates the load at the top. This manner of loading provides uniform current distribution and produces the important 50-ohm match at resonant frequency. The size of the antennas—the Eighty, Forty, and Twenty Meter versions are six feet long and the Ten and Fifteen Meter units are only four feet long—makes it easy to locate the whips on upper portions of the vehicle such as the trunk lid, cowl, fender, or hood. In contrast to bumper mounts, this insures a sufficient ground plane for proper radiation and loading.

Put Through the Mill. These antennas are especially flexible, and lend themselves to a variety of uses. We first tested the Heliwhip series on a full-size American car. The transmitter used for the testing was an all-band Yaesu FT-7, running about 20-watts DC input. Results were uniformly excellent on the mobile tests. On Ten and Fifteen Meters we were able to get a Standing Wave Ratio (VSWR) of less than 1.3 to 1 at antenna resonance. On Twenty Meters the SWR was about 1.5 to 1 at resonance, and on Forty and Eighty Meters the SWR was still below 2 to 1. Working mobile with the FT-7 balanced on the front seat, and the Heliwhips mounted on the trunk lid (admitttedly not as effective as the sheet metal mount) on Ten and Fifteen Meters, no trouble was experienced getting 5 by 9 reports from anywhere in the continental USA. At one point, stuck in a traffic jam on the New England Thruway, in quick succession we worked California, Washington, New Mexico, and Nebraska, and never got lower than a 5 by 7. The real surprises came on Ten Meters, when we worked

(Continued on page 89)



Anixter-Mark's continuously helically-wound antennas combine important equal current distribution and good SWR characteristics.



With a little ingenuity, a Heli-Whip makes an excellent apartment window antenna. On the 27th floor, the A/M works the world.

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Electronics in the News!

Lasers Work Assembly Line

Use of lasers and high-speed dental drills to fine tune advanced smoke detectors are among the features of a new automatic Honeywell assembly line. Each detector goes through more than

Jim Mourning, Sr., machine design engineer, watches as smoke detectors on the assembly line have thick-film resistor networks cut by laser beams. Green goggles are required on personnel and a remote-screen television projection shows resistors as they are being cut by the laser beam.

60 quality control checks during the assembly process—many of them by hand, but most of them with computers and automatic assembly machines.

Assembly starts with a custom-designed, in-line insertion machine that takes a blank circuit board and in less than a minute runs it through 12 statios to assemble resistors and integrated circuits that are the brains of the detector. As these parts are put into the board, a computer is checking them and will not only reject a bad board but give the machine operator a printout telling why it was rejected.

Next on the assembly line, the 85-decibel level horn alarm is added and also a thick-film resistor network that does the job of four conventional resistors with greater dependability because of the solid-state design. This resistor network is trimmed precisely for each detector by laser beams later in the assembly operation.

At this point, every component on the printed circuit board and horn assembly is checked automatically by a computer troubleshooter. Then the PCB and sensing chamber are added to the housing and each detector is ready for calibration. An automatic assembly machine checks 10 detectors at a time, testing each horn 16 times and recording the characteristics of each detector in three vital areas.

When the device goes to the laser room next, the computer trims the resistor chip for high-sensitivity, low-sensitivity and the low-battery detector. When the low-battery detector senses need for battery replacement, it will sound the horn alarm intermittently for at least 30 days to warn homeowners even if the battery gets weak while they are away on vacation.

The last of the more than 60 quality control checks comes on a machine that gives the detector a fully-automated inspection in which every component is checked. The detector is then ready for shrink-wrapping, boxing and shipping. A look at the final product reveals a simple design belieing a detailed programmed assembly.

Beer Can Cell

A new 2-volt, 25 Ah (Ampere hour) energy cell has been developed for pilot production by Gates Energy Products. The unique design of the BC cell (named because the battery is the size of a 16 oz. beer can) overcomes many of the former limitations of lead-acid cells while retaining the low cost, reliability, ruggedness and long life which have always been assets of lead-acid systems.

The BC cell, along with Gates' D and X cells, is truly sealed—no acid, acid vapor or water loss—and incorporates recombination of gasses within a starved electrolyte system. The cell is constructed with thin, spirally-wound, pure lead, which results in low impedance, low corrosion, long life and excellent float characteristics.

While it will never replace a tall, cool one at the ballgame, this new beer-can-sized battery from Gates might make a lot of industrial batteries obsolete.

Typical specifications of the Gates' BC cell are: nominal cell voltage of 2.0 VDC and capacity ratings of 26 Ah at a 20-hour discharge rate, 25 Ah at 10 hours, and 20 Ah at one hour.

If you want further information and application ideas about the new Gates BC cell, write to Gates Energy Products, Inc., Department BC, 1050 South Broadway, Denver, Colorado 80217. ■

HI·FI REPORTS

A Dual cassette deck with lots of features — a Crown preamp with straight-line performance.

By Gordon Sell

☐ IN PAST ISSUES I have talked about upgrading from a budget to a medium priced hi-fi system. First you replace the weak links, the palsied turntable or the one-bias deck, and then you add a power amp and a hearty pair of speakers. Now you are ready to develop a good system into a great system.

There are many things you can do but they boil down to two basic routes: improving the signal inputs or improving the signal processing. As always, these improvements should be made where your system is weakest. If you are feeding a good power amp with a rather crotchity old receiver then you might consider adding a pre-amplifier. While, if you are dissatisfied with your tuner, turntable or cassette deck then upgrade from there.

In this Hi-Fi Report I'll take a look at a couple of pieces of gear that will add a new dimension to your audio set-up; gear that will give your system the look and sound that you expect

Dual C-819 Cassette Deck. When it comes to nice features and great performance it's hard to beat this deck. It has one of the neatest features ever devised for the off-the-air recordist — a fade-in/fade-out erase control. With this you can counter the average DJ's annoying habit of cutting in before a record has completely finished. The music just before the DJ cuts in is usually unimportant so if you rewind and turn on the Dual's fade-out erase just before the DJ comes on you can eliminate the sudden stop in the music. Likewise you can fade in late in the intro to a song without the sudden and disconcerting off-to-on transition.

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Dual C-819 Cassette Deck

In addition to this, and one of the lowest wow and flutter measurements our lab has ever seen, the Dual C-819 has everything else we've come to expect from a first rate cassette deck. It has mic/line input mixing, selectors for ferric oxide, ferrichrome and chrome tape bias, individual left and right record level indicators, Dolby, record level limiter, automatic tape stop/disengage, individual left-right headphone controls and a memory reset counter.

Its performance, with one exception, makes it an outstanding value for a unit in its price class. Where it really shines is in its ability to get great performance with low cost tapes.

Using TDK-D without dolby the record/play back frequency response measured +1/−2 dB from 20 to 15,000 Hz. Distortion, with the record level meter at 0 db, measured 1.1 percent THD (Total Harmonic Distortion) with 6.5 dB headroom to 3 percent THD. The signal to noise ratio was 48 dB at a 0 dB record level. With Dolby on the frequency response measured +1/−3 dB from 20 to 13,000 Hz, distortion and headroom were the same and the signal to noise ratio went to 52 dB wideband and 59 dB narrowband.

With chrome tape all performance factors were off slightly except for the signal to noise ratio which went up to 63 dB narrow band. We could not get acceptable results with ferrichrome tape, but this should not be much of a drawback since you can get even better results with the less expensive ferric oxide tapes such as the TDK-D. (This could have been a fault of the machine that we tested.)

The limiter provides total protection against record level overload by cutting in hard at −1 dB. The wow and flutter measured an outstanding 0.04 percent. All in all this is a great cassette deck and with the fade-in/fade-out feature you can make truly professional recordings right off the air. The Dual C-819 retails for $430.

Crown SL-1 Pre-amplifier. If you are looking for an overall improvement in your sound quality then parhaps you should consider a pre-amplifier like the SL-1 (Straight Line One). It gets its name from Crown's philosophy of pure, no frills, straight line, signal amplification. The sound emerges at the output with all the fine details intact and, next to no added distortion. If you can find a pre-amp that does this then you have a pre-amp that does just what it's supposed to. Unlike some pre-amps the SL-1 doesn't have tone controls.

With the elimination of these signal interrupting circuits Crown feels that they gain a significant improvement in distortion specifications. Our laboratory tests seem to bear this out. The THD (Total Harmonic Distortion) measures 0.005 percent. The actual figure might even be lower but the reading is indistinguishable from the residual noise level of our test equipment. There wasn't a quiver in the frequency response curve.

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Crown SL-1 Pre-amplifier

One feature of the SL-1 that is rather unique is the remote phono preamplifier module. If you've ever had a delicate Mozart concerto interrupted by "Breaker one nine this is Steel Hauler hammer down on 80 West," then you'll really appreciate this module. It suppresses the Radio Frequency Interference (RFI) that often gets into the wires that run from the cartridge to the first amplifier stage and act like an antenna. In addition to a built in RFI cancelling filter, its close proximity to the turntable allows the shortest lead-in cables possible. The module's input impedance can be switch selected to either 47K- or 100K-ohms.

The only adjustment, other than volume and balance, that can be made is the engaging of a low frequency filter to tune out rumble or other subaudible noise. It is 3 dB down at 33 Hz and 13 dB down at 20 Hz.

The SL-1 can handle up to six inputs and monitor the two tape inputs.

There are two overload warning LEDs that light if the output level reaches the 11-volt clipping level. With a 3-mV input and a 1-volt output the magnetic input hum and noise, with maximum module gain, measured 65 dB with no trace of opposite channel crosstalk.

The SL-1 is a pre-amplifier that does just what it is supposed to do and it does it very well for a suggested retail price of $549. If you want tone control get a graphic equalizer. That combined with the SL-1 will give you much more than most pre-amps with built in tone control.

Pioneer wants you to wake up to the sound of your hi-fi by replacing your clock radio with a DT-400 digital audio timer. It will turn on two AC outlets at whatever time you program the four-digit LED clock. It also has a "sleep" shut off. Retails for $100. Circle Number 63 on the reader service coupon. ■

See The Newest In Quality Electronics You

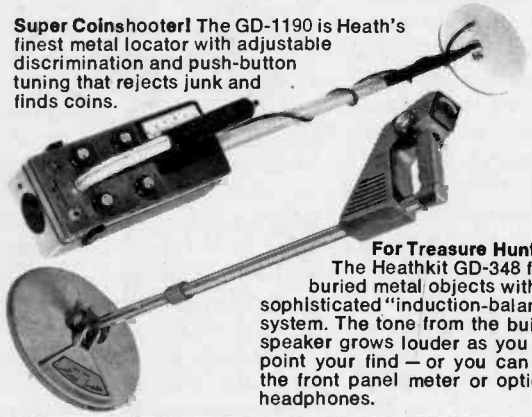
Custom Car Accessories like the Heathkit GC-1406 Digital Quartz Car Clock shown, or it's companion car clock with trip timer and stopwatch functions for the rally enthusiast, are easy and fun to build. And you have the quality and dependability in custom car accessories you can show-off with pride. Now you can choose one of these fine car clocks, a windshield wiper delay, a deluxe mobile siren and P.A. system, an ultrasonic intrusion alarm, an electronic speed control or a cab-to-camper intercomm — all in money-saving kit form you can build, service and install yourself.

A Super-Accurate Digital Alarm. The ideal choice for a 'first kit' — with snooze feature, AM and PM indicator, 12 or 24 hr. format and pleasant green-blue digital display. Budget priced, too!

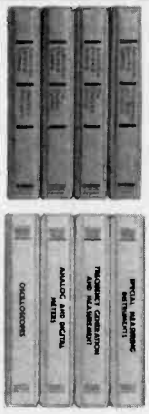
A Doorbell That Plays Your Favorite Tune! A fun way to greet guests with any 16-note tune you program — and you can even add remote speakers!

Low-Cost Home Security with this Heathkit GD-600 Photoelectric Lamp Switch. Turns your lamp on at dusk — off at daylight, for that 'lived-in' look when you're away from home.

Super Coinshooter! The GD-1190 is Heath's finest metal locator with adjustable discrimination and push-button tuning that rejects junk and finds coins.



For Treasure Hunters! The Heathkit GD-348 finds buried metal objects with it's sophisticated "induction-balance" system. The tone from the built-in speaker grows louder as you pinpoint your find — or you can use the front panel meter or optional headphones.



Learn To Service and Maintain Your Car's Electrical System with this newest Heathkit Automotive Electrical Continuing Education Program. Think of the money you'll save when you really understand how your car's electrical system works and how you can service it. This 4-part self-learning program takes you through electrical principles, starting and charging systems and accessories and body electrical... all at your own pace and at lowest cost.

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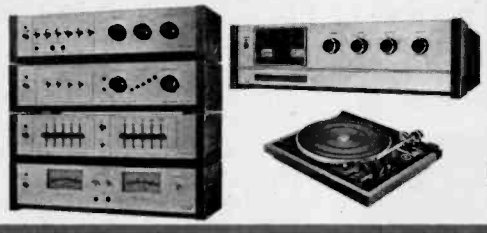

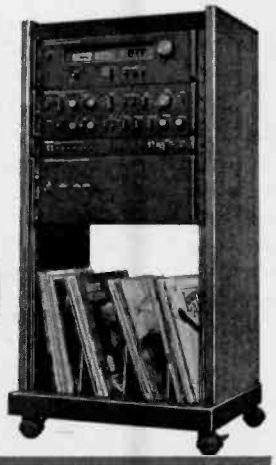

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OCTAVIZER

A new dimension in sound for the hobbyist and musician

by James J. Barbarello

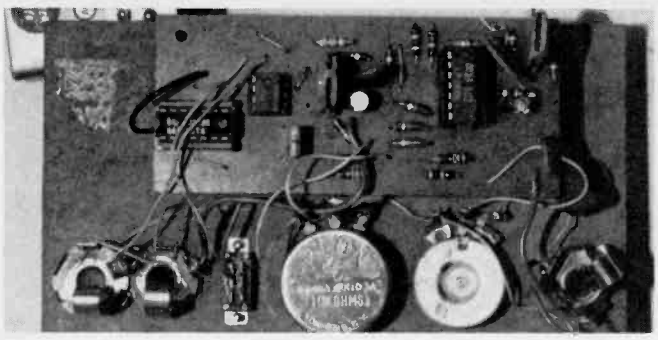
elementary Electronics July/August 1979

CONNECT ANY ELCTRIFIED or electronic musical instrument to OctaVizer and your instrument's single frequency output is expanded threefold. In addition to the single frequency input signal, square waves at fifty-percent of the frequency and one at twenty-five-percent of the frequency are available at OctaVizer's output. All three signals can be mixed in any proportion desired, using the *blend* and *prime* controls. The composite output signal can be used immediately, or further processed using filters or other such devices.

The *blend* control adjusts the relative magnitude of the two square wave signals, while the *prime* control adjusts the amount of input signal which is fed through to the output. The footswitch-operated cancel function disables the square wave outputs when activated.

OctaVizer uses readily available linear and CMOS digital integrated circuits, is powered by a single 9-volt battery, and can be built for less than $15.00.

How It Works. As shown in the schematic diagram, the input signal is AC coupled through C1 and C6 to a low-pass filter and a level control (R23) respectively. R4 and C2 form the low pass filter with a −3 dB point of about 350 Hz, which filters higher order harmonics that might otherwise be detected in later stages and cause false triggering. The filtered signal is amplified in IC1D along with the DC level set by R2. The output of IC1D is further processed in IC1A where it is squared up and clipped. The output of IC1A is AC coupled through C3 and added to the variable DC level set by R12 in the R11, R12, R13 voltage divider. This composite signal is used to trigger a monostable multivibrator (one shot) formed from IC2, R14, R15 and C4. If pin 4 of IC2 is held low by grounding J2, the output remains low regardless of the input. If J2 is not grounded, pin 4 of IC2 is held high by R16 and the pin 3 output is a pulse train of the same frequency as the input signal. This pulse train is used to clock two divide-by-2 flip-flops (IC3B and IC3A) which produce square waves at one-half and one-quarter the frequency of the input pulse train. The two flip-flop outputs are attenuated in the two variable voltage dividers formed by R17, R18 and R19. With R19 set at midrange, two equal voltage dividers are formed which attenuate the 9-volt square wave outputs to about 95-millivolts each (a level similar to that of the input signal). As the wiper is moved toward one side, that divider's signal level is decreased while the other's is increased. Therefore, *blend* control R19 can select either signal alone, or any ratio of the two. The level of the input signal provided to IC1B is selected by the *prime* control (R23). This signal, along with the out-



As you can see from this almost full-scale photograph, the circuit board is rather compact. It would be a relatively easy matter to build it into an existing pre-amp.

put of the two voltage dividers, is added in unity gain summer IC1B. Since the output of IC1B has a DC component, it is coupled by C5 to output jack J3.

Construction. OctaVizer can be constructed using any standard technique. Standard CMOS handling precautions should be observed when handling IC3. IC sockets may be used if desired. Assemble all components onto the board, being sure to observe polarity for the ICs, D1, and C5. Note that C6 is not mounted on the PC board, but is wired directly between J1 and R23. Interconnect the completed PC board with all jacks and controls. Any suitable case may be used to house the project.

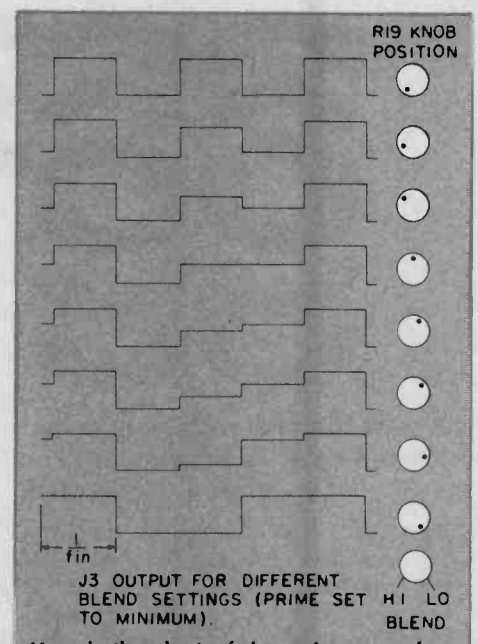
Alignment. If the input to OctaVizer was always a pure, mono-frequency signal, no alignment would be necessary. However, many electrified musical instruments' outputs are generated by a non-linear electromagnetic device (such as a magnetic pickup) and, as such, contain non-sinusoidal and/or harmonically related components. These components can be detected and cause false triggering. The alignment procedure outlined below will minimize the effects of these components while maximizing the overall response of the unit.

Begin by setting the wiper of R2 to ground, and the wipers of R12 and R15 to midposition. Connect the input device you will be using, and patch the output to an amplifier. Turn the unit on and rotate the wiper of R12 towards ground until you hear oscillation begin. Now turn the wiper of R12 slightly past the point where the oscillations stop (If a VOM is handy, set the voltage on the wiper to about 3¼-volts). Set R23 (*prime*) to minimum and R19 (*blend*) to high. As you play the instrument, rotate the wiper of R2 until an output is obtained. If the output is not half the frequency of the input (as determined aurally), back off R12 very slightly. You will notice that when the proper frequency output is obtained, its duration may be short. To increase the duration, adjust R2 slightly in the direction that produces oscillation. Next, play the highest note you will intend to play. The output will either be correct, very static sounding, or much lower in frequency than anticipated. If the output is correct, no adjustment is required. If the output is static sounding or lower than anticipated, rotate R15 until the proper output is obtained.

The final step is a fine adjustment which will maximize how long the signal lasts while minimizing false triggering. This adjustment consists of alternately adjusting R12 and R2 until you are satisfied you have obtained maximum duration and minimum (if any) false triggering.

Use. OctaVizer can be used over a 3-octave range. As with any new device, it is best to experiment with all controls to determine the effects that can be obtained. A standard guitar can be used with OctaVizer to create a raspy bass guitar effect by setting *blend* to "Hi" and *prime* to "Min." An interesting effect is created with *blend* to midvalue and *prime* set so both output components are of equal loudness. By striking the strings forcefully, you can create high amplitude harmonics that will false trigger the unit and raise the square wave outputs in frequency by an octave. Thus, by varying your striking

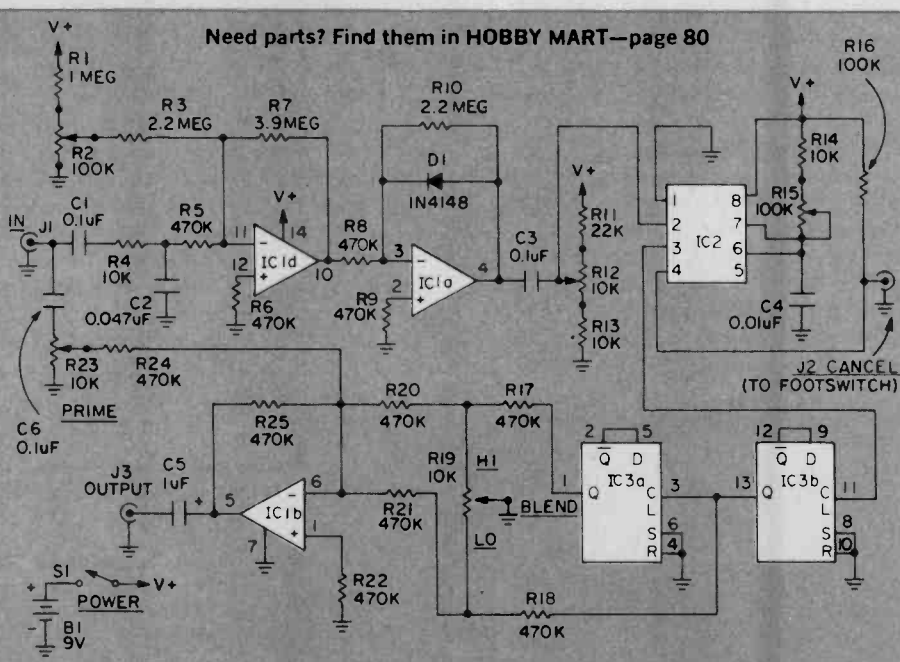
(Continued on page 83)



Here is the chart of the various waveform configurations made possible by varying settings on the "blend" and "prime" controls. Although designed for use through a three-octave range, if used with an electric guitar, false harmonics can be generated by forceful strumming, thus raising the outputs by one full octave automatically.

PARTS LIST FOR OCTAVIZER

B1—9-volt transistor battery
C1, C3, C6—0.1-μF, 25-VDC disc capacitor
C2—0.047-μF, 25-VDC disc capacitor
C4—0.01-μF, 25-VDC disc capacitor
C5—1.0-μF, 16-VDC electrolytic capacitor
D1—1N4148 diode
IC1—LM3900 quad op amp
IC2—555 timer
IC3—CD4013 dual flip-flop
J1, J2, J3—standard 2-conductor phone jack
R1—1,000,000-ohm, ¼-watt resistor
R2, R15—100,000-ohm, ¼-watt vertical-mount trimmer potentiometer
R3, R10—2,200,000-ohm, ¼-watt resistor
R4, R13, R14—10,000-ohm, ¼-watt resistor
R5, R6, R8, R9, R17, R18, R20, R21, R22, R24, R25—470,000-ohm, ¼-watt resistor
R7—3,900,000-ohm, ¼-watt resistor
R11—22,000-ohm, ¼-watt resistor
R12—10,000-ohm, ¼-watt vertical-mount trimmer potentiometer
R19, R23—10,000-ohm, ¼-watt linear-taper potentiometer
S1—SPST slide switch
Misc.—cabinet, hookup wire, knobs, etc.

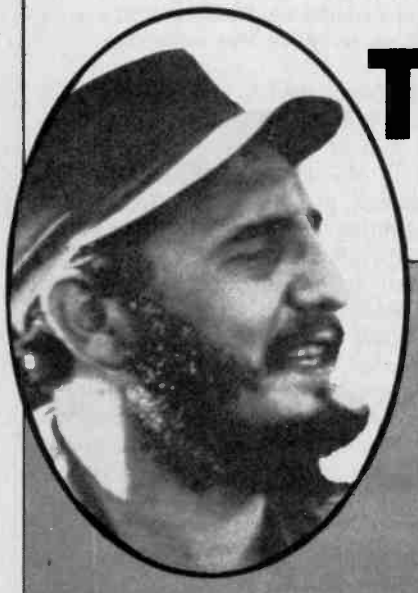


Note: A complete parts kit is available from: BNB Kits, R.D. #1, Box 241H, Tennent Road, Englishtown, NJ 07726, for $18.95. The PC board alone is $6.00 from BNB also.

THE BIZARRE SIDE OF DX

Tune in on history as it happens

by C. M. Stanbury II



AS EVERY EXPERIENCED shortwave listener and DX'er knows, radio stations sometimes turn up transmitting from the wildest of locations, get involved in strange capers, and are received under bizarre circumstances. If you're bored with simply keeping track of how many countries you can hear and verify, try adding some of these targets from my all time weird list.

To start with, you might look for the pirate broadcast ship "Mebo II" (formerly Radio Northsea International). During the brief 1977 Egyptian/Libyan border fighting it was stationed off the Libyan coast. But did the vessel broadcast Arabic propaganda, patriotic slogans, or martial music? No, Mebo II aired nothing but old rock records and frequency announcements on the hour and half hour. Why?

Libya. When fighting broke out, Libyan Radio's land based facilities did of course react. In fact, they suddenly added at least two new high powered transmitters, probably in the 500 KW range, and overnight became a major player in the international broadcast game. The fact that all these new shortwave facilities were ready just as hostilities began is certainly an interesting coincidence—unless of course the Libyan government planned it that way.

Then in January 1978, Libyan Radio's engineers seem to have completely forgotten about Mebo II. It had returned to Tripoli (after a brief excursion), still rocking on 6205, while one of the landbased Libyan powerhouses suddenly appeared on 6200 kHz, which certainly must have caused some mutual interference. In the middle of that month, both transmitters disappeared from this part of the dial but later Libyan Radio's English service was reportedly heard in Europe on 6205 at 1300-1400 EST—a very difficult time for reception in North America. Much easier to log are Libyan Radio's Arabic transmissions on 11700 kHz until 1700 EST and on 9500 kHz from approximately 1715 until 2015 EST.

The Reincarnation of Radio Cuba Libre. If Mebo II's role in the Libyan-Egyptian conflict is shadowy, the part played by radio ships in North and South American clandestine broadcast activities is even more shrouded in mystery.

Radio Cuba Libre began as a five minute newscast on the famed Bay of Pigs station, Radio Swan. It soon underwent a major expansion with purchases of substantial blocks of air time from WWL (870 kHz New Orleans), WGBS (710 Miami), and WKWF (1600 Key West). According to a 1977 New York Times story, these were intended as back up in the event Radio Swan's main transmitters were destroyed by saboteurs. Other versions of the story suggest an even more important role for Radio Cuba Libre had been planned.

And when you add to this a philatelic

angle, things can really get weird. Of course shortwave listening and stamp collecting have always been two interconnected "hobbies" while the connection between broadcasting and postal artifacts also appears in literature—Thomas Pynchon's "The Crying of Lot 49" as well as our own "underground" novel "Anti-Matter."

Our interest in Radio Cuba Libre was rekindled when a small cylindrical container recently came into our possession. It bears a label from something called the "Cuba Libre Courier Service" and a souvenier Canadian postal cancellation from the 1974 Baltimore Philatelic Exhibition ("BALPEX 1974"). The logo on the label is a radio tower which seems to link the courier service with the Cuba Libre broadcasts.

According to the label, the courier service served Swan Island (even though the island was ceded to Honduras in 1972), San Juan, Key West, and Isle of Palms (a luxury suburb of Charleston, S.C.). These locations have two things in common: (1) all have been involved in anti-Castro activities and/or have significant nearby Cuban populations, and (2) all are accessible by sea.

There have been persistent rumors in DX circles that Radio Cuba Libre broadcasts from aboard ship and this tale has caused RCL to be confused with another, related, anti-Castro Cuban station, Radio Cuba Independente, which began transmissions in September 1960 on 6130 kHz. The only way those original Radio Cuba Libre broadcasts could have been from the high seas would be if Radio Swan's shortwave transmissions at one time temporarily emanated from the same vessel used by Radio Cuba Independente.

On the other hand, not too long before "BALPEX 1974," another version of Radio Cuba Libre had been operating on the 40 Meter band and it is much more likely that these later broadcasts did indeed come from a pirate radio ship. Therefore it is not surprising that an element of mystery surrounds all 1974 Cuba Libre operations. In addition to the BALPEX artifact, we were provided with a photostat of an envelope bearing a Cuba Libre Courier Service label and addressed simply to a "Suite 515" in a Chicago office building. We wrote to Suite 515 at that address on the envelope in hopes of obtaining a current address for the Courier Service but—again no surprise—our query wasn't answered.

DX'ers will have much better luck logging stations which formerly carried Radio Cuba Libre transmissions. WWL operates 24 hours a day on a clear channel. Unless you have a local on 860 or 880 kHz, you should be able to receive it almost any night of the year. Meanwhile WGBS is also a 50 KW'er and widely heard in the Southeastern U.S.

Radio Clarin. Another station which subsequently carried Radio Cuba Libre transmissions was Radio Caribe in the Dominican Republic, and, by a circuitous route, Radio Caribe eventually evolved into Radio Clarin. The latter became well known to the hobbyist during 1977 and early 1978 because of its lively English language programs for DX'ers, SWL's and prospective tourists. But the station also acquired a good deal of notoriety due to involvement in the very controversial 1978 Dominican presidential election.

This pennant, sent by an organization called the (South) Korean SWL Association, accompanied 4 propaganda booklets and a completely filled-out QSL, even though no reception was reported.

Beginning the day of the election May 16, all Dominican stations were required to relay the official results from Radio Clarin. It seemed strange that Radio Clarin was chosen for this purpose as the station had consistently campaigned for one of the candidates, incumbent Joaquin Balaguer. Besides, there already was an official government network (Radio-TV Dominicana) in that Caribbean nation. Then around dawn on May 17, with the opposition candidate well ahead, the Dominican army seized the ballots and counting was halted for over 24 hours. When it resumed, the Balaguer forces claimed victory on the basis of late returns. It should be noted that this station also supported the Balaguer government when it was called Radio Caribe.

Prior to the election, Radio Clarin had hour-long English transmissions at 0700, 1500, 1800, and 2200 EST. But because of the presidential fiasco don't be too surprised if the international service on 11700 kHz is suspended. In that event try for the all night BCB operation on 860 kHz.

Space Games. Meanwhile, back at the end of 1968, Radio Cuba Libre, Radio Caribe, and Radio Swan (later known

(Continued on page 86)

The Voice of America acted as though Apollo 8 was a top secret mission. According to a VOA memo, extensive coverage was planned long before the actual flight, but this was not revealed until it seemed certain that the mission was going to be a successful one.

e/e checks out the...

B&K Precision DP-50 Logic Probe

This deceptively simple gadget makes digital trouble shooting a snap

CIRCLE 35 ON READER SERVICE COUPON

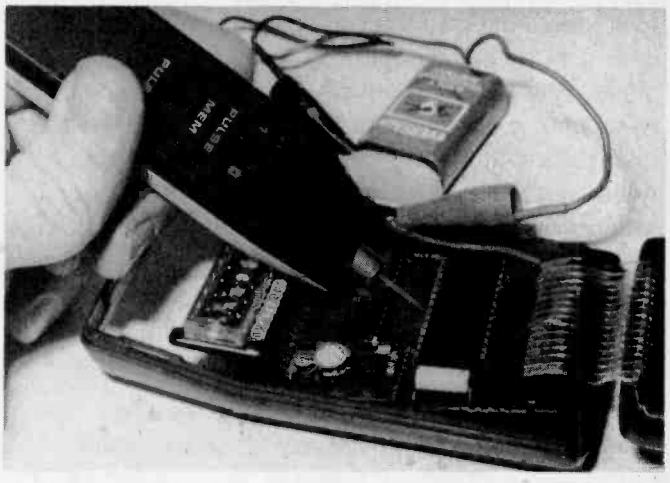
REMEMBER WHEN TROUBLESHOOTING meant dusting out the cobwebs and eyeballing the chasis for a burnt out tube, broken wire or a fried resistor. Or perhaps you date from a more recent era and are used to spraying coolant on suspicious transistors or checking power supply voltages with your pocket VOM. Well no matter what you are used to, it is time to recognize that we are solidly into the age of digital electronics. Our troubleshooting techniques have to be brought up to date with digital age equipment such as this B&K Precision DP-50 Logic Probe.

The key to digital troubleshooting is to know what is going on at each of the IC chip pins. If you know how to read an integrated circuit data sheet you can find out what voltage levels or pulse trains to expect where. Once you know what you are looking for you need something that will measure the logic levels. If you have a few hundred bucks to spare for an oscilloscope your troubles are over, but if you can't spare that kind of bread a logic probe might be just what you need.

"But," you are probably saying, "why should I buy a logic probe when my VOM will measure all the highs and lows I need?" And you are right—up to a point. A VOM is just fine for checking *static* and very low frequency Logic levels, but what happens when the pulse rate increases to more than a few hertz or you need to confirm the occurrence of a single short duration pulse. You won't know if the lack of meter movement is indicating a low or a pulse stream, and your logical deductions could be all wrong.

Taking the Pulse. This is where the DP-50 logic probe really starts to pay the bills. It has LEDs that give a positive indication of both high and low logic levels plus a third LED that lights when it detects a pulse stream as fast as 50 MHz. The DP-50 also has a switch selected circuit called a Pulse Catcher. This circuit detects single pulses and causes the LED to light and remain lit until the switch is reset. It also has a pulse stretcher that enhances the indication for short duration pulses.

The DP-50 is compatible with TTL, DTL, RTL, HTL, MOS, CMOS and HiNIL (High Noise Immunity Logic). We checked it out on the bench and the LEDs all clicked on and off at just the right voltage levels. It has a 2-megohm input impedance, a voltage overload capacity of ±50 VDC, and the hook-up leads are reverse polarity protected to 50 VDC. The DP-50 is powered directly from the tested circuit's Vcc and ground via a pair of long, alligator-clip tipped leads. The B&K Precision DP-50 retails for $50. For more information circle number 35 on the Readers Service Coupon. ■



The compact size and light weight of the DP-50 lessens user fatigue, and increases accuracy in test procedures. Special memory feature stretches pulses for "true" in-function testing. Circle 35 on the reader service coupon.

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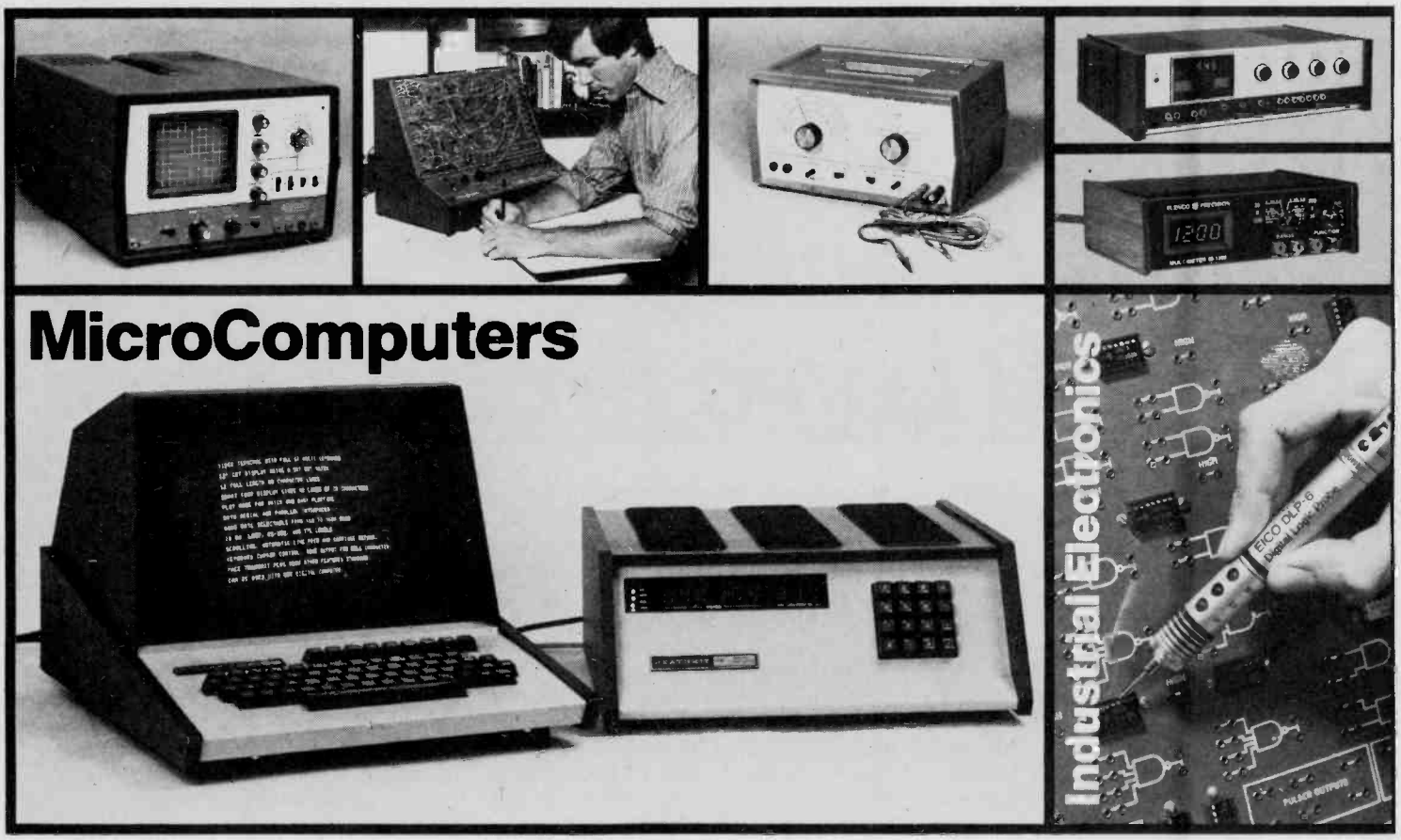

The world of electronics is daily becoming more challenging. Technology is growing more specialized, and the importance of digital systems increases every day. Test instruments, home entertainment units and industrial control systems are all going digital. And now, NTS training programs include a wider choice of solid-state and digital equipment than ever before offered in any home study course: Advanced NTS/Heath digital color TV (25" diagonal with optional programming capability), NTS/Heath microcomputer, digital test equipment, digital stereo receiver (70 watts per channel), NTS compu-trainer, plus much more state-of-the-art equipment to make your training exciting and relevant.

The equipment you receive with NTS training programs is selected to provide you with a solid background in electronic systems. Kits and lessons are designed to work together to demonstrate electronic principles and applications. The kit-building not only shows you how electronic hardware functions, but how various circuit designs accomplish different purposes. Your lessons guide you through any number of experiments associated with many projects. This is the Project-Method, and it works. Step-by-step, you learn how and why digital electronics has become a part of our world, and the even bigger role it is sure to play in the future.

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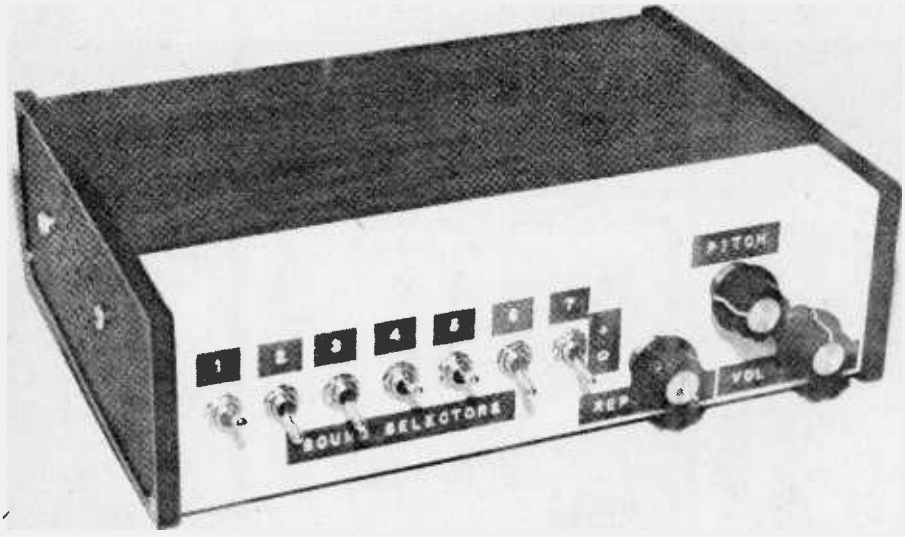
Super Sound Effects Synthesizer

Bring way out sound effects right into your home

by Cass R. Lewart



IF YOUR IDEA OF FUN is a locomotive in your bedroom, or a siren announcing breakfast, then we have the right kind of project for you! This simple-to-build sound effect generator will produce a variety of sounds resembling a ticking clock, a locomotive puffing away, a police siren, a ray gun straight out of a science fiction movie or a tweeting bird. The sound generator can be used to add a "living" sound to electronic games, or it can be a part of a futuristic bell chime.

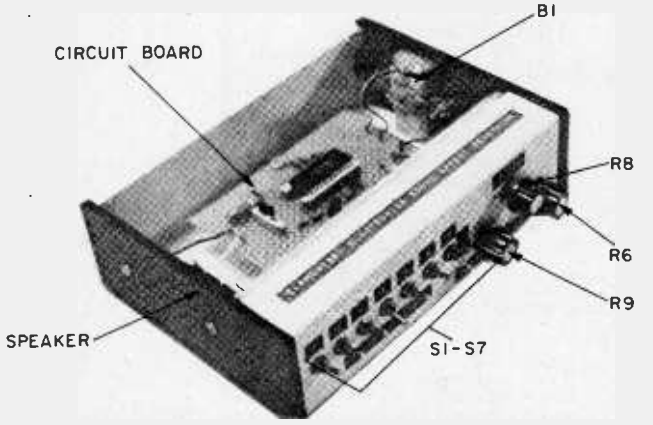
How It Works. The guts of the sound generator—a newly developed integrated circuit—consist of thousands of transistors. The main building blocks of this IC are a noise generator, an audio pitch generator and a Super Low Frequency (SLF) generator. The SLF generator controls the changing pitch and the repetition rate of the audio generator by, for example, producing a slowly rising and falling pitch of a siren. The SLF generator can also turn the other two generators on and off at a slow rate. A puffing locomotive sound will result when the SLF generator controls the noise generator.

Several pins on the integrated circuit control the mixing mode of the three generators. Seven of these control pins are brought out to switches S1 through S7. The frequency of the SLF generator and of the audio pitch generator is controlled by the potentiometers R10 and R8, respectively. Transistors Q1 and Q2 drive a small speaker while potentiometer R6 adjusts the volume. Switch

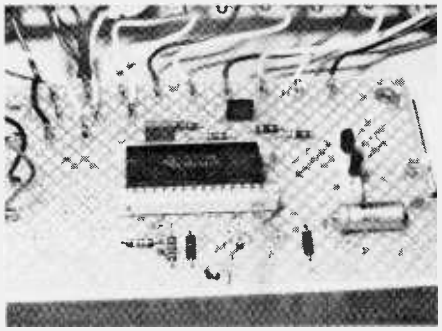
TABLE OF SWITCH POSITIONS

The table at right shows some of the more popular effects made possible by our synthesizer. More combinations can be had by experimenting at random with the switch positions. If you feed the synthesizer through your stereo system, the tone controls can also be used to vary the sound effects.

1	2	3	4	5	6	7	Sound Effect
+	+	+	+	+	0	0	Siren
0	0	0	0	+	+	0	Locomotive
+	+	+	0	+	+	0	Tweeting bird
0	+	0	0	0	+	0	Phaser gun
0	+	+	0	+	+	0	Phaser gun
0	0	+	0	0	+	0	White noise (sea sound)
+	+	0	+	0	+	+	Different siren
0	0	0	0	0	+	0	Steady organ sound
+	+	0	+	0	+	0	Ticking clock
0	0	0	+	0	+	+	Alternating tones
0	0	+	0	+	+	0	Interrupted tone



The arrangement of parts on the perfboard is not at all critical. Wire the switches and potentiometers to the circuit board before mounting them to the front of the cabinet. You may wish to purchase a larger cabinet to accomodate a larger speaker. This will definitely add depth to the sound quality of the Super Sound Synthesizer.



Make sure to follow the proper pin orientation for the IC. See the text for details.

S8 ganged with the volume control turns the unit on and off.

Construction. The sound generator operates at audio frequencies, therefore no special wiring precautions are necessary. We assembled our prototype on regular breadboard stock with point-to-point wiring techniques, and encountered no difficulties. Caution is advised when handling the IC. It is highly sensitive to static electricity discharges passed from the body, and can be destroyed before you are aware that you've done the damage. During construction, do not remove the IC from its packing until you are ready to install it in its socket, which should be fully connected to the rest of the circuit.

Take care that you have followed the correct pin orientation in wiring the socket. The pin connections are supplied with the IC, and pin number one is marked on the IC's body. Make a small mark on the IC socket to indicate pin number one, and wire the pins in consecutive order to avoid confusion and possible errors.

After assembly, you may find that the small, built-in speaker does not provide sufficient sound for the purposes which you intend the synthesizer's use. To provide for direct input to your home stereo system, or to a tape deck, simply wire a 22-ohm, ½-watt resistor across the leads running to the built-in speaker (you must disconnect the speaker for this purpose), and run the synthesizer directly into your system.

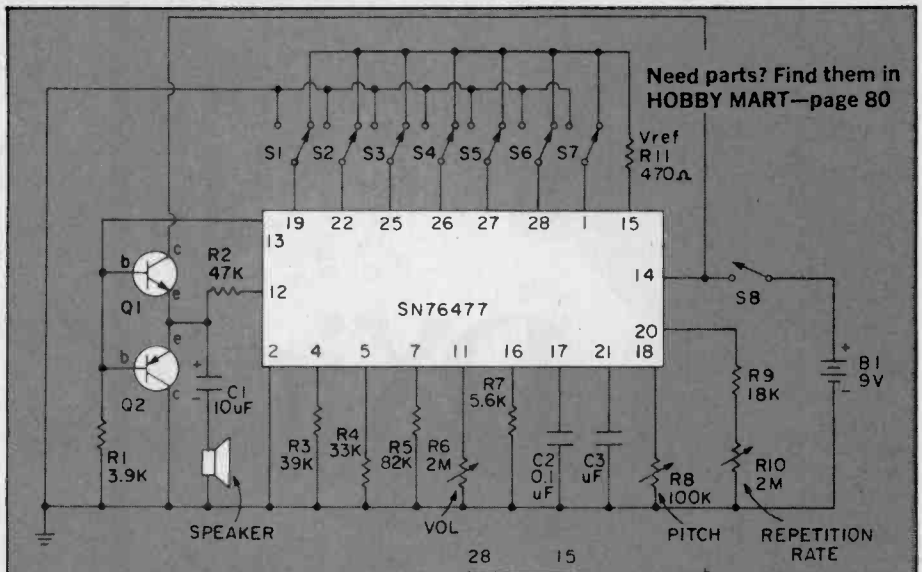
Of course, these are only some of the many combinations and effects available. With a little experimentation, many more are available. If you are using a guitar amplifier with the synthesizer, the reverb, vibrato, and accessory controls, such as "fuzz" can also enhance the effects which are generated. Even the tone controls on your stereo can cause dramatic changes in the synthesizer's effects.

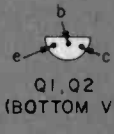
One note of caution: Your stereo speakers may not be able to handle sustained high-level output when being driven by the synthesizer. Watch your levels!

Operation. You can control the sound coming out of the sound generator by setting switches S1 through S7 and by adjusting the pitch and the repetition rate with potentiometers R8 and R10.

Shown are some representative switch positions and the corresponding sounds. A "+" in the Table means that the switch is connected to Vreg, a "0" means that it's connected to ground. ■

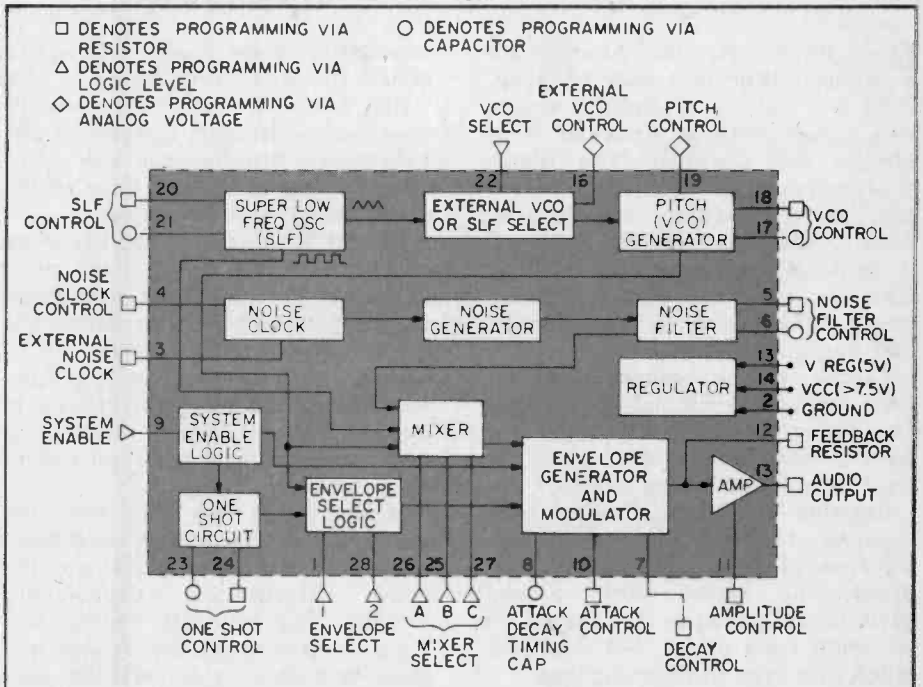
Need parts? Find them in HOBBY MART—page 80





PARTS LIST FOR SOUND SYNTHESIZER

B1—9-volt transistor radio battery
C1—10-μF, 35-volt electrolytic capacitor
C2—0.1-μF, 35-volt mylar capacitor
C3—1-μF, 35-volt electrolytic capacitor
IC1—SN76477 (Radio Shack #276-1765)
Q1—2N2715 NPN transistor
Q2—2N3673 PNP transistor
R1—3,900-ohm, ½-watt resistor
R2—47,000-ohm, ½-watt resistor
R3—39,000-ohm, ½-watt resistor
R4—33,000-ohm, ½-watt resistor
R5—82,000-ohm, ½-watt resistor
R6—2,000,000-ohm audio taper potentiometer with SPST switch attached (S8)
R7—5,600-ohm, ½-watt resistor
R8—100,000-ohm linear taper potentiometer
R9—18,000-ohm, ½-watt resistor
R10—2,000,000-ohm linear taper potentiometer
R11—470-ohm, ¼-watt resistor, 5%
S1 through S7—SPDT toggle switches
S8—SPST switch, part of R6
SPKR—8-ohm miniature PM speaker
Misc.—cabinet, 28-pin IC socket, battery holder and clip, knobs, hookup wire, etc.



Here's a flow chart of the inner workings of the SN76477 chip. As you can see, there's an immense amount of circuitry. An actual schematic would fill up three full pages.

DXing Cyprus

An SWLs guide to this trouble torn and divided island

by Don Jensen

PART EUROPEAN, PART ASIAN, that's Cyprus! For thousands of years, Cyrus has been in the middle, caught in a squeeze between East and West, Moslem and Christian. This island, third largest in the Mediterranean, has seen 'em all, Assyrians and Persians, Romans and Crusaders, St. Paul and Richard-the-Lion-hearted! Recent years have seen protracted fighting between Greek majority and Turkish minority, civil war, a divided island.

Cyprus' strategic position has meant some strange and fascinating radio history during the past few decades. For the shortwave listener this makes for some interesting SWLing today!

Beaming to Araby. Probably the strangest of Cyprus' shortwave voices was *Sharq al Adna*—the Near East Arab Broadcasting Station—which, around 1950, began operation at Limassol on the south coast of the 140 mile long island (See map on following page.)

As its name suggests, this station, which initially had a single relatively low-powered transmitter, had nothing to do with the Greek-Turkish question. It was, ostensibly, a commercial station transmitting to the Arab world of the Middle East and North Africa.

But *Sharq al Adna's* commercials were window dressing. In reality it was a clandestine British station with a mission of trying to counter some of the more strident Arab broadcasts.

But like Scheherazade and her seven veils, it seems, the British didn't cover up too well. In the bazaars of Baghdad and the banks of Beirut, the station was called, laughingly, the "Cavalry of St. George," after the patron saint of England. Still, the Arab world listened to *Sharq al Adna* for some of the best and most current musical hits from Cairo's "tin-pan alley!"

Making things even more interesting was the fact that the official, but fiercely independent voice of Great Britain, the British Broadcasting Corporation, "bought" time from the underground *Sharq al Adna* to relay its Arabic language broadcasts to the Mid-East and northeastern Africa.

Relations between the United Kingdom and Egypt worsened in the middle 1950s, capped by Egypt's nationalization of the Suez Canal in the summer of 1956. Late in October Israel invaded Egypt, followed two days later by a joint Anglo-French military move to take over the Suez Canal.

In an ill-fated attempt to influence Arab opinion at this crucial moment, the British army commandeered *Sharq al Adna!*

BBC Booted. Then things really got confused! *Sharq al Adna,* the clandestine British station vanished. In its place, but using its equipment, was born the Voice of Britain. It was, however, the voice of the then-in-power Conservative party government in London. Its aim was to counter hostile broadcasts. Naturally this included the powerful Radio Cairo of Egyptian President Gamal Abdel Nasser. But it also included the British Broadcasting Corporation, which the government considered much too unbiased in permitting opponents of the Suez incursion to air their views.

But nothing went right for the new Voice of Britain! First the entire Arab staff, carried over from *Sharq al Adna,* resigned rather than broadcast overt anti-Nasser propaganda. Then the Brit-

ish director, contending the switch from covert to overt propaganda created something other than "the sort of station I had been engaged to run," also quit and went back to England to become a clergyman.

Belatedly, someone in the government realized that the BBC broadcasts were still being relayed by the Limassol transmitters part of the time, under the old *Sharq al Adna* commercial agreement. Broadcasting opponents, the Voice of Britain and the BBC, sharing time on the same transmitters? That was the crowning blow! The BBC was quickly shut out!

A government troubleshooter—ironically recruited from the BBC—was brought in. He assembled an Arabic-speaking staff and soon the Voice of Britain was broadcasting ten hours of programming in that language daily. The Voice of Britain operated for five months, until March 1957, and a political failure, it died.

But just to prove that old stations never really die, but rather, fade away, the old 7.5 kilowatt transmitters and the "new" 20 kw'ers continued pumping out Arabic programming, the broadcasts of—you guessed it—the British Broadcasting Corporation!

Yes, the late *Sharq al Adna*/Voice of Britain station had become the BBC's East Mediterranean relay station on shortwave. And so it remains today, still using the same old transmitters, plus four newer 100 kilowatt units. In addition to Arabic programs, the relay station also airs what was, in 1957, called the General Overseas Service, but is now the World Service in English.

DXers can tune in the BBC's East Mediterranean shortwave relay of the World Service on 15,420 kHz during the 0400-0530 GMT time frame.

Cypriot Causes. These stations were aimed at the Arab-speaking world outside Cyprus. At the same time, there was trouble brewing on the island between the Greek and Turkish Cypriots. Those of Greek ancestry make up about 80 percent of the population; Turkish Cypriots, a bit less than 20 percent.

Great Britain controlled Cyprus since the 1870s, and added it as a Crown Colony in 1925, despite longtime aggitation by the Greek majority for *enosis*, or union with mainland Greece. After World War II, *enosis* fever grew, with Archbishop Makarios III, patriarch of the Greek Orthodox Church on Cyprus emerging as a leader of the movement.

In 1953, the British government established the Cyprus Broadcasting Service. Trying to walk the straight and narrow, the CBS operated several medium wave stations on the island with separate broadcasting services for the Greek and Turkish communities.

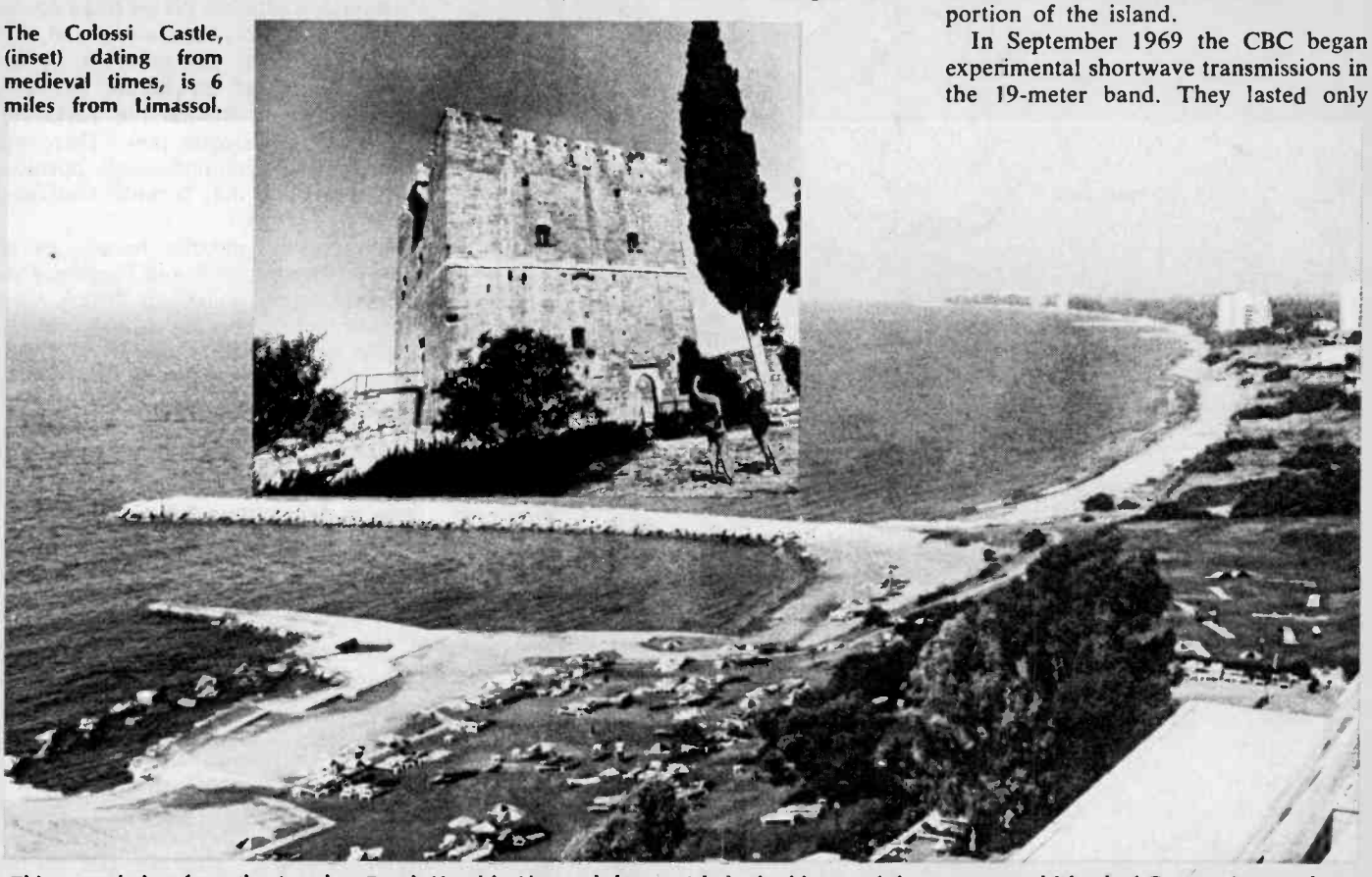
Enosis demands led to terrorist attacks on British military targets. Makarios was exiled to the Seychelles Islands in the Indian ocean and on Cyprus all hell broke loose until the archbishop was allowed to return in 1957. Britain wanted out. Greece wanted to annex the island. Turkey wanted Cyprus partitioned into separate states. Cypriots themselves were split!

But by 1959 a plan was hammered out by the three nations and Cypriot leaders. It called for an independent nation, the Republic of Cyprus. It would have a Greek Cypriot president, a Turkish Cypriot vice president and a proportionally spilt parliament. The new nation was born on Aug. 16, 1960. And with independence, the CBS became the Cyprus Broadcasting Corporation, a government operation that also solicited commercials to cover operating costs.

Civil War. But the compromise constitution was doomed to failure. In 1963, civil war broke out. Only a thin line of United Nations troops managed to restore a shaky truce in 1964. Turkish inhabitants gradually were forced to concentrate in the northern and eastern portion of the island.

In September 1969 the CBC began experimental shortwave transmissions in the 19-meter band. They lasted only

The Colossi Castle, (inset) dating from medieval times, is 6 miles from Limassol.



This coastal view from the Amathus Beach Hotel in Limassol does not bely the history of the war-ravaged island of Cyprus. At any given time, four or more factions are struggling for political control. DXing Cyprus is a must for action seekers.

e/e DXING CYPRUS

into the spring of 1970.

Open warfare again broke out on Cyprus in the summer of 1974, when the Cypriot National Guard, led by Greek officers, seized the government, driving President Makarios from Cyprus. The new government favored the old dream of *enosis* with Greece.

In the coup there were reports at first that Makarios had been slain, but these were quickly squelched when the patriarch was heard on a makeshift clandestine broadcasting station, on 917 kHz medium wave and 6,663 kHz shortwave, from a station he still controlled in the town of Paphos. But like many such underground stations, *Elevtheri Foni tis Kipron*—the Free Voice of Cyprus—operated only briefly.

Division. Fearful of anexation by Greece, Turkey invaded Cyprus and by mid-August, Turkish troops controlled the northeastern part, some 40 percent of the island. The following June, Turkish Cypriots voted to make the defacto partition of the island official—from their viewpoint. A separate Turkish Federated State of Cyprus was formed. About 200,000 Greek Cypriots left the Turkish-controlled sector. A divided Cyprus was—and remains—a fact.

Today, the Cyprus Broadcasting Corporation, which functions as the voice of the Greek-oriented government of the Republic of Cyprus goes on, mostly with home service medium wave broadcasts. But DXers can still hear this one on shortwave on a very abbreviated schedule—using the BBC relay transmitters—directed to Greeks living in the United Kingdom.

Tune the CBC's Greek language program on Friday, Saturday and Sunday, from 2215 to 2230 GMT. Listen for the guitar interval or tuning signal for about three minutes before sign on. At this writing the frequencies in use were 6,150, 7,190 and 9,695 kHz—the latter probably being the best bet.

The station has QSLed with a lovely, oversized artsy verification card! Reports go to Cyprus Broadcasting Corporation, P.O. Box 4824, Nicosia, Cyprus.

The Turkish Cypriots. But what of the Turkish minority? It is another fascinating story, this one of an emergency, jury-rigged station that grew to a major modern radio and television broadcasting service. It is the story of Radio Bayrak.

"Radio Bayrak was born out of sheer necessity on December 25, 1963," the station's deputy director, Mehmet Fehmi recounts. When the bloody civil war broke out, "the commonly-run Cyprus Broadcasting Corporation was one of the institutions from where the Turkish Cypriots were forcibly ousted."

The Turkish Cypriot leaders felt an urgent nead for radio communication, not only with their own people on Cyprus, but with the outside world. The Turkish CBC personnel were called upon to put a station on the air from scratch.

Fehmi recalls: "The first effort was a crude and primitive affair located in a garage. As the power in the Turkish quarter of the town was cut by the Greek Cypriots, the transmitter, consisting of parts from British Army junk, was powered by scores of car batteries. A telephone receiver was used for a microphone in the early days!

"The whole thing was improved each passing day as bits and pieces were acquired, adapted or improvised, until by the passage of time, a fully fledged and professional radio station came into being. It was truly a pioneer operation!"

Bayrak Radio has grown to an operation that has medium wave and FM stations in four communities in the northern part of the island, including Lefkosa, which is what the Turks call their part of Nicosia now. There are also four television channels operated by Bayrak in the Turkish Federated State of Cyprus.

Until recent months, because of an unfavorable schedule and frequency selection, North American DXers were unable to hear the shortwave voice of Radio Bayrak. In the fall of 1978 that changed and SWLs began hearing the station's 7-kilowatt signal, occasionally at rather decent levels. It signs on the air at 0330 GMT on a frequency that has been fluctuating near 6,280 kHz, give or take about three or four kilohertz. But as station director Hakki Suha says, the transmitter "is supposed to transmit on 6,150 kHz and eventually we will come to that frequency."

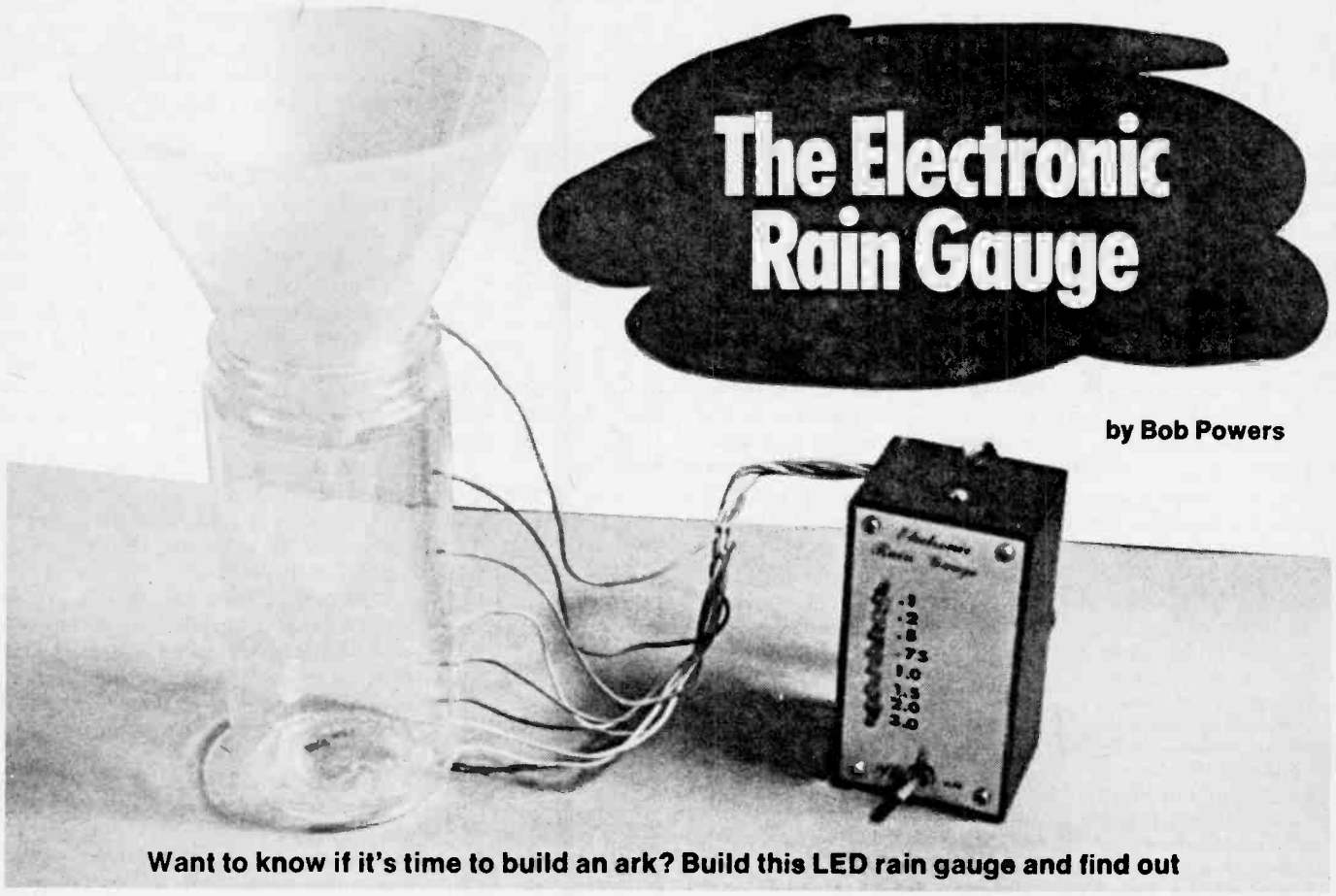
Like the C.B.C., Bayrak Radio has an attractively styled yellow and black QSL card with which it answers listener reports. If you log this one, reports may be sent to Bayrak Radio, Ataturk Square, Lefkosa, Turkish Federated State of Cyprus, *VIA* Mersin, Turkey.

So there you are, three different and interesting ways you can DX the divided island of Cyprus! ■

One look at the map tells you why Cyprus has such natonalistic and, for that matter, strategic importance to many of the Mediterranean nations. It lies only about fifty-miles from the mainlands of no less than four major middle-eastern powers in the area.

The Electronic Rain Gauge

by Bob Powers

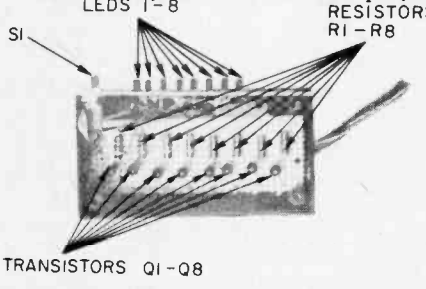


Want to know if it's time to build an ark? Build this LED rain gauge and find out

WHO KNOWS HOW MUCH rain has fallen during any period of time? The *Electronic Rain Gauge* knows, and will tell you at a glance! This neat little unit will quickly tell you how much rain has fallen during any period of time, overnight for example. You won't have to wait for some giggly weatherman to tell you the precipitation over a 24-hour period either. *The Electronic Rain Gauge* will tell you with its' eight-LED readout.

Unlike old-fashioned rain gauges assembly is fast. The entire project cost is about $5 if you shop wisely, and best of all, you won't get soaked while using it either!

How the System Works. The project consists of two parts: A cabinet that houses all of the circuitry including the LED display, and a water retaining bottle (with a funnel) that will hold the rain to be measured.



Construction of the LED raingauge is a snap. Just eight LEDs, eight transistors and eight resistors does the trick. Use perfboard construction and a mini-box, and you can't go wrong. Two AA penlight batteries should last you through a summer of cloudbursts.

A ground wire, mounted on the bottom of the bottle, represents a negative potential that can turn on (bias) each of the transistors, Q1-Q8, through their respective sensing wires. When rain water bridges the gap, the ground wire and, for example, the 0.1 inch sensing wire (connected to the base of Q1) is turned on, and LED1 glows, showing that 0.1 inches of rain has fallen. The resistance of water is very high here, (20,000 to 100,000 ohms typically) but it takes little negative potential to turn each of the eight transistors on.

Note that each sensing wire connects to the base of a transistor, which it controls. The length of the sensing wires can be of any convenient length. For example, you can have the cabinet with the circuitry and LED readout inside of your house, and the water retaining bottle outside for a real custom installation!

Circuit Assembly. To house the circuitry, choose a cabinet small enough to make the project compact, yet large enough to house all of the circuitry and LEDs. Since there are few parts, a neat layout on a small piece of perfboard would be your best bet. Point to point wiring, using short lengths of wire would be best with the perfboard arrangement.

Mount the LEDs on the front of the cabinet where they will be easily visible. If you mount the LEDs on a metal face, make sure that the LED leads do not short on the metal facing. Drill a hole in the top or side of the cabinet large enough to allow the 8 sensing wires and the ground wire to pass through. The sensing wires can be of any gauge, but use solid, not stranded, wire. It would be a good idea to use color coded wire for the sensing wires so you can tell more easily where each wire will go when you install them into the water retaining bottle. The sensing wires can be any length that you wish, but if you use a really appreciable length, then use the thickest gauge of wire practical.

Rain Collector Setup. The water retainer bottle will catch rain directed into it and hold it for continuous measurement. You will need to drill eight holes for the sensing wires to go into, at their respective levels. One additional hole, flush with the bottom of the bottle, will also be necessary for the ground wire.

The water retainer can be almost any plastic or metal container but it should have straight sides (the same diameter from top to bottom). You will also

e/e RAIN GAUGE

need a funnel to help collect the rain drops. You could use the container just as it is but little rain would get into the relatively small opening and it would be rare that the water depth ever exceeded a small fraction of an inch.

If you use a funnel that is twice the diameter of the container you will collect four inches of water in the tube for every inch that falls. This is because doubling the diameter of a circle increases its area by a factor of four, and four times as much rain is collected. You need to determine the ratio of the funnel area to the area of a cross-section of the measuring tube.

To do this you can use the attached chart or use the following formula:

$$\left(\frac{\text{Diameter of Funnel}}{\text{Diameter of Tube}}\right)^2 = \text{Height Ratio}$$

For example: a 5.75-inch funnel feeding a 1.66-inch tube would have a height ratio of:

$$\left(\frac{5.75}{1.66}\right)^2 = 11.9983 \text{ or } 12$$

So, 12 inches of water in the tube will equal one inch of rainfall, 6 inches will equal a half-inch and 3 inches will equal a quarter-inch of rain.

Drill holes in the bottle at the appropriate locations. Note that if you use the same funnel and tube as mentioned above, that tube will need to be three feet long to measure three inches of rain.

Strip at least ½-inch of insulation off the ends of the sensing wires and push them through their proper holes so all of the non-insulated wire sticks inside the bottle level with its hole. Put a drop of super glue right where the insulation of each wire butts up against its proper hole. This will hold the wire snug and also prevent water from leaking out. Be careful not to get any of the super glue on the non-insulated part of the wire.

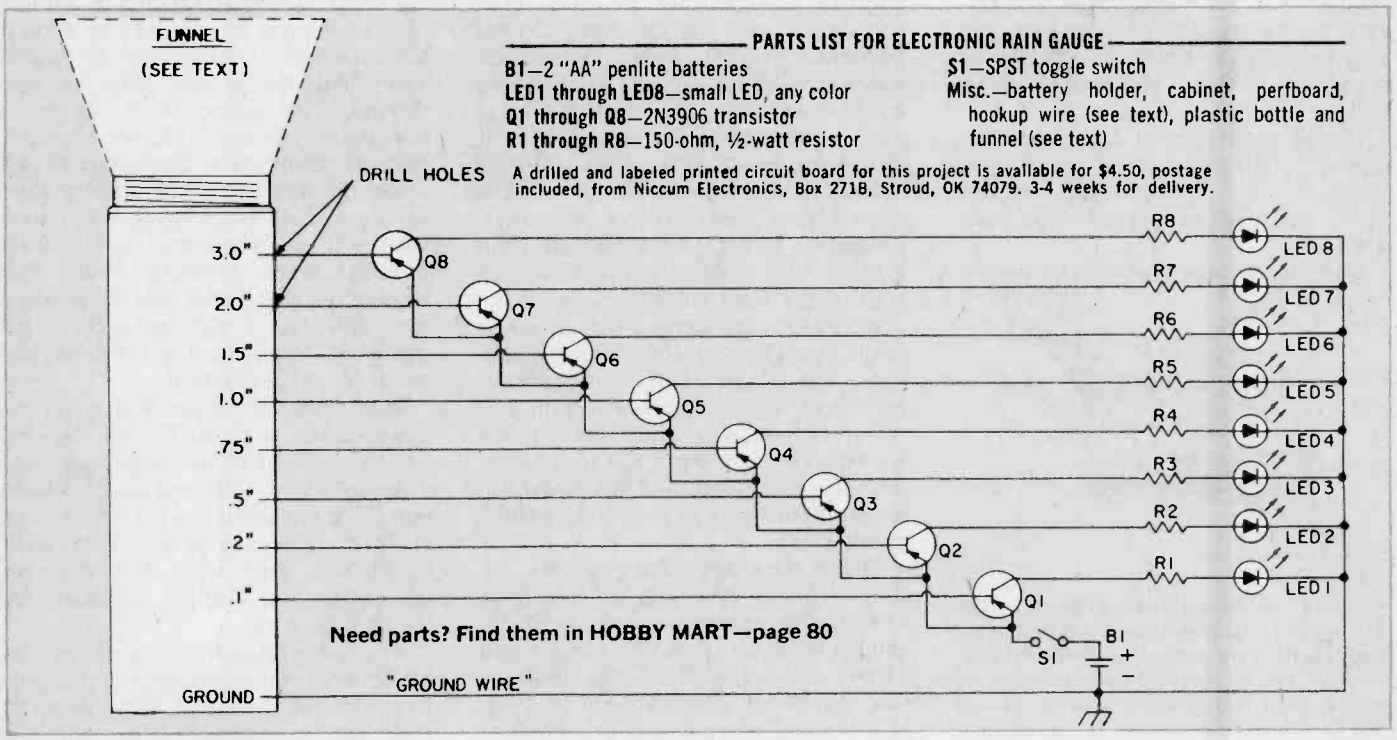
Strip at least 1½-inches of insulation off the ground wire, and install it like the others in its hole at the bottom of the bottle. Make sure it sits flat on the bottom of the bottle.

Operation. When the glue is dry on the water retaining bottle, fill it with water to make sure that it doesn't leak. If it's watertight, you can then test the whole system out. If there aren't any dark clouds around to help you, you can fill the bottle slowly with tap water. Run water in slowly and as each sensing wire is submerged, its respective LED should glow.

If no water is in the water retaining bottle, none of the LEDs will glow, and thus no current from the batteries is drawn. Leaving the unit on with the bottle empty does not drain your batteries. So there you have it. You'll be nice and dry whenever the next time arrives that you need to know, or are just curious, how much rain has fallen in the next storm or drizzle. ■

The numbers up the left side represent the diameter of the funnel in inches and the numbers along the bottom represent the diameter of the retaining tube in inches. A six-inch funnel on a three-inch tube will have a height ratio of 4.0 where four inches of water in the retaining tube would represent one inch of rain. If a one-inch tube had a 12-inch funnel that tube would need to be 144 inches high to measure one inch of rain collection.

DIAMETER OF FUNNEL	DIAMETER OF TUBE 1	1.5	2	2.5	3	3.5	4
12	144	64	36	23.04	16	11.76	9.0
11	121	53.77	30.25	19.36	13.44	9.88	7.56
10	100	44.44	25	16	11.1	8.16	6.25
9	81	36	20.25	12.96	9.0	6.61	5.06
8	64	28.44	16	10.24	7.111	5.22	4.0
7	49	21.78	12.25	7.84	5.44	4.0	3.06
6	36	16	9.0	5.76	4.0	2.94	2.25
5	25	11.1	6.25	4.0	2.77	2.04	1.56
4	16	7.11	4.0	2.6	1.78	1.3	1.0
3	9.0	4.0	2.25	1.44	1.0	0.73	0.56

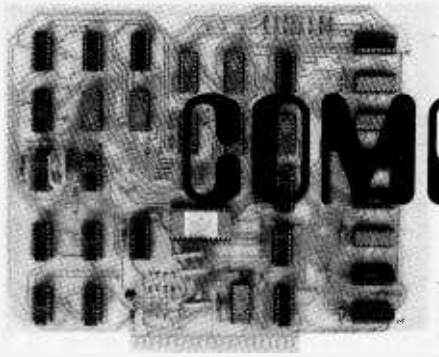


PARTS LIST FOR ELECTRONIC RAIN GAUGE

B1—2 "AA" penlite batteries
LED1 through LED8—small LED, any color
Q1 through Q8—2N3906 transistor
R1 through R8—150-ohm, ½-watt resistor
S1—SPST toggle switch
Misc.—battery holder, cabinet, perfboard, hookup wire (see text), plastic bottle and funnel (see text)

A drilled and labeled printed circuit board for this project is available for $4.50, postage included, from Niccum Electronics, Box 271B, Stroud, OK 74079. 3-4 weeks for delivery.

Need parts? Find them in HOBBY MART—page 80



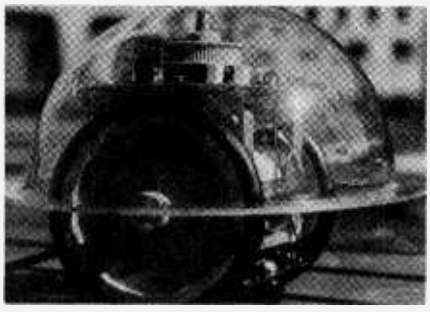
COMPUTER READOUT

Robots—the facts can be more exciting than the fancy

THE IDEA OF MAN'S CREATING an artificial, thinking likeness of himself has been with us since before the days of alchemy. Frankenstein is in this tradition. and the idea of the mechanical humanoid, the robot, has existed since the beginnings of science fiction. An extension of the idea, the android, envisions the mechanical human possessed of all the intelligence, strength and natural language ability of man with an artificial human body . . . human, yet better; perfect because of its technical design.

With the advent of microcomputers, it has for the first time become possible to produce actions having the look of intelligence from a compact little box. The visions of the past and the new breakthroughs of the present have spawned the serious discipline of *robotics*. To see just how near or far we are from some of the old visions, let us first see what a robot is *not*.

Non-Robot. In late 1977, a company on the East Coast was publicising an "affordable" home robot it had produced. Klatu, sometimes called "Sam Strugglegear," was billed as the home servant of the future who would do the laundry, clean the house, and serve cocktails. News of Klatu, who reportedly could converse actively with people in crowds at shopping centers where he was being shown off, brought much publicity in newspapers. At least one computer magazine published a serious article on the "robot" as if it were everything its makers said it was.



The Terrapin Turtle is a $300 kit robot that operates in conjunction with a computer.

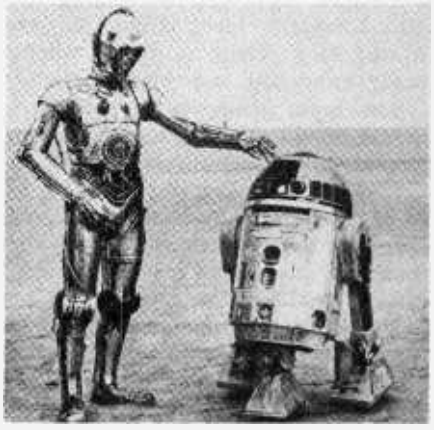
I had a chance to see Klatu in action at last year's National Computer Conference in Anaheim, California. There he was, a cone-shaped body with a spherical head, talking animatedly with a crowd of onlookers. He was moving back and forth, raising and lowering his arms and turning to face whomever he was talking to.

Having been tipped off, however, I looked around the edge of the crowd and saw a man with one hand held to his mouth in a thoughtful manner. The other hand he had in a flight bag, which he had over one shoulder. I got closer to him and saw that the hand at the man's mouth concealed a small microphone with a wire runing down his sleeve. I peeked inside the flight bag and saw a radio control box like those used for model airplanes.

Klatu, then, while quite entertaining, was not a robot, but a remote controlled puppet. It was at that same computer conference, however, that I saw something which demonstrated some true principles of robotics, and these principles can be explored by the home computer enthusiast today.

Remarkable Rodents. *Spectrum*, a professional magazine for electrical engineers, had sponsored a "Micro-Mouse Contest" in which a self-contained electronic "mouse" built by each contestant was to find its way through a maze. Simply watching one of these "mice" go through its paces was enough to demonstrate the differences between a true robot and a remote controlled gadget.

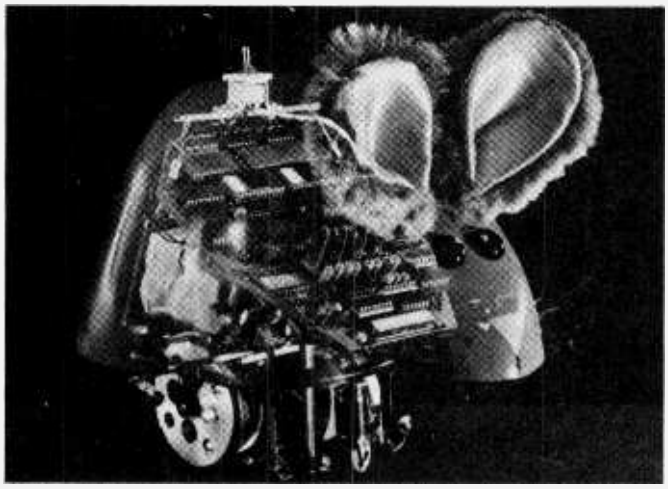
The mouse was made of several circuit boards of the same type one would find in any home computer—CPU, memory, ROM—which were mounted on a wheeled, motorized base. The mouse moved forward until it encountered a wall of the maze. Then it would turn left, then right until it could continue. If it came to a dead end in the maze, it would turn around and go back to a point from which it could



20th Century Fox photo

The science of robotics is far from the age of Star Wars' famous robots R2-D2 and C3P0.

This working Robot can find way through a complex maze without error after one exploratory try. Its microprocessor control system learns by trial and error and doesn't repeat its mistakes. It's called the Moonlight Special and was made by engineers at Brartelle Memorial Institute in Richland, WA.



explore further.

Through the Maze. All the while the mouse was finding its way through the maze, it was storing its successful tries in its memory, creating a "map" of the correct route through the maze. When it finally found its way through, its "trainer" picked it up and put it back at the starting line. This time there was no trial and error. The micro-mouse ran flawlessly through the maze on the first try. It had learned the way on its previous trip through.

One of the main things that makes a robot a robot is its ability to gather information from the world around it and make decisions based on that information and act on them. In the case of the micro-mouse, that information was of a very limited, either/or nature: "You can continue in this direction," or "You cannot continue in this direction. Try another."

Likewise, the "world" of the micro-mouse was very limited; it consisted of the walls of its maze. But how would a machine cope with the complex and often random input from the real world? How would it decide what is really important and what not?

The basic principles of the micro-mouse would still apply: Input information about the surroundings; process the information according to the existing program or by comparing it with data previously "learned," and then make a decision and act on the information available.

For a really functional robot, the world would consist of much more than just "go/no go." There would be language, visual data, and a changing environment to navigate in. In order to cope, such a machine would have to posess some form of artificial intelligence.

Artificial Intelligence. Artificial intelligence (AI) research is the most advanced field in computer science. It encompasses several concrete lines of research: pattern recognition, natural language processing, and the automated representation of knowledge. All three subjects are concerned with how to relate *specific* input (e.g. seeing a grey-and-white tomcat) with *general* data or knowledge (the general concept of cat).

Pattern recognition, as the name implies, is the attempt to generalize underlying patterns from large amounts of input data. It is different from pattern matching in that when a computer does a pattern match, it compares all the bits of data equally. If any don't match, or if a predetermined number don't match, the whole comparison is a mismatch.

In pattern recognition, some bits of data or combinations of bits, carry more weight than others. For instance, a large number of less important bits might outweigh a smaller number of more important bits, or vice versa. The letter "A" can appear in many sizes and typestyles, printed or handwritten, but we still recognize it as the letter "A." The bits of data concerning proportion, relation of curves to each other, etc., are more important than those relating to line thickness, and slant, for example. Computers have been taught to distinguish between these characteristics and the method involves very heavy-duty statistical and analytical equations—just to recognize one pattern.

Syntax. *Natural language processing* is necessary if we wish to teach a machine to understand human, rather than computer, languages. Computer languages utilize words and statements which are unambiguous. That is, each word, command or statement has a single meaning which is not altered by the context in which it is used. Thus the machine can't get confused about meaning. It can get confused over syntax—the use of words or commands in inappropriate combinations or order.

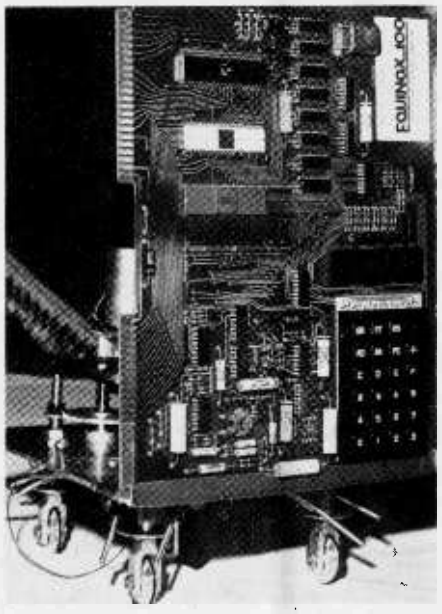
Human language, on the other hand, depends heavily on how and where a word is used: The word 'fine' in "Draw a fine line," is quite different in meaning from "This is a fine mess you've got me into."

Much of the research in natural language processing is being done with a language called LISP (List Processing) which allows the programmer to relate the syntax of human language to the meanings of words and phrases. Programs written in LISP have these units of meaning (lists) set off by parentheses, which has given rise to the saying among computer types that LISP really stands for *L*ots of *I*rritating *S*illy *P*arentheses.

The *automated representation of knowledge* concerns taking all the individual data our machine gathers from its world and storing it in such a way as to represent an adequate model of that world. In the case of the micro-mouse, this world was limited to the map of the maze. In a sophisticated robot, that world would be much more complex. The model of the machine's world is adequate if the machine can survive and solve problems relating to its environment based on the knowledge it has acquired.

Again, this knowledge must be able to be used in a general way to deal with specific situations in the robot's world. Because of these considerations,

The Berkeley Micro-mouse used an optical sensor and bumpers to find its way through.



One Equinox microprocessor board, four wheels, and a motor makes a neat mouse.

Human or Machine?

A test for machine intelligence, called a modified "Turing Test" after the theorist Alfred Turing, calls for putting a human and a computer on one side of a wall separating them from another human. Communication between the two sides of the wall is by means of keyboard and display. The single human can interrogate the two on the other side all he wishes. If he cannot tell the difference between man and machine based on their responses, the machine is said to have intelligence.

This is, of course, an idealized situation. But if we limit the range of responses to a certain area, say that of chess, could a human player say for sure whether he was playing a man or a machine? And if not, could we not say that, at least in that limited range, the machine posessed intelligence?

many academic researchers in AI have become less interested in constructing machines that can walk and talk and act intelligently than in building models of human intelligence in an attempt to investigate the nature and process of human thought. Not that this hasn't led to some pretty amazing robots, however!

A Real Robot. Computer scientists at Stanford University's AI laboratory have constructed a robot (a *true* robot) which can look at the parts of an unassembled automobile generator lying on the table, pick them up and assemble the generator. Consider for a moment some of the things the machine must do.

First, it must have in its memory the knowledge of what each part looks like and how it fits into the geenrator. Second, it must have a step-by-step program for carrying out the actual assembly process. This program must not only know which part to put where, how and in what order, it must also keep track of the current position of each moving part of itself so that it can co-ordinate its movements.

The pattern recognition part of the process is also quite complex. The machine must be able to recognize parts lying in different positions and locations of the work area. For each generator assembled, the parts may be scattered on different locations on the table. To do this, the robot must relate the specific pattern it sees to a general knowledge of the part in its memory. Thus it will know if a part happens to be lying upside-down on the table and will be able to decide how to turn it to fit it into the assembly.

The natural language aspect of the process concerns how to "explain" to the machine how to assemble the generator. The human programmer must be able to tell the robot to do something in a general way. For example, if the programmer says, "put screw A in hole B," the robot should already know what end of the screw goes in the hole and which way to turn the screwdriver. Again—using *general* knowledge for *specific* situations.

The "world" of Stanford's robot is limited to a table with a bunch of generator parts on it, yet it is one of the most ambitious projects in robotics undertaken to date. When one considers the complex "world" a walking, talking robot would have to deal with, the mind boggles. How do you program a machine to deal with siutations even the programmer can't forsee?

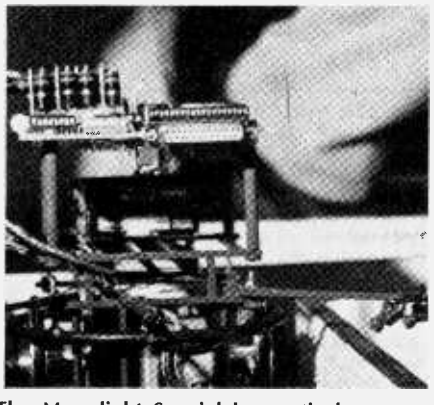
Computer Chess. Though these problems are just beginning to be solved in the most esoteric branches of computer science, it does not mean that they can't be overcome eventually. The game of chess was thought of early on as a significant research object in artificial intelligence. Computers can now play chess on the Grandmaster level and the day is not far off when the world chess champion may well be a computer program. But the science of robotics is still very far from producing an R2D2.

Microelectronics will continue to make strides in sophistication and miniaturization. Software development—an equally important aspect of the problem—will be accelerated and will filter down from the universities into more general use. A version of LISP has been developed for the 8080 microprocessor and has been published in the public domain (*Dr. Dobb's Journal,* Vol. 3, No. 10, Nov./Dec., 1978).

There is also hardware available for those who wish to experiment in robotics. Terrapin, Inc. (33 Edinborough St., 6th Floor, Boston, MA 02111) makes a small "turtle," a wheeled, computer-controlled unit with a switch that signals the computer when it has run into an object. The turtle can be connected to the parallel port of any computer via a ten-foot cable.

The turtle, controlled by the program in the computer, can be used to map rooms: solve mazes like the micromouse even though it is not self-contained: teach geometry; dance, or do many other things dreamed up by the programmer. It looks like a little wheeled army helmet; the round top is attached to a switch at the top which is tripped if the edge of the dome hits something. In this way, the computer gets informaiton about its "world." With the turtle, the enterprising hobbyist has the opportunity to explore some of the most fascinating aspects of machine intelligence, such as how a machine "learns."

The real problems confronting robotics and artificial intelligence are just now being recognized and are a long way from being solved. But they are much more interesting than a shopping center curiosity because they take us to the limits of our present day technology. And if we pursue them far enough, we may solve them. What's more, we may also learn more about ourselves. ■



The Moonlight Special has optical sensors that follow the walls and indicate obstacles.

This programmable mouse can be told how to get through the maze by pre-instruction.

Here the Moonlight Special is put through the maze by its design team. Micro - Mouse contest mazes are redesigned for each new challenge. The mouse gets a trial run to learn and then a timed run through the maze. They are not allowed to climb the walls or to receive instructions during a run.

IT'S SIMPLY BASIC

Program your own computer casino **by Larry Friedman, WB2AHN**

Here's a program to add excitement to a rainy day, liven up any party, or perhaps raise a little money for a local charity at a Las Vegas Nite. This month's program, JACKPOT, is the computerized version of the "one armed bandit" slot machine, and is easily customized to fit any occasion.

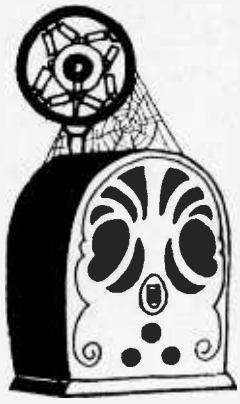
JACKPOT is a game where the player gambles a quarter in the hopes of winning some money by having the computer randomly (at line 440) select a winning combination of 3 objects out of a possible 7. If the computer picks three of the same object (apple, cherry, etc.), 2 of the same object on the first 2 wheels, or 2 cherries for the last 2 wheels, the player wins. The payout depends on what the winning combination is, and how much money the house has. In this version, designed for home enjoyment, the payout percentages are high. The computer starts by taking 60% of the money for the house, and from the remaining amount comes the payout. However, I strongly recommend that you don't try to use this program to make money without changing the payout percentage. This is controlled at line 610. It reads: 610 P1 = B*.40. If you want to make more money for the house, change that .40 to a .25 or .30. (The figure represents the payout percentage by the house.)

This program uses the AND statement (see line 490 for example) which is a logical command. It's used in IF-THENs and, translated, means: IF A AND B ARE TRUE THEN XX (where XX is some function for the computer to do). Examine lines 180-250 carefully; they are provided to allow each wheel to have different odds for each object. For example, there is only one ORANGE on the first wheel, while there are 2 on the second and third wheels. The odds for the payouts are computed at lines 530, 540-580, and 600. You can change them if you wish, keeping in mind that at the moment they are pretty high

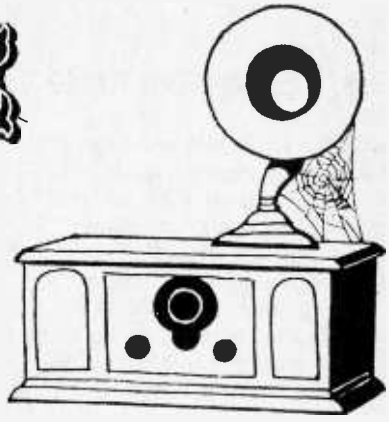
When you are finished playing, enter Q for QUIT. The computer will print how much money you either have or owe, and how much money the computer has (it starts with $20). It will then reset the player's money to $0 for the next player, but will maintain the house's money as the standing jackpot. If you wish to exit the entire program, just hit CONTRL/C (or whatever your computer's interrupt is) at any point in the game.

The program was writen for the HEATH H-8 computer. If you wish to use this program on another system, the following alterations must be made: lines 260 and 390 must be changed so as not to say LINE INPUT, since that statement is not recognized by all BASICs. It is the equivalent of saying INPUT 1$, just a simple stringed variable. There may be some other minor alterations that are needed to tailor the program to your system, but the program is relatively standardized and should run on most systems with few changes. ■

```
100 REM  *
101 REM  *                "JACKPOT"
102 REM  *
103 REM  *           BY LARRY FRIEDMAN
104 REM  *         WRITTEN FOR HEATH h-8
105 REM  *       EX. BASIC VERSION 10.02.01
106 REM  *       FOR ELEMENTARY ELECTRONICS
107 REM  *
108 REM  * THIS VERSION OF BASIC HAS SUPPRESSED
    TRAILING DECIMAL
109 REM  * ZEROES; THEREFORE  $1.50
    IS INDICATED AS $1.5
110 DIM R$(7),P$(3),W(3,9),C(3)
120 P=0:B=20:Y=0
130 DATA "JACKPOT","CHERRY","LEMON","ORANGE"
140 DATA "APPLE","PEAR","PEACH"
150 FOR R=1 TO  7
160 READ R$(R)
170 NEXT R
180 DATA 1,2,2,3,3,4,5,5,5
190 DATA 1,2,3,3,4,4,5,5,5
200 DATA 1,2,3,4,4,5,5,6,7
210 FOR X=1 TO 3
220 FOR Y=1 TO 9
230 READ W(X,Y)
240 NEXT Y
250 NEXT X
260 LINE INPUT "NEED INSTRUCTIONS (Y/N) ?";I$
270 IF I$="N" THEN 365
280 PRINT "JACKPOT - A SIMULATED SLOT"
290 PRINT "MACHINE. EACH PLAY IS $.25"
300 PRINT "PAYOFFS ARE FOR 3 OF A KIND,"
305 PRINT "2 OF A KIND ON THE FIRST 2 WHEELS,"
307 PRINT "OR CHERRIES FOR THE LAST 2 WHEELS."
310 PRINT "THE OBJECTS ARE: JACKPOT, CHERRY"
320 PRINT "LEMON, ORANGE,APPLE, PEAR, PEACH."
330 PRINT
365 IF D<0 THEN PRINT "YOU OWE THE HOUSE $";D*-1
370 IF D>=0 THEN PRINT "THE HOUSE OWES YOU $";D
380 IF I$="QUIT" THEN I$="":GOTO 810
390 PRINT :LINE INPUT "PLAY OR QUIT  (P/Q)  ?";G$
400 IF G$="Q" THEN 800
410 PRINT "THE LEVER HAS BEEN PULLED!"
420 D=D-.25:B=B+.25
430 FOR R=1 TO 3
440 C(R)=INT(RND(1)*9)+1
450 PRINT R$(W(R,C(R)));"    ";
460 P$(R)=R$(W(R,C(R)))
470 NEXT R
480 PRINT
490 IF P$(1)=P$(2) AND P$(1)<>P$(3) THEN 530
500 IF P$(1)=P$(2) AND P$(2)=P$(3) THEN 540
510 IF P$(2)="CHERRY" AND P$(3)="CHERRY" THEN 600
520 PRINT "YOU LOSE!!!":GOTO 365
530 I=.1:GOTO 610
540 IF P$(1)="JACKPOT" THEN I=.75
550 IF P$(1)="CHERRY" THEN I=.55
560 IF P$(1)="LEMON" THEN I=.4
570 IF P$(1)="ORANGE" THEN I=.4
580 IF P$(1)="APPLE" THEN I=.3
590 GOTO 610
600 I=.2
610 P1=B*.40
620 P2=P1*I
630 Y=INT(P2/.25)*.25
660 PRINT "YOU WIN!! ==> $";Y
670 D=D+Y
680 B=B-Y
685 IF B<=0 THEN 710
690 Y=0
700 GOTO 365
710 PRINT "YOU HAVE DRIVEN THE COMPUTER TO POVERTY!"
720 STOP
800 I$="QUIT":GOTO 365
810 PRINT "THE JACKPOT STANDS AT $";B
820 D=0:PRINT :PRINT "NEW GAME!":PRINT :GOTO 390
9999 END
*
```



ANTIQUE RADIO CORNER



by James A. Fred

Powering up those vintage radios is no longer a hassle

Some of the items most wanted (after radios) by collectors are books, magazines, and other literature. In past columns, I have listed many books that were available, with suppliers' names and prices. I now have one more to add to the list. The Vestal Press has been around a long time, but until recently all their offerings concerned player pianos, automatic music machines, music boxes, and records, etc. Now their catalog has a section featuring books of interest to collectors of old radios.

Crosley Reprint. Recently I received a book from them titled "Crosley Radio Apparatus," which is a reprint from the original in the collection of the Harold Staie Musical Museum in Intercession City, Florida. I didn't find a date of printing in the book, but it shows everything from "A" and "B" batteries, to the Crosley Model XXV radio receiver. Other sets illustrated and described are: Models VX, XV, XII, VI regular, portable, and special, the Harko Senior, and the crystal receiver Model 1. Other units shown are an Audion Detector, Radio Frequency Tuned Amplifier, and a Two-Step Audio Frequency Amplifier. There are two pages showing suggested hook-ups of all the Crosley units. There are two pages of Crosley Experimental Units which I didn't even know existed. Then there are eight pages of component parts. An especially interesting page lists all the radio cabinets then available with dimensions and prices. Imagine being able to purchase a hard wood cabinet 5½ by 6½ by 7-inches for only $2.50. You could also buy 3/16-inch-thick Formica panels cut to size for 2½-cents per square-inch.

The Crosley book has 32 pages beautifully printed on enameled stock with a beige-colored soft cover. It is priced at $4.00 plus $1.50 for shipping, which is a flat amount for any size order. I recommend it as a valuable addition to your collection of radio literature. If you want this book or a catalog of all the books published, write to the Vestal Press, P.O. Box 97, 320 N. Jensen Road, Vestal, NY 13850. The catalog is priced at $2.00, but it is a bargain since it has 60 pages and is printed on high quality slick paper.

Battery Eliminators. One of the problems mentioned frequently by readers of this column is that of powering up old battery-operated radio receivers. In a previous column, I reviewed an all purpose power supply that would operate from one to six-tube battery radios. Within the past month, I have heard from three readers who have just one radio set, a Radiola III. These readers stated that this was the only old radio they would ever bother with, but all three wanted their radios to play. This presents a problem, since the instruction book calls for three #6 drycell batteries of 1.5-volts each, and two 20-volt "B" batteries. At today's prices, #6 dry cells are about $2.00 or more each, and a 45-volt battery with a tap at 22.5-volts sells for about $9.00. So here you have a bill for $15.00 worth of batteries before you can play your Radiola III. Not only are they costly, but you can hardly find a store that sells them. A friend of mine is making his own "B" batteries. Radio Shack had a sale on "AA" size batteries during January, and he bought 100 of them. These will produce 150-volts when connected in series. This is enough for 3 "B" batteries, but since the available power is low, I doubt they would operate a multi-tube radio for very long. Commercial power supplies are available, but cost over $100.00 each. These power supplies are great if the collector wants to operate many different radios. One Canadian reader stated that a power supply delivered to his home by the Canadian Post Office would cost at least $130.00, including shipping charges and import duty. He wanted to know if there was a cheaper way to operate his Radiola III. This started me to thinking about the problem, and I then designed a power supply especially

Battery Chargers. Several years ago, I purchased a Fansteel Electrolytic Battery charger. In 1978, I found a Forest Electrolytic charger, and in January 1979, I found another one in a box of junk I recently bought. This made three units, so I decided to restore them all to duty. These chargers all use lead and

If you're a real stickler for authenticity, you'll want to operate your antique with batteries. But what happens when the batteries run down? Why charge them up again with an antique battery charge, of course! See the text.

e/e ANTIQUE RADIO

tantalum electrodes and require Sulfuric Acid as the electrolyte. I couldn't find out what concentration of acid to use, but one old book said to use "battery-grade Sulfuric Acid." This is what I did and the chargers worked fine. The charging rate is around one-half to three-fourths-ampere, so charging takes a lot of time. If you have a 5-tube radio using 201A's, you would have to charge the battery 2 hours for every 1 hour of use.

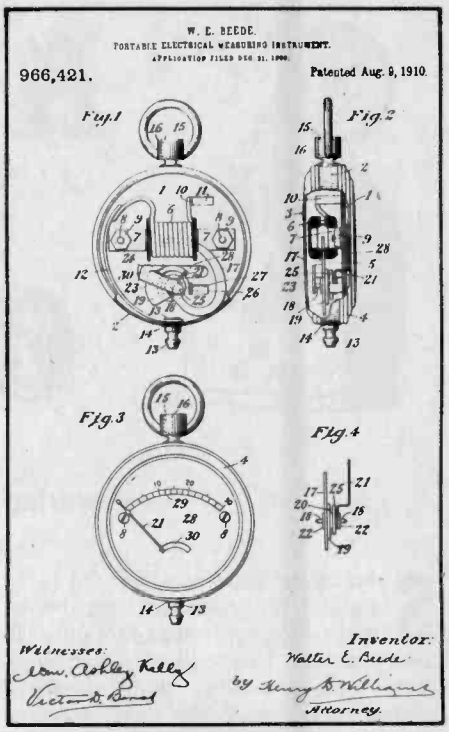
Many collectors are interested in documenting their old radio equipment. Collectors are always looking for books, schematic diagrams, etc., that relate to their artifacts. One area that hasn't received much attention is obtaining copies of patents relating to their equipment. One collector who had only one radio, an Atwater Kent Model 35, tried public libraries without finding any information on his radio. There was a patent number on the radio set, so he wrote to the patent office for a copy of the patent. What he received was a copy of an Atwater Kent radio patent showing a wooden cabinet, with a radio chassis inside. Of course, that didn't apply to a Model 35, and was probably for the Model 20 which was the first set he made with a cabinet. All the previous Atwater Kents had been breadboards. It might be interesting for you to find your oldest radio with a patent notice on it, and send for the earliest patent number listed.

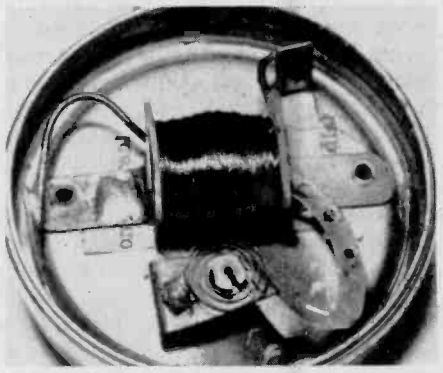
The First Travelling VOM. I have always been interested in the nickle-plated "pocket meters" (sometimes called watch case meters) that were made in the 1920's to read "A" and "B" battery voltages. I found a meter that was made to read either 50-volts or 50-amps. Several years ago, a friend gave me a copy of a patent, number 966,421, dated August 9, 1910. The front page of the patent is reproduced here. I have also taken a picture of the insides of my meter. At once you can see that they are identical.

I will quote you a sentence or two from the body of the patent. I am sure you will find it as interesting as I did: "My invention relates to portable electrical measuring instruments, such as are adapted to be carried in the pocket and which in general appearance resemble a watch." This is where the expression "Watch Case Meter" originated.

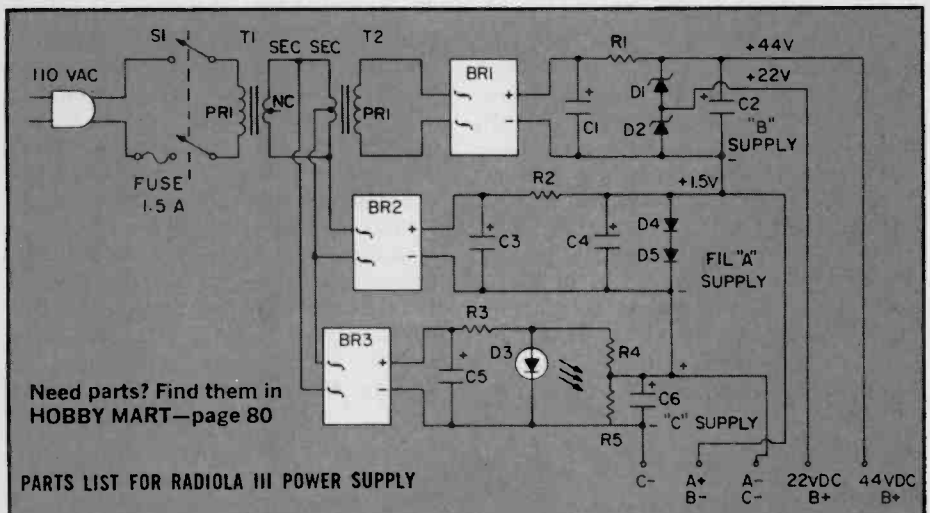
You can see that there are two windings on the coil form, a single layer of heavy wire for the ammeter, and a winding of many turns of fine wire for the voltmeter. This meter wouldn't read very accurately and couldn't be used with today's radio equipment. However they do make nice collectables to dis-

(Continued on page 83)





Here's an original patent drawing for one of the watchcase meters I've picked up. No matter what brand you might happen to come across, all units made during this era are pretty much alike, so restoration can be accomplished by following drawing and photo. A unique conversation piece.



Need parts? Find them in HOBBY MART—page 80

PARTS LIST FOR RADIOLA III POWER SUPPLY

BR1—full-wave bridge rectifier rated @ 200 PIV @ 1-amp
BR2, BR3—full-wave bridge rectifier rated @ 50 PIV @ 1.4-amp
C1—80-μF, 150 VDC electrolytic capacitor
C2—50-μF, 150 VDC electrolytic capacitor
C3 to C6—1,000-μF, 16 VDC electrolytic capacitor
D1, D2—zener diode rated @ 1-watt, 22 VDC
D3—large LED
D4, D5—silicon rectifier rated @ 600 PIV @ 6-amps
R1—3,500 to 5,000-ohm, 1-watt resistor (adjust impedance for 44 VDC output)
R2—2-ohm, 5-watt resistor, 5% tolerance
R3—150-ohm, ½-watt resistor, 5% tolerance
R4—300-ohm, ½-watt resistor, 5% tolerance
R5—1,500-ohm, ½-watt resistor, 5% tolerance
S1—DPST toggle switch
T1, T2—power transformer with primary rated @ 117 VAC, and secondary rated @ 6.3 VAC (center tapped) @ 1.2-amps

ANTIQUE RADIO SUPPLIERS

Tubes, parts, schematics: Antique Radio Parts, P.O. Box 42, Rossville, IN 46065—Puett Electronics, P.O. Box 28572, Dallas, TX 75228.

Books: Vintage Radio, P.O. Box 2045, Palos Verdes, CA 90274.

Tubes: Steinmetz Electronics, 7519 Maplewood, Hammond, IN 46324.

Power supplies for battery radios: G. B. Schneider, 6848 Commonwealth Blvd., Parma Heights, OH 44130.

Power Transformer rewindings: Jess Price, 507 Raehn St., Orlando, FL 32806.

CIRCLE 73 ON READER SERVICE COUPON

e/e checks out the...

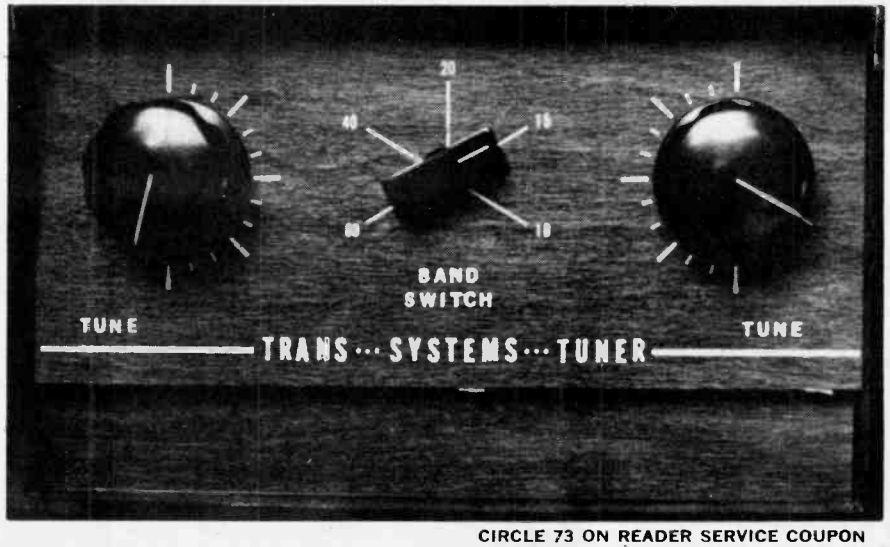
Apollo Systems Transmatch

The missing link between your transmitter and antenna

In the last few years the trend towards "appliance operation" on the Amateur Radio bands has become increasingly prevalent. Virtually all hams have at least one piece of equipment in their station that arrived preassembled and pretested, and often is used without any real understanding of its design theory. The most consistent offender in this area is—paradoxically—the one which is easiest to build, adjust, and understand: the transmatch, also called the antenna tuner. It is now exceptionally difficult to locate the few components necessary to build one from scratch. But, luckily, there is still one manufacturer that offers an antenna tuner kit. The company is Apollo Products, and the unit is the model 2000X-2 Trans-Systems Tuner, an impressive piece of equipment which combines excellent time-proven circuit design with components of the highest quality.

Why a Tuner? Those of you who haven't yet looked into the fascinating hobby of Amateur Radio, or who may have limited their operation to the VHF bands, where tuners are virtually never used, may be wondering now just what all the fuss is about. Well, if you're a CBer, you probably have noticed that your rig and your antenna don't always get along. Sometimes your transmitter just doesn't seem to like your antenna, and seems to hold back some of its power output. When this happens, it's usually because something called the Standing Wave Ratio, or the SWR for short, is too high. A high SWR means that the antenna is—to simplify matters—pumping a fraction of the transmitter power back into the transmitter, instead of sending it out into the ether. This itself isn't too bad; the real problem lies with the solid state output design, which virtually all CBs and many new Amateur Radio transmitters incorporate. Transistor output stages only operate well with a low standing wave ratio, and in fact shut themselves down (if they're well-designed) in the face of a high SWR.

The reason for this is that output transistors like to see a 50 to 75-ohm load impedance from the antenna, and a high SWR usually indicates that the impedance of the antenna itself is either too low, or more likely, too high. This can occur even though the coaxial cable feedline may be of the proper imped-



CIRCLE 73 ON READER SERVICE COUPON

The front panel, modestly decorated without the brand name, depicts the ease of operation you will experience with the Apollo Systems' Transmatch. Select the proper band, trim the two capacitors until minimum SWR is obtained, and then forget that it's there. In operation on 40 phone, we found that one adjustment covered the entire band segment. Of course, these adjustments will vary with the individual characteristics of your antenna and transmission line, but we feel that they are pretty representative of the manner in which the Apollo will operate for you. Remember this—The Apollo will definitely not cure poor transmission and reception caused by a bad antenna; it only protects your rig.

ance. The issue boils down to something relatively simple: *You* can live with an impedance mismatch, but your solid state transmitter cannot. This is where the antenna tuner comes in. What the transmitter needs is a transformer to match the two different impedances—and that's exactly what a tuner is!

How Does It Work? A good tuner or transmatch will perform this very simple but essential function: it will take an antenna with an impedance of anywhere from a few ohms to a few hundred ohms and make the transmitter output think that it's seeing somewhere from 50 to 75 ohms. But it's not allowed to do anything else.

It shouldn't unstabilize the output in any way—you don't want oscillation and its associated harmonics. And it shouldn't dissipate any power on its own. That means that its components should be tough and conservatively rated so that they won't heat up and therefore consume the radio frequency energy that's meant to be radiated by the antenna. It sounds easy, but it takes careful design, and high quality components to achieve.

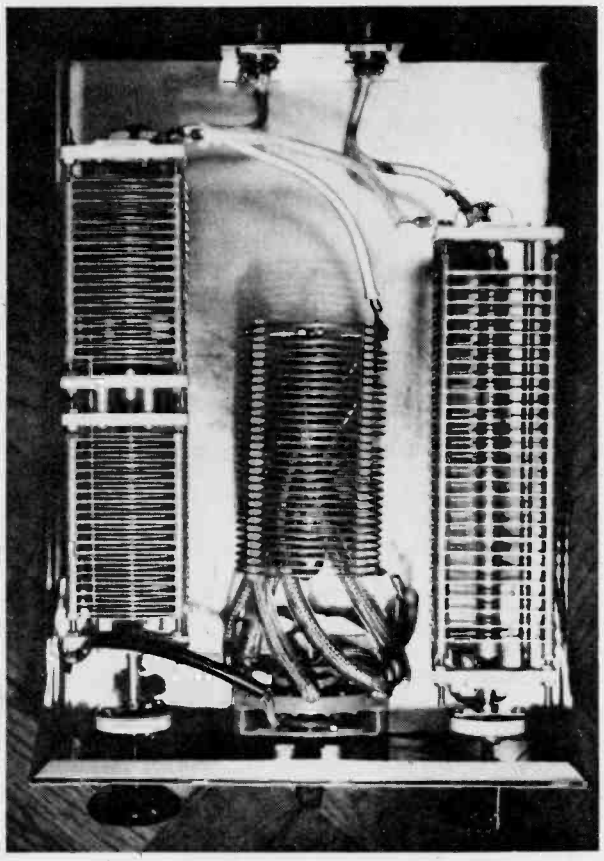
Down to Brass Tacks. The Apollo Trans-Systems Tuner does everything a transmatch is supposed to do—and nothing that it's not supposed to do—and does it superbly and easily. We used the Apollo Tuner with a variety of antennas on Amateur Radio bands from 80-meters to 10-meters. Our antennas are basically good—we don't believe there's much point in testing a high-quality piece of equipment with a duffer's antenna that it's unlikely to ever be used with. However, even the best of antennas aren't perfect, and some of them displayed standing wave ratios of up to 3-to-1, high enough to disturb our Heath SB-104A's solid state output. There was never an instance where the Apollo Tuner wasn't able to drop the SWR to virvually unmeasurable levels, thereby indicating that it was doing a perfect job in matching antenna and transmitter impedances.

After the test with the 100-watt solid state rig, the Apollo Tuner was matched with a 1000-watt linear amplifier on the Amateur Radio bands, to test its performance under high power. The tuner had been perfectly stable with the low power rig, and it remained totally stable with the 1000-watt input. The tuner exhibited no evidence at all of heating up, a fact which confirmed the quality and conservative ratings of its components. Moreover, the tuner displayed a particular characteristic which is the gauge of a tuner's effectiveness. It cut the level of TVI—inadvertant interference with nearby television sets—by over 75%. That means the "Q" of the tuner is high (as it should be)—that it passes only the frequency it's tuned to, and supresses all others to the greatest possible degree.

First Things Last. Assembling this kit was a snap. There are only four major components: a big inductor or coil, two huge variable capacitors, and a hefty six position band switch. (Yes, *six* position! The tuner covers 160-meters too, but we had no antenna on that band so weren't able to test it down there.) There are some coax sockets, standoff insulators, nuts and bolts, knobs, and a lot of heavy copper braiding and sealing. The heavy guage cabinet was pre-drilled, but we had to do a little filing and fiddling to make everything fit. A word of caution: make sure you're well set up with rosin-core solder—the braiding just soaks it up at every connection.

The Apollo Tuner comes with a good set of assembly and adjustment instructions, as well as schematic and parts placement diagrams. The schematic and parts placement sketches show all wiring clearly, but the wiring instructions leave out one final step in the assembly. Be sure you install the ground strap between the front (panel) end of the inductor and the stator of C1, as shown in the Apollo's two diagrams. Also, we have one suggestion to make, which we think substantially increased the versatility of the tuner. Instead of soldering the six taps to the inductor, try using insulated miniature alligator clips as fasteners. This will allow you to have a much greater freedom in varying the inductance, and provide a much finer matching with various antennas.

Summing Up. This is an excellent kit, both as an important piece of equipment around the ham station, and as an introduction to the theory underlying antenna operation. At $122.50 ($146.50 pre-wired), it's not cheap, but just having all those hard-to-get high-quality parts in one place is worth the price, as well as having a pre-drilled chassis and cabinet, and a top-flight circuit design and instruction manual. (Before going to press, the manufacturer was informed of the single omission in the assembly steps, and has set about making the correction). The Trans-Systems Tuner kit is available from Apollo Products, 216 Center St., P.O. Box 245, Vaughnsville, Ohio 45893. For more information, circle number 73 on the Readers Service Card. ■



As you can see, the Apollo is really built. No doubt the rugged components could easily handle twice as much power as you will ever use. It's a pleasant surprise to test a piece of equipment whose design and construction has been accomplished with one thought in mind: Build a quality product that will last. In our prototype, we elected to run the braided wiring to the band switch inside the inductor. We did not experience any problems in doing this, but you may desire to make your taps on the outside of the coil, and then run the wires to the switch. The only area of caution in the entire assembly is the soldering of the braided wires to the inductor. It's easy to drip solder onto the coil, thereby shorting out turns. This decreases the selectivity later during use, so exercise caution while soldering, and doublecheck when finished.

THE SIMPLE SIGNAL TRACER

A pocket radio **dies** so that others may **live**

By Bob Powers

Remember that AM pocket radio your cousin gave you last year? How about the one the bank gave you last week when you opened up a new account? Most electronic experimenters end up with one such useless radio at some time, and that spare radio can be converted into a piece of test equipment that will be an invaluable aid to your workbench; a signal tracer.

In AF and RF circuits, even after you have taken voltage measurements and begun to suspect certain components, it really helps to be able to *hear* what's there. The signal tracer can be used to probe the area in such cases and can also be used as a simple amp/speaker system.

This project will outperform the inexpensive tracers on the market, which cost about $15. If you already have a spare AM radio, you can complete this project for 3 to 4 dollars. If you don't have a spare radio already, some sharp shopping should nab you one for about two or three dollars. Either way, you'll enjoy a considerable savings over the store-bought tracer, as well as better performance.

How It's Done. Every radio has two sections in it: An RF (Radio Frequency) section and an AF (Audio Frequency) section. The RF section yanks the radio signals from the air and demodulates them to recover the audio signals that are being broadcast. The AF section then amplifies these weak audio signals to a volume that we can hear.

What we'll do then, is to tap in just before the volume control (The volume control works by sending a varying signal to the AF section that has been produced by the RF section. The variation is the volume control setting.) So the volume control will control the loudness of the input signal that you put in when you're tracing.

Refering to the schematic, in the AF mode of operation, the signal input goes through C1, which blocks any DC coming from the circuit under test, but couples the signal to the radio's amplifier input. For tracing RF signals, D1 and C2 couple and demodulate the RF signal that is being traced.

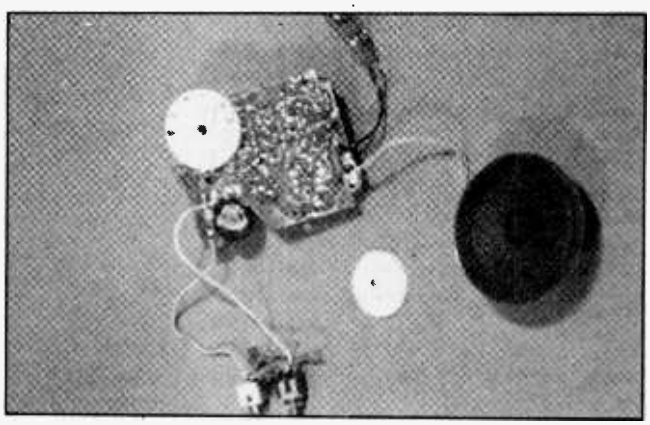
Construction. Remove the back cover of your radio, and locate the volume control potentiometer. Remove the small screw that is holding the volume control dial to the potentiometer's shaft, and remove the dial so that you can clearly see the three "lugs" (or pins) on the volume control potentiometer.

Now, it's necessary to find the lug that carries in the signal from the RF section of the radio. You can eliminate the center lug. Next, take an ohmeter and clip its ground lead to the negative battery wire. Take the positive ohmeter lead and touch it alternately to the two remaining lugs of the volume control potentiometer. The lug that, when touched reads no resistance (0-ohms), can be eliminated, as the remaining lug (the third one) is the one you'll need to operate on for the modification.

Now, take a sharp knife or cutting tool, and cut the foil on the PC board that runs to this lug on the potentiometer so that there is no longer any connection there. This cuts off the signal from the radio's RF section so that it won't be heard. Now, solder a three-to-four-inch piece of insulated wire to the disconnected lug. Solder a similar length of wire to the point on the PC board where the battery's negative lead is attached.

Connect the wire from the lug of the potentiometer to the center lug of switch S1. Follow the schematic, and wire capacitor C1 to one side of switch S1, and to the tip connector on jack J1. In a similar manner, connect diode D1 and capacitor C2 to the other side of switch S1, and to the tip connection point on jack J1. Observe the polarity of D1, and use a heat sink when soldering it. Next, connect the sleeve connector of J1 to the wire from the negative side of the battery that you installed earlier. Finally, drill two mounting holes in the radio's case to accommodate J1 and S1. Be sure to mount them where there is no possibility of their connecting lugs coming in contact with the PC board. This is usually best done near the battery compartment.

Finally, solder different colored wires (red for the center connector, black for the sleeve connector) to P1, and attach an alligator clip to the black lead, and a probe tip to the red wire. A paperclip wrapped with electrical tape will make a functional probe tip.



With the chassis removed from the case, the connections to the radio's printed circuit board are visible. The input wire running from S1 to the volume control's input lug, as well as the ground wire from jack J1, are the only two hard-wired connections necessary.

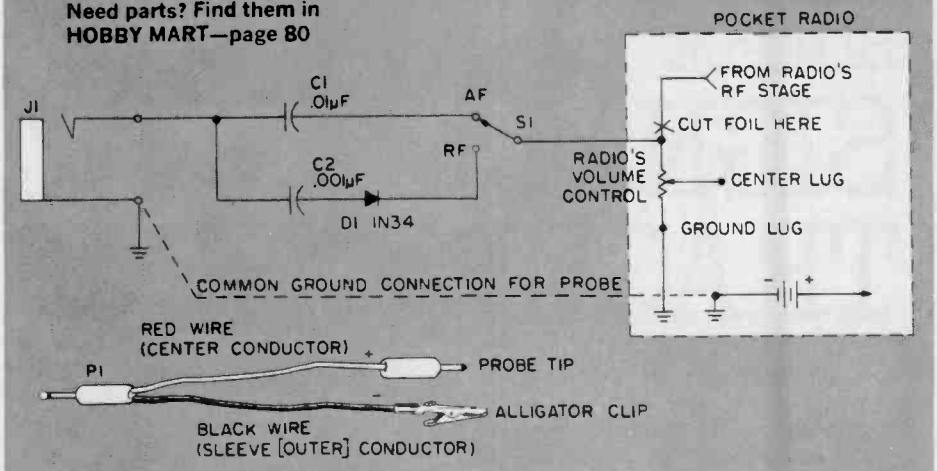
e/e SIMPLE SIGNAL

Use. Turn on the tracer, as you would regularly turn on the radio, and set the volume up half-way. Now insert the plug with the input leads into jack J1. Connect a signal source to the tracer's input leads and listen for it.

With its RF circuitry, you can listen to modulated RF signals when switch S1 is in the RF position. The normal procedure is to connect the tracer's ground (−) input lead to the ground of the unit under test, and connect the positive tracer lead in a radio frequency circuit somewhere before the "detector."

Books on troubleshooting can give you many tips on how to best utilize a signal tracer and with only a little practice, you can start beating down the high cost of professional service, and maybe even make a little money by fixing your friends' and family's electronic gear! ■

Need parts? Find them in HOBBY MART—page 80



PARTS LIST FOR SIGNAL TRACER

C1—0.01-uF, 15-VDC ceramic disc capacitor
C2—0.001-uF, 15-VDC ceramic disc capacitor
D1—1N34 germanium diode
J1—subminiature phone jack, 2-conductor
P1—subminiature phone plug (to match J1)
S1—SPDT subminiature toggle switch (low voltage type)
MISC.—hookup wire, solder, alligator clip, probe tip, pocket radio suitable tor conversion.

Computers On The Move

Computer Cuts Bills

An Apple II computer carried in the trunk of a Porsche is helping to put more nutritional and economical meals on the tables of thousands of low income families and senior adults. The mobile personal computer is part of an experimental program intended to stretch food buying dollars for people living in the Miami, Florida area.

The Apple II, donated by Apple Computer, Inc. of Cupertino, California, is serving as an output terminal to a large general purpose computer which monitors the best food buys available at over 700 food stores in Dade and Broward counties. Because approximately 100 food items are advertised in the two local papers each week, it's virtually impossible for an individual to manually select the best buys consistent with a well balanced diet. However, with the availability of low-cost computer data processing, this task has been greatly simplified. Each week a computer analysis is made available to the public, reflecting the lowest available prices on specific food items, the individual markets or food chains offering these items, as well as a weekly menu plan which makes use of the advertised specials.

Helping to cut grocery bills is only one of the ways computers ease our daily chores.

Student computers are continuously being made more accessible with more memory.

More Memory for Plato

Students in the University of Illinois' computer educational system are now less aware of the computer's machinations and more immersed in classroom work thanks to an Intel semiconductor memory system.

Intel's *in-458* memory system has added more than a million semiconductor memory words to the "Plato" computer system's extended core memory. "Plato" is an educational system accessed by classes in colleges, universities, junior colleges, high school, elementary school, and military installations throughout the United States and Canada. The Intel memory makes it possible to expand the "Plato" user base from 1000 to 1250 terminals. At the same time, the number of "active" terminals on line has been increased from 600 to 800 while maintaining a 100 to 200 millisecond response time.

The *in-458* added 1,048,576 more 60-bit words to the Plato system's two million word capacity, giving Plato a new memory capacity of more than three million words. Now, the University student's can keep on talking and Plato can listen, and react at a word transfer rate of ten megaHertz. That should speed up learning. ■

Crystal detectors and how they work

Join us in a trip down memory lane to the time when *radio* meant *crystal*

by James A. Fred

RADIO WOULD NOT BE POSSIBLE without a means of detecting the signals. Detection of a signal refers to the separation of the audible signal from the radio frequency carrier signal. Over the years since 1873, many kinds of detectors have been used. The first really sensitive and stable detector was the mineral detector of Dr. Greenleaf Whittier Pickard. Utilizing the research of Professor Braun which showed the "unilateral" conductivity of certain minerals such as Pyrite and Galena, Dr. Pickard developed the crystal detector. During the developmental process, Pickard found over 250 different minerals that would detect radio signals when used in conjunction with metal contacts. He actually tested over 31,000 combinations, finding many hundreds of useful pairings.

Early Development. The crystal detector developed by Dr. Pickard between 1902 and 1906 was the first truly sensitive and fairly stable detector. The crystal detector was more sensitive than the Fleming Valve (diode) and even the deForest Audion (triode). As testimony to that fact, many radio operators kept a crystal detector on standby for their vacuum tube receivers. The one drawback to any detector, including the crystal detector, is that they do not amplify signals, but merely detect the signals received.

Ups and Downs. This lack of amplification requires that every possible step be taken to provide the highest level of signal to the receiver. The antenna gathers in the radio signals and the higher it is and the longer it is (to a point) the stronger the signal is. Of course in this day and age there has to be a limit to the height and length of the antenna. These limits will vary with where you live and how far you are from radio stations. For use with the crystal radio we are about to describe, your antenna should be from 10 to 25-feet high, and from 50 to 100-feet long.

Lack of caution in erecting antennas has caused some fatal accidents, so we urge that you use care when making your installation. No antenna should cross, go under, or even be erected *near* power lines, or even telephone lines. Keep your antenna in the clear. Not only will this prevent an accident, but it will help avoid picking up power line noises that could drown out the radio signals.

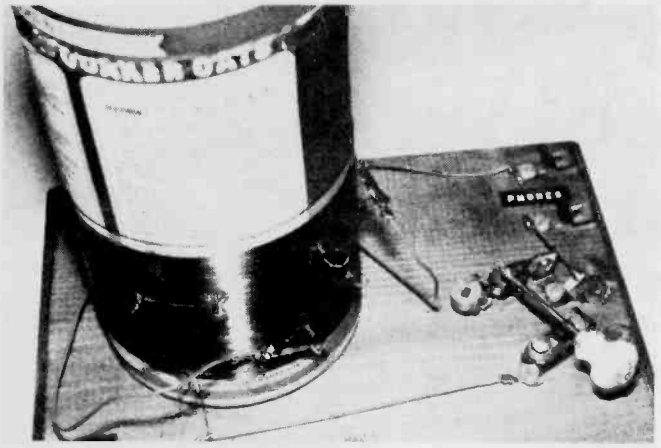
A good ground is next in importance, since the ground completes the antenna circuit. Usually a connection to a cold water pipe is considered an acceptable ground, but today this is not always true. The pipe could have a plastic section, or could be separated from the earth by a meter or other device. A better ground can be obtained by driving a copper-plated rod at least six-feet long into moist soil. Try to avoid sandy or dry soil, as it makes a poor ground. Don't drive the rod under the eaves of the house, because the rain will not moisten the ground there. The old-time radio experimenters sprinkled a few crystals of copper sulphate around the upper section of the ground rod. The copper salts would improve the soil conditions and make a better ground. Use a good ground clamp to attach your ground lead-in or better yet solder it to the ground rod.

The Human Connection. With further respect to the fact that crystal detectors do not amplify, and that every possible way to improve the strength of the received signal must be taken advantage of, the need for a set of the most sensitive headphones available must be recognized. You cannot use crystal headphones or the low-impedance (4 to 16-ohms) dynamic phones found on today's market. Most of the mail order radio parts catalogs will list 2000-ohm headphones, which are the ones you should buy. If you can find 4000 to 8000-ohm units, you will hear an even stronger signal on your crystal radio.

While the preceeding tells us what to do to receive the best signal possible, we have not discussed the crystal detector itself. If a crystal detector is examined, it will be found to be merely a

stand that holds the mineral in place with electrical contacts probing the mineral. Most minerals are mounted in a metal cup filled with a low melting-point metal, called Woods metal. The low melting-point prevents damage to the mineral crystal, which could cause it to loose its sensitivity. The adjustable electrical contact probing the mineral is called a "Cat Whisker," since it is a fine, springy wire. These two contacts to the mineral form a junction that permits electrical current to flow in one direction, or, as Pickard called it, "unilateral conductivity." This is a form of rectifier diode, and its action detects the audible signal which operates the headphones and permits us to hear the program material.

Now that we have all the necessary background for building and using crystal detectors, let's build a simple Cat Whisker crystal set which requires no parts beyond the wire and crystal, which we in jest have called the "No Parts Crystal Set."



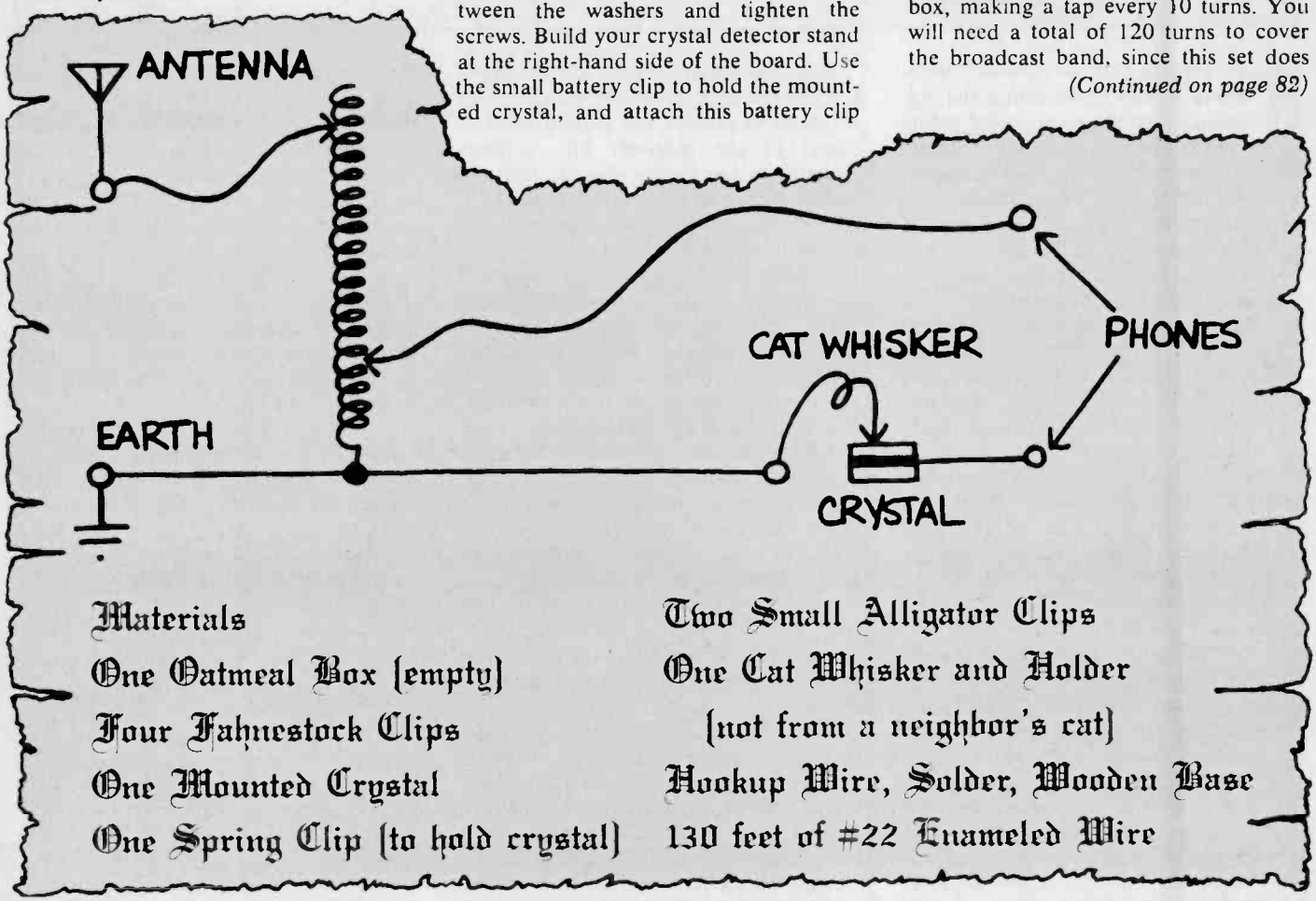
You can't make a simpler, or less expensive BCB receiver than this one. Even the coil winding isn't terribly critical, but the value we selected gave the best result.

Construction. You can build your crystal receiver on a piece of pine board, just as the oldtimers did. If you follow our layout, you won't need any fancy hardware, and in fact, you can use the exact same materials which were used years ago to build the first sets. Don't laugh! They actually worked, as you will see.

First, mount 4 terminals. You can use Fahnestock clips, or make your own with four wood screws and washers on them. Run the antenna wire, etc. between the washers and tighten the screws. Build your crystal detector stand at the right-hand side of the board. Use the small battery clip to hold the mounted crystal, and attach this battery clip to the board with a small angle bracket. Connect this to one headphone terminal. Take a 3-inch piece of wire, strip away the insulation, and mount it about 1½-inches from the mounted crystal. Form a cat whisker with this wire so that it touches the surface of the crystal. If you want to go first-class, you can buy a complete, mounted detector, but this is not necessary. Connect this catwhisker to the ground terminal on your board.

Wind your coil on the empty oatmeal box, making a tap every 10 turns. You will need a total of 120 turns to cover the broadcast band, since this set does

(Continued on page 82)



This "authentic" schematic was found in Grandfather's trunk in the attic, wrapped around a stack of Grandmother's love letters. Gramps was never too much of a sentimentalist anyway, except when it came to radio. For good, clean fun in his day, radio couldn't be beat.

Kathi's CB Carousel

by Kathi Martin, KGK 3916

A super base station that lives up to its billing

THROUGHOUT ALMOST THE ENTIRE history of CB, there have been *superbase* transceivers, which generally turned out to be routine high-performance transceivers in extra-heavy, fancy cabinets, with more controls, switches, and meters than even the most dedicated CB hobbyist would ever need. Fact is, many of these "super" rigs were designed primarily for eye appeal, and were real dogs when it came to on-the-air performance.

Even when the mail brought mounds of letters asking for reviews of superbase transceivers, I had a difficult time finding the few that justified their price tag; and so I've reviewed very few superbase transceivers in the years I've been keeping you up to date on the top developments in CB.

Quite by accident, I came across a real sleeper in superbase transceivers. Actually, I found it while visiting the test lab, checking out CB equipment for the *1979 CB Buyer's Guide*. (No smart shopper buys any CB gear without checking *The CB Buyer's Guide.*) I happened to walk in just as a lab technician finished testing the Cobra 2000-GTL, and saw him give a "thumbs up" to another tech, indicating he had found a real winner. So I decided to see what the Buyer's Guide found so exciting.

Good Looks Don't Hurt. Firstly, the only thing indicating the Cobra 2000 GTL might be a superbase, is a matching external speaker console and what appears to be an LED digital clock. (As I was to discover, the clock display is also used as separate transmit and receive frequency counters, but more on that later.) Though the sloping front panel and wood cabinet imply some sort of high-performance model, it's not the "boat anchor" we've come to expect in superbase transceivers.

It's only when you get up real close

CIRCLE 44 ON READER SERVICE COUPON

The Cobra 2000 GTL is one superbase transceiver that certainly lives up to its billing. There are enough features and controls to keep even the most avid gadgeteer satisfied.

to see the extra features, such as a dual-range clarifier and a separate SWR/Modulation meter, that you know the Cobra 2000GTL is no run of the mill transceiver in a fancy cabinet.

The Features Make It. First off, the 2000GTL is an AM/SSB model designed to work primarily off 120 VAC, though there is a socket for a 13.8 VDC power input for portable and mobile use. Features include S/RF-output and SWR/Modulation meters, the remote speaker console and jacks for a second remote speaker and headphones, an AUX jack that permits recording or monitoring of both the received and transmitted signals, a P.A. speaker jack, a microphone gain control, a dual-range "voice lock" (clarifier), and the timer/counter. All this in addition to the usual superbase RF gain control, tone control, etc.

One of the Cobra's outstanding features is the built-in digital frequency counter.

Coup de Grace. Now for the real biggie, the timer/counter. Control and function (or mode) is determined by two banks of 3 push-switches each. One bank is labeled COUNTER/TIMER; the other is labeled DYNALERT. The DYNALERT switches are: *Set, Alarm,* and *Radio.* The *Set* switch allows the user to set the clock's alarm by displaying the alarm time; releasing the switch restores the time indication. The *Alarm* switch turns the alarm on and off; the alarm turns itself off after one minute if not manually turned off. The *Radio* switch causes the transceiver to be turned on at the preselected time.

The COUNTER/TIMER switches are: *Counter, Auto,* and *Time.* The *Counter* switch causes the receiver frequencies to be displayed in the receive mode, and the transmit frequencies in the transmit mode. The counter resolution is 100 Hz, meaning the counter would indicate, say channel 1, as 29.9650. If the transmit or receive frequency was up to 100 Hz above the exact channel frequency the display

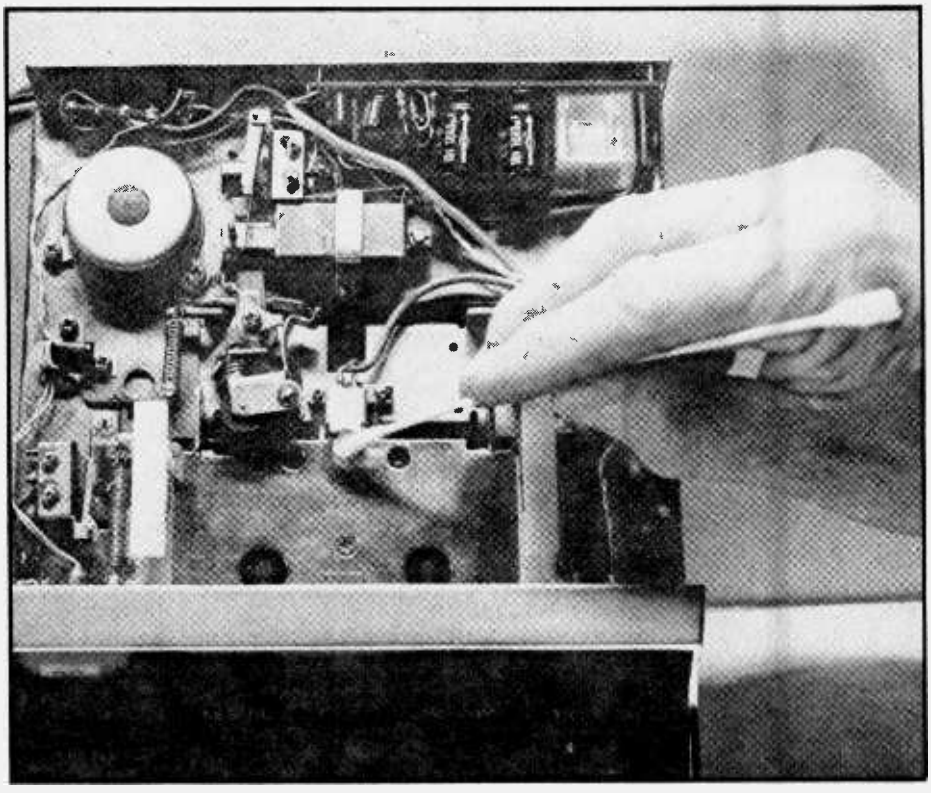
(Continued on page 86)

As with all types of electronic equipment these days, car stereo, or car-fi as it is now popularly called, as well as having become better and more sophisticated, is equally more complex. As a result, when they require some sort of repair, or, for that matter, even routine maintenance, many owners are finding it necessary to take them to the local service shop. With bench labor prices at a premium these days, a little do-it-yourself consumerism seems appropriate. While we are not advocating that you undertake major surgery on your unit, we feel that with a little knowledge (and some guts) you can apply routine maintenance to your tape player, and hopefully forestall larger labor costs later, as well as some smaller ones right now.

Of course, it is impossible to prescribe the specific remedies and maintenance courses for each and every tape player on today's market. There are literally thousands of types! Below, you will find seven general tips that will apply to almost all conventional makes of cassette players. Don't be scared to unscrew the lid of your unit and have a look inside. It is highly unlikely that you can do any damage simply by looking. In many cases, the problem(s) will be evident immediately from a cursory inspection, and even if you feel that the task of repair is beyond your individual capabilities, at least you will be aware of what areas are affected by the malfunction, and what to look for on the repair bill. Hopefully, you won't be sold a bill of goods. If indeed you choose to take your cassette player to a shop for repair, don't ever be ashamed to ask for the return of all defective parts. If the bill doesn't make sense to you, ask questions! Remember, it's your money, and your music!

7 STEPS TO AUTOMOBILE CASSETTE REPAIR

by Homer Davidson

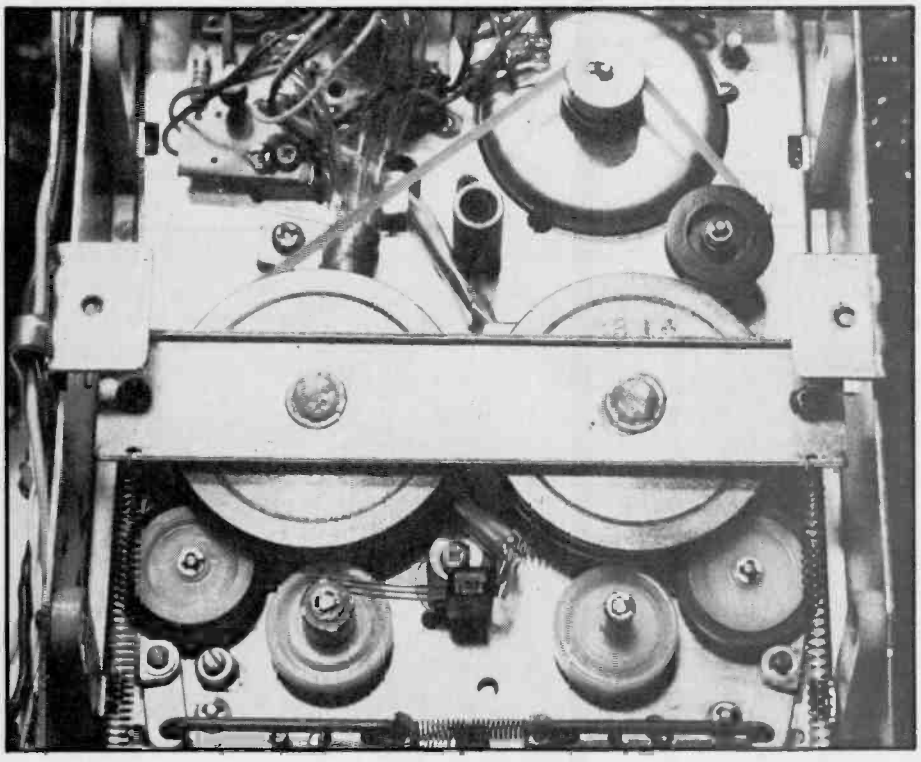


1 It is absolutely essential that the tape head be kept clean for maximum performance. The gaps on the pickup surface are very small, and only the smallest amount of oxide from the tape surface will impair the sound quality if it is not removed from the head regularly. The symptoms of a dirty head are: Loss of high frequency sound, loss of volume, distortion, or loss of one or both channels entirely.

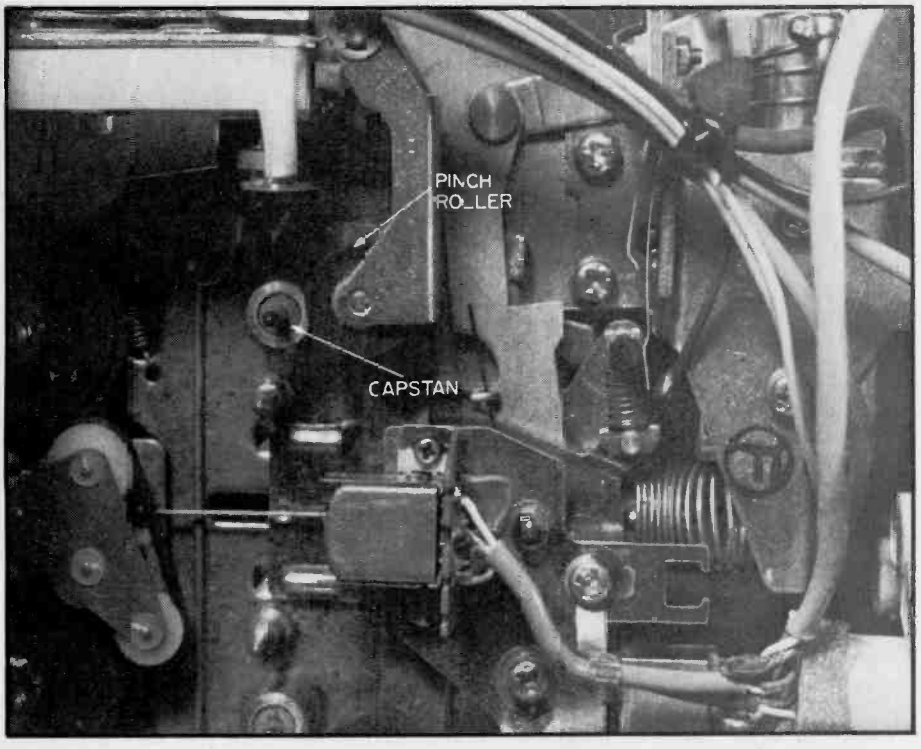
While some manufacturers of cassette tape have provided head-cleaning leaders on the beginning and end of each tape (such as Maxell), we suggest regular maintenance with a cotton swab and Freon or denatured alcohol. In cleaning the head, beware of getting the cleaning solution on any of the pinch rollers or plastic tape guides. Some cleaning fluids have the nasty habit of eating away at the synthetic materials used to make the rollers and guides. The guides and pinch roller surfaces may be effectively cleansed with solutions made specifically for the purpose. In many cases, the owner's manual for your particular unit may recommend a particular brand or type of cleaner, and it is always safe to follow their recommendations.

Never use a pointed instrument, such as a pencil, to clean any surface —particularly the head—inside the machine, as even the slightest scratch on the head surface will damage tapes.

2 Probably the worst problem with any tape player is when the tape drive develops an appetite for your tapes, and "eats" them. This condition is usually caused by improper, or lack of, operation on the part of the takeup spindle. The takeup spindle is driven from the motor by means of a separate belt and pulley system, and the same troubleshooting procedures used for the main tape drive (as described later) apply here. Check for loose or worn belts, or a binding pulley at the takeup spindle. With the belt to the spindle disconnected, turn the spindle by hand to make sure that it's moving freely.



Also, make sure that the pinch roller is making firm contact with the capstan, thereby pulling he tape from the cassette and feeding it to the takeup. Because the pinch roller is backed off from the capstan during rewind or fast forward operation, it is always possible that, over a period of extended use, the arm on which the pinch roller rides may have become bent, thereby not allowing the roller to come into firm contact with the capstan, and allowing the tape to feed out of the cassette with nowhere to go, even with the takeup spindle functioning normally. This can happen because the takeup spindle operates with very little torque to avoid streching the tape beween it and the pinch-roller/capstan.



3 Erratic tape speed, that is, the slowing down and speeding up of the tape at random, can usually be attributed to two factors: Defective tape, or a worn pinch roller. As we mentioned earlier, many inexpensive brands of tape lack the internal guides necessary for smooth winding of the tape, and, as a result, often produce irregularities in the playback. There is not much that can be done to remedy this. If the tape has irreplaceable material on it, then the best thing to do is to play the tape back on a high quality home deck with dual capstan drive (these drives have more muscle to them, and can often alleviate the wow and flutter) and record it onto another, and hopefully higher-quality tape, on another machine.

If, however, the source of the problem is not in the tape(s), then you should strongly suspect the pinch roller. These are usually made of neoprene, and, as a result, have a somewhat lower resistance to dirt, grease, and oxide buildup than natural rubber, while being generally more resistant to wear.

The first step is to visually examine the roller for sign of dents, divots, and chipping. If any surface irregularity is apparent, including loss of roundness, then discard the roller and get a new one. If no irregularities appear, then a thorough cleansing of the surface is in order, even if no grime is visible.

If these procedures don't eliminate the problem, then go through all of the troubleshooting procedures we've outlined elsewhere for the tape drive, beginning with the motor, and working your way up to the capstan and pinch roller. Sometimes a slipping drive belt can cause wow and flutter as well as a bad pinch roller.

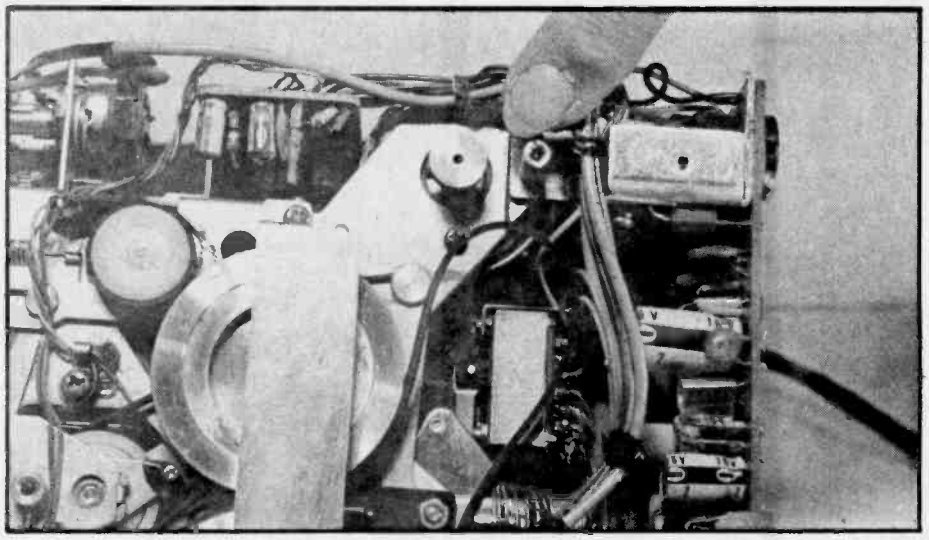
4 Stoppage of tape movement may be caused by any one of several components within the machine, and it is best to eliminate each one in order to save time on your troubleshooting and repairs.

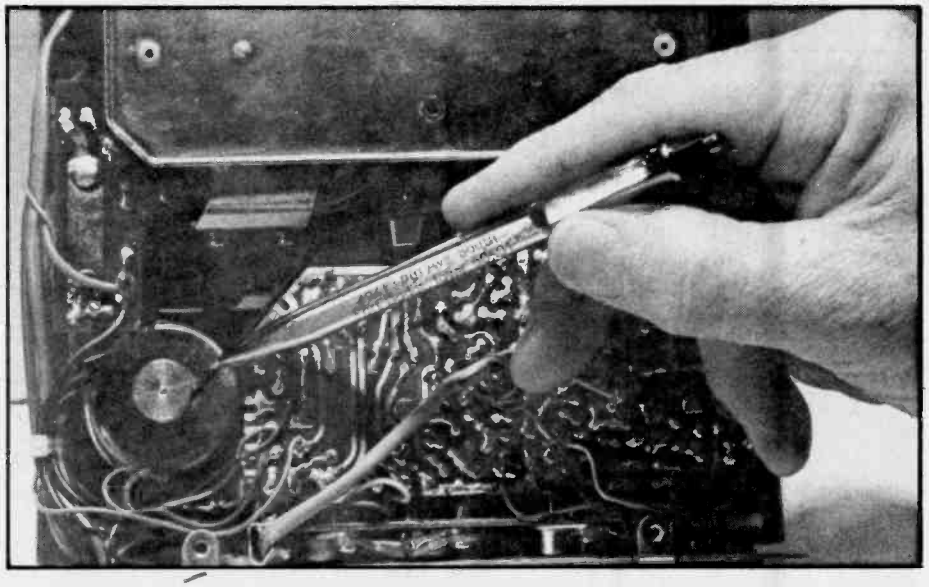
The first thing to check is the fuse. If the fuse is shorted, this indicates a short circuit either in the wiring of the power leads to the tape deck or in the motor itself. Eliminate the external wiring as the problem first, as this is usually the source in nine out of ten cases.

Next, examine the wiring from the automatic start switch to the motor. Make sure that power is getting to the switch from the main power line of the tape player. Then, either by inserting a cassette or by closing the start switch manually, check to see that power is getting to the motor terminals. If power is being fed to the motor and it still will not turn, move the drive wheel that is attached directly to the end of the motor's shaft to insure that it is not jamming the motor. If it turns easily, then you can be certain that it's time to hunt up a new motor.

Should you discover that the motor is operating, but not moving the tape, visually inspect the drive system of belts and pulleys to see if any one of them is not moving with its drive belt, that is if the drive belt is moving, but the pulley it wraps around is not, or vice versa.

Frozen pulleys usually have to be separated from their mounting spindles and, if they will not turn freely after cleaning and light lubrication of the contact surfaces, the spindle may have to be narrowed by rubbing with fine emery cloth to remove the built-up effects of metallic oxidation and/or warping due to heat. The lack of regular (annual) lubrication on these pulley contact surfaces increases friction which can warp the spindle.





5 Tape drag, as opposed to complete tape stoppage, may be one of the hardest problems to diagnose because it's not absolute. If the tape is not moving at all, you can usually find something jammed or broken to account for it. With tape drag, the examination must be more precise and painstaking.

The first thing to examine is the drive belt which runs from the motor pulley to the flywheel or, if the flywheel is attached directly to the motor, from the motor/flywheel to the capstan. If the belt appears to be worn, replace it. If there is a shiny band on the flywheel, this is an indication that the belt is slipping and it should be replaced immediately. If you cannot obtain a direct replacement belt from the manufacturer, there are several kits available which allow you to custom-make a belt to the size needed.

If the belt is tight and in good condition, examine the captan pulley, with the belt removed, to see if it is binding. If it is, first try lubrication with a bit of powdered graphite. If this method does not succeed, remove the pulley from the spindle and rub down the spindle with fine emery cloth. The capstan itself may be mounted on a spindle, and it will be necessary to check its freedom of movement and apply the above procedure to it if it is found to be the source of excessive friction.

Remember, that if your machine has "eaten" a tape, there is likely to be some tape wrapped around the capstan. If this tape gets caught between the spindle and the capstan, it will serve to bind up the capstan, thus producing drag. As a general maintenance rule, if a tape gets eaten, you should open up the machine as soon as is conveiently possible to remove the debris. Delaying this increases the chances of dragging or jamming, and the jamming always occurs when you least want it to happen.

Remember, that the less expensive the tape, the more likely the chance that the cassette itself may have a high level of drag built into it, due to the lack of internal tape guides, or to the lack of a lubricating compound in the base material of the tape. You get what you pay for in casette tapes.

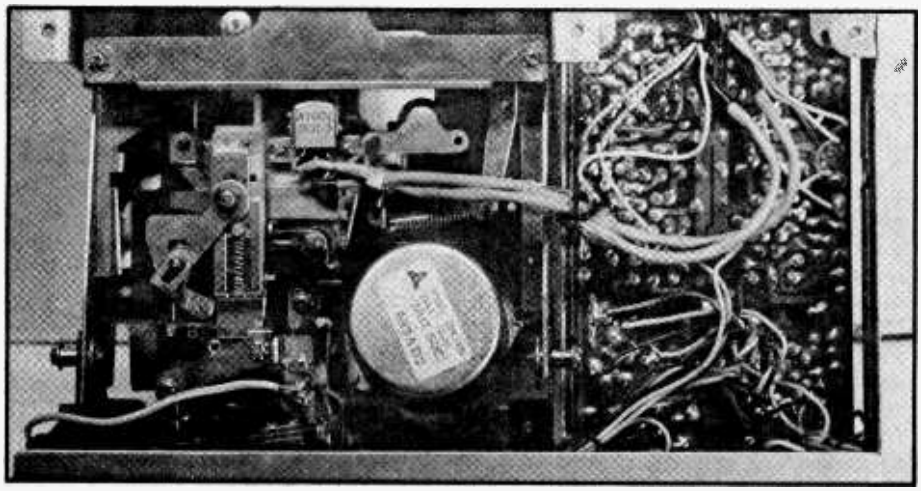
6 Unfortunately, not all problems in your tape player are mechanical in nature. Even though today's electronic technology is vastly superior in terms of durability compared to that of even a few years ago, you may find yourself in the position of being minus one channel even with a clean head and proper tape alignment. In a case such as this, unless you have sufficient knowledge to troubleshoot an amplifier circuit, you would be best advised to refer the repair to an experienced and qualified shop, preferably one which is an authorized service center for your brand of machine. The manufacturer usually includes a list of service centers for all areas of the U.S., and it is a safe bet to take it to one of them, if only because they are responsble to the manufacturer in case something should be botched on the repair.

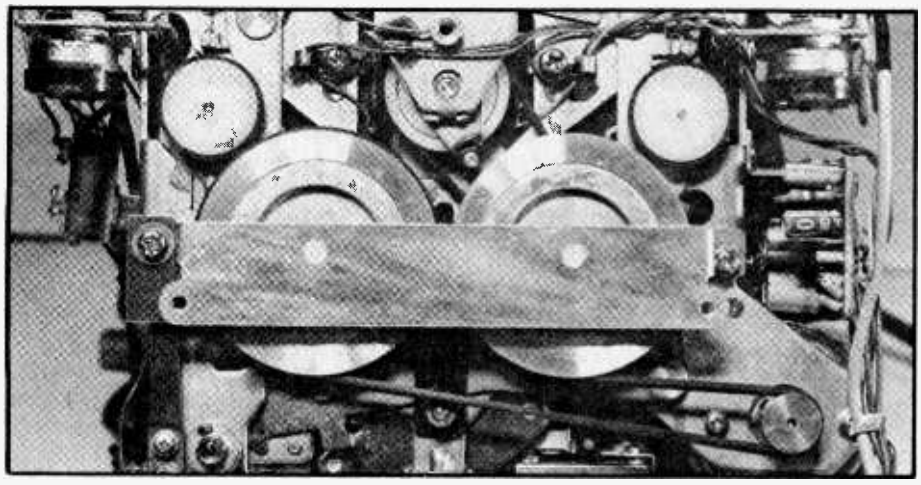
Before taking the unit to a repair shop, there are some checks which you can perform quickly and easily, even without specialized knowledge:

Visually inspect the soldered leads to the tape head. If any appear to be loose, resolder them with a low-power (15-watt) iron. If the leads appear to be firmly soldered, you may wish to check the output leads to the speakers from the PC board. In many units, there are interlock devices which are used to pass the leads through the cabinet, and these may sometimes become loosened from tugging during installation, and cause outages. Also, check the solder connections at the board for continuity.

If your unit incorporates a radio section, turn the radio on and see if both channels are working. If they are both functioning, then the problem is in the tape head and preamplifier, and not in the final amplifier. If this seems to be the case, then it would be a good idea to visually trace the wiring from the tape head to the PC board, and when reaching the PC board, to rock all of the components gently to see if there are any loose solder connections among them.

Sometimes, a defective tone or volume control can be the culprit, since the signals from the tape head are channeled through them. Rotate the controls through their entire arc. If the missing channel comes on at any point in the rotation, then you have found the defective component, and it should be replaced with an equivalent potentiometer.



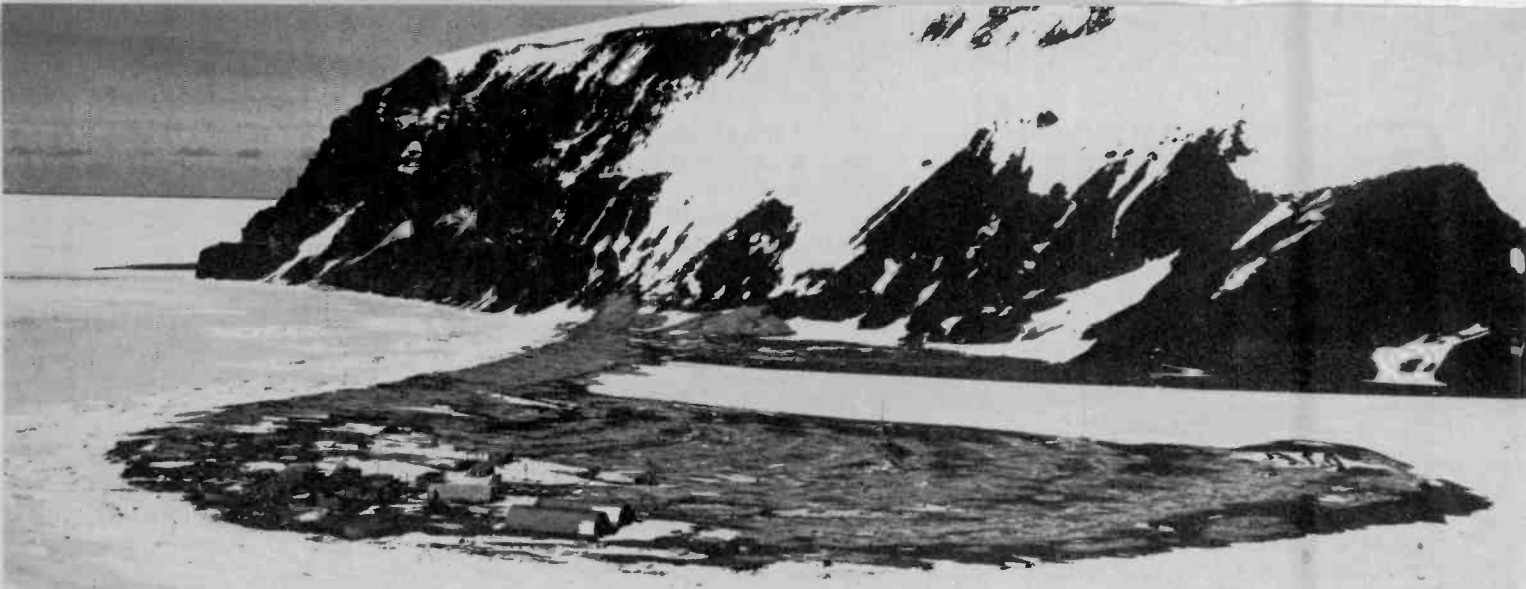


7 Many of the newer casette players incorporate an automatic reverse feature which eliminates the need for removing the tape from the machine in order to play the other side. These mechanisms take many forms, both electrical and mechanical, and it seems that each manufacturer has his own unique (and complicated) way of accomplishing automatic reverse. There are, however, some general tips which we can pass along.

If your unit is the type which is actuated by a little arm which rides on the surface of the tape itself, and is actuated by increased tension at the end of the tape, then you should make certain that the arm moves freely back and forth. Also, make sure that the arm is sticking out far enough to make contact with the tape, depressing it slightly as the tape moves across it, and then moving back when the slack is taken up at the end of the side of tape.

From there, make sure that when the arm does move back, that the switch which it is connected to actuates the reversal mechanism. If it does not do this, check for loose wires at the switch, and trace the wires back to the solenoid which actually moves the mechanism. If power is reaching the solenoid, yet it refuses to work, check to make sure that the reverse mechanism is not jammed by moving it manually. If it moves freely, then replace the solenoid. The same goes for automatic eject units.

If your tape player is the type which is actuated by a cam and follower assembly, then there isn't much you can do, except to determine if the mechanism is being jammed, possibly by debris from an old tape. There are so many different types of mechanisms, that it is impossible to describe them all and suggest troubleshooting procedures. Use common sense. If the mechanism appears as so much spaghetti to you, then you're much better off letting a repair shop untangle the intricacies of it, rather than trying it yourself. You're more likely to do damage than good, and you'll end up with a king-sized repair bill and a headache as well. ■



POLAR DX

Go to the ends of the Earth without leaving home

by Harry Helms, Jr.

☐ THE POLAR REGIONS proved to be huge obstacles to early explorers, frustrating many expeditions. While the polar regions are no longer as difficult to get to, they are still frustrating many SWLs who tune for radio signals from the top and bottom of the world! Such places as Greenland, Antarctica, Iceland, and Alaska are missing from the logbooks of many SWLs, yet reception of such places is not impossible, even for the SWL with a simple receiver. Far more important than your receiving gear is patience, persistence, and even a bit of luck in bagging stations from the polar regions. And when you do hear these stations, almost all will QSL correct reception reports.

You can DX research stations throughout Antarctica, even the South Pole itself. The top photo shows Hallet Station, Antarctica.

The Forty-Ninth State. Alaska is one of the most difficult states for the SWL to hear, since it has no shortwave broadcast stations and is out of broadcast range for many DX'ers. Yet Alaska does have one widely heard station on shortwave: the aviation weather (VOLMET) station located at Anchorage airport. This station operates around the clock, broadcasting weather information to airplanes aloft. This station operates in the AM mode on 2980, 5519, 8903, and 13344 kHz. Broadcasts are scheduled to begin five minutes before the hour and half-hour. If you hear them, you can send your reports to Anchorage VOLMET, Station KIS70, Federal Aviation Administration, 2016 East 5th St., Anchorage, Alaska, 99501. Correct reports gets a QSL letter in return.

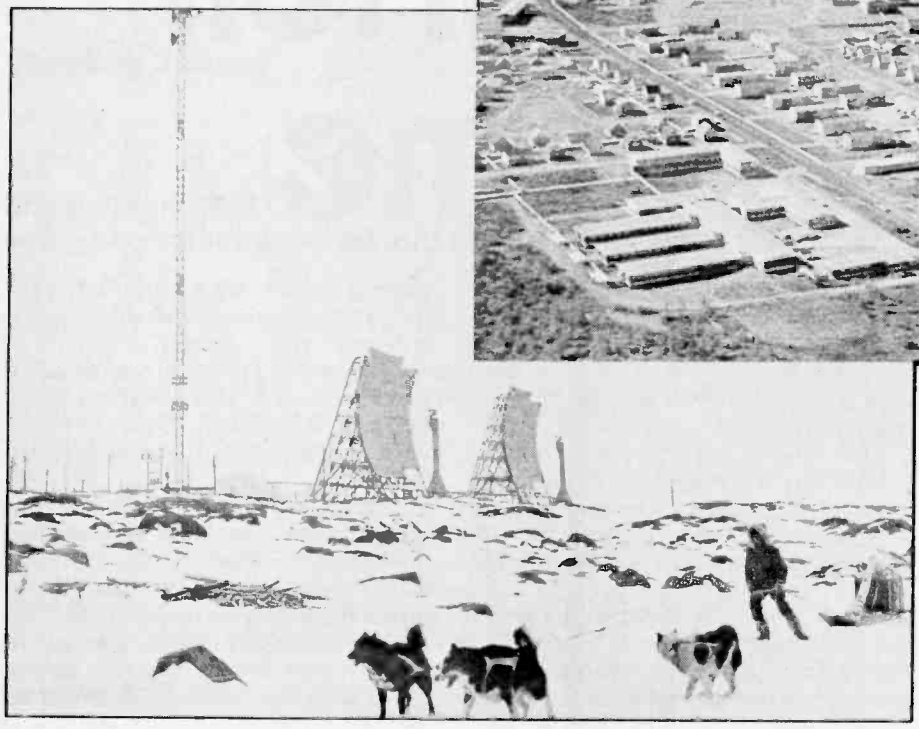
While tuning Alaska on the broadcast band (540-1600 kHz) is not easy, listeners in the Northwest may be able to hear Alaska this way. The best time to tune would be after midnight on Monday mornings, when interference is lowest on the broadcast band. One widely-heard Alaskan station is KYAK, 650 kHz, located in Anchorage. Another Alaskan is located "next door" on 660 kHz, where KFAR in Fairbanks operates. Perhaps the best Alaskan to try for outside the Northwest is KFQD, 750 kHz. It has been heard in the Midwest on those Monday mornings when station WSB in Atlanta is off the air.

Canada's Arctic. You won't find much shortwave broadcasting coming out of Canada's Yukon and Northwest Territories (NWT) but you will find some fascinating listening on the Canadian Broadcasting Corporation (CBC) Northern Service transmissions. These broadcasts are from the CBC's Sackville, New Brunswick facility are unlike any other in North America. Not only do they transmit in English and French, but also in Inuit (Eskimo) and Cree. The programming is great listening if you've never heard a native North American language spoken before. The Northern Service transmits seven days a week from 06:28 EST to 01:07 EST the following morning, on 6065, 6195, 9625 and 11720 kHz. Try the lower frequencies in the mornings and evenings. Send reception reports to the CBC Northern Service, P.O. Box 6000, Montreal, Quebec, Canada.

If you live in the north central U.S. or Canada you might go after some of the broadcast band stations listed elsewhere in this article. Some of these will be real DX challenges since the ionosphere in these northern regions is not always as "bouncy" as it is down south, and radio transmissions often go straight off into space.

The World's Largest Island. Greenland happens to be the largest island in the world. It's also a Danish territory and dwarfs its parent nation. While

The polar zones are lands of harsh winters, as shown in the photo of a Canadian Radar Station (Below), and short but warm summers as seen in this view of Inuvik (Right), a town just inland from the Arctic Ocean. Inuvik is the home of a number of radio and television stations that serve the region.



Greenland has a shortwave broadcast station, most DX'ers will find it far easier to log through the point-to-point station of the Grønlands Tekniske Organization. This station is used for overseas telephone service to and from Greenland. It tests its equipment with a continuously repeating tape, read in English and Danish by a female speaker, giving various facts about Greenland. This station has been reported recently on 14900 and 17672 kHz around 1700-2300 GMT. You can report to this station at P.O. Box 602, 3900 Godthaab, Greenland.

Radio Greenland, the island's shortwave broadcast station, is a challenging DX catch even for the experienced pro. Perhaps the best chances of hearing this station are from 2000-0200 GMT on 9575 kHz. Programming consists of much orchestral music with some pop, and the most commonly used language is Greenlandic. If you manage to hear them, you can send for their QSL card by writing Grønlands Radio, P.O. Box 607, 3900 Godthaab.

Iceland has no shortwave broadcast station listed in any of the well-known SWL references such as the *World Radio TV Handbook*. Thus, it may come as a shock to most DX'ers that Iceland indeed has a shortwave service! Like Greenland, Iceland has a point-to-point station for overseas telephone service. But from 1200-1300 GMT on 12175 kHz, this point-to-point outlet is used to relay programs to Icelandic fishermen at sea. Programming is entirely in Icelandic, featuring talk and music. If you should hear this one, address your reports to Rikisutvarpid, Icelandic State Broadcasting Service, P.O. Box 120, Reykjavik, Iceland.

Iceland can also be bagged via station TFA, a coastal station used for communication with ships at sea. This station runs at frequent intervals a "marker tape" in Morse code. This marker consists of VVV VVV VVV speed slow enough to allow it to be DE TFA TFA TFA, and is sent at a copied with the aid of a Morse code table if you don't know CW. If you succeed in hearing them, you can send a reception report to Reyujavik Radio—TFA, The Posts and Telegraph, P.O. Box 442, Communication Centre-Gufunes, Reykjavik, Iceland.

The International Continent. Antarctica holds the distinction of being an international continent, governed by international treaty agreements signed by several nations. It is also home to one of the most eagerly-sought shortwave broadcast stations in the world: the American Forces Antarctica Network (AFAN), operating on 6012 kHz with 1000 watts of power. This station is best heard in North America during the spring and summer months from around 0700 GMT to local sunrise at the listener's location. Programming is all English, most of it originating locally, and is transmitted from the Navy base at McMurdo Sound. If you're lucky enough to hear them, you can send your report to American Forces Antarctic Network, U.S. Navy "Operation Deep Freeze," Fleet Post Office, San Francisco, California, 96601.

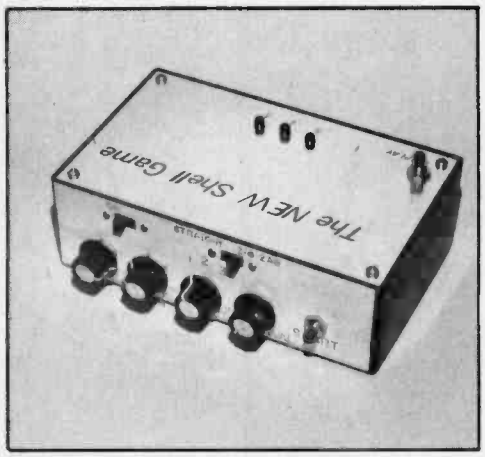
Easier to hear are the various sta-

(Continued on page 82)

BCB TARGETS IN THE CANADIAN ARCTIC

Location	Call	Freq.	Power
Whitehorse, Yukon	CFWH	570	1000 watts
	CKRW	610	1000 watts
Fort Simpson, NWT	CFMR	1490	50000 watts
Frobisher Bay, NWT	CFFB	1210	250 watts
Inuvik, NWT	CHAK	860	1000 watts
Tuktoyaktuk, NWT	CFCT	600	1000 watts
Yellowknife, NWT	CFYK	1340	1000 watts

The Canadian Broadcasting Company has many affiliated stations in the far north of Canada. These serve wide-spread populations of Inuits (eskimos) and northern indian tribes with broadcasts in the native languages, plus English and French.



the new Shell Game

James J. Barbarello

Step right up and build this semiconductor con game

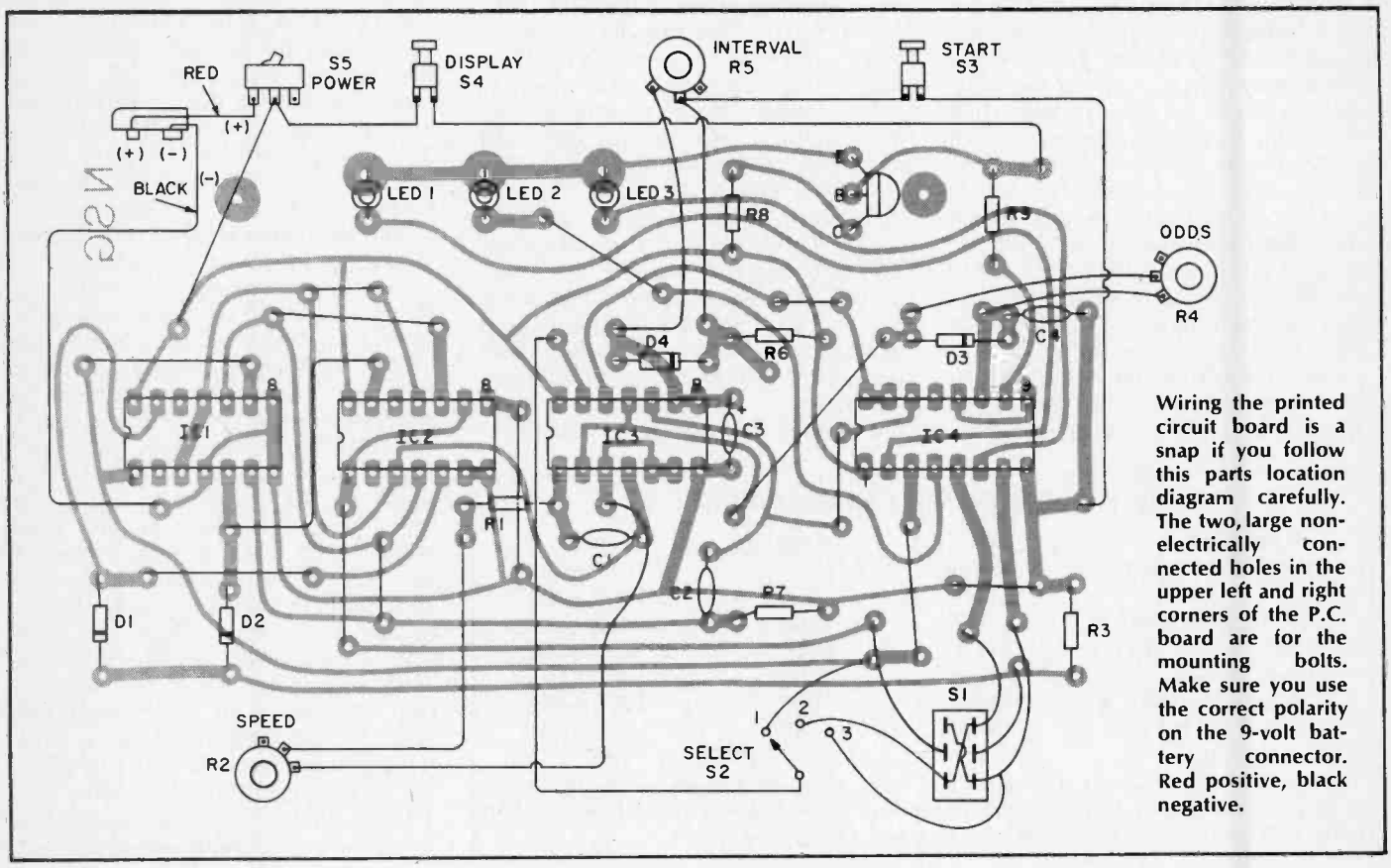
YOU WILL HAVE to be alert to win at *The New Shell Game*. In this electronic version of the famous carnival shell game, the electronic "pea" is manipulated in full view, rather than hidden under one of three walnut shells. As the game starts, the three light emitting diodes (LEDs) are dark. The operator presses the *start* button, a single LED lights and then moves back and forth in a straight or zig-zag pattern. After a time, the light goes out. The player's job is to follow the light's movement in an effort to determine which one was on last.

How fast the light moves, the total time of the manipulation, which light is on last, and for how long, are all controlled by the operator. The operator also selects either the straight or zig-zag sequencing pattern. The controls allow a full range of settings, from one that is fully obvious, to one that is totally misleading.

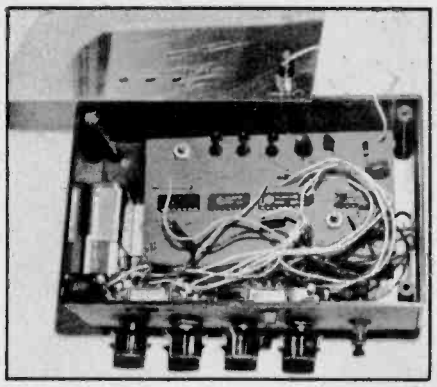
The skill of the player is pitted against that of the operator in this project that uses readily available CMOS devices, is powered by a single 9 volt battery, and can be built for about $20.00.

How it Works. As shown in the schematic diagram, flip-flops IC1 and IC2 form a four stage shift register. When *start* switch S3 is depressed, a logic "1" is loaded into IC1a through the *set* input, while all other stages are set to zero. As the shift register is clocked, the "1" bit continually circulates like a standard ring counter. Outputs 2 (IC1b), and 4 (IC2b) are combined in the discrete OR gate made up of D1, D2, and R3. The 1, 2 (or 4) and 3 outputs drive LEDs 1, 2, and 3 respectively.

NAND gate IC3 and associated components form a one-shot (monostable) multivibrator. When S3 is depressed, C3 discharges rapidly through D4, and drives the IC3c gate output high. When S3 is released, C3 charges through R5 and R6 with a time constant proportional to [C3 × (R5+R6)]. When the voltage across C3 reaches 4.5V (the CMOS logic level), the output of IC3c

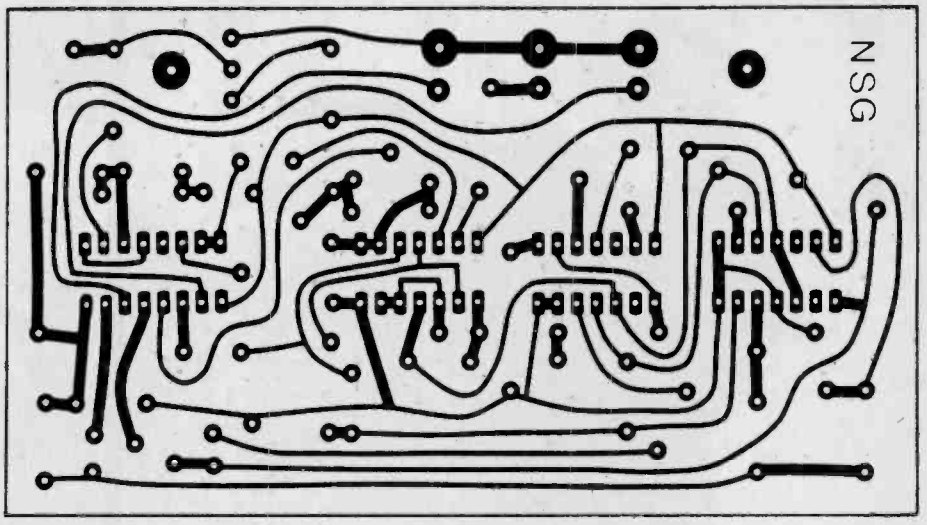


Wiring the printed circuit board is a snap if you follow this parts location diagram carefully. The two, large non-electrically connected holes in the upper left and right corners of the P.C. board are for the mounting bolts. Make sure you use the correct polarity on the 9-volt battery connector. Red positive, black negative.



The three LEDs must be carefully soldered to the PC board so that they will just fit through the holes in the project faceplate.

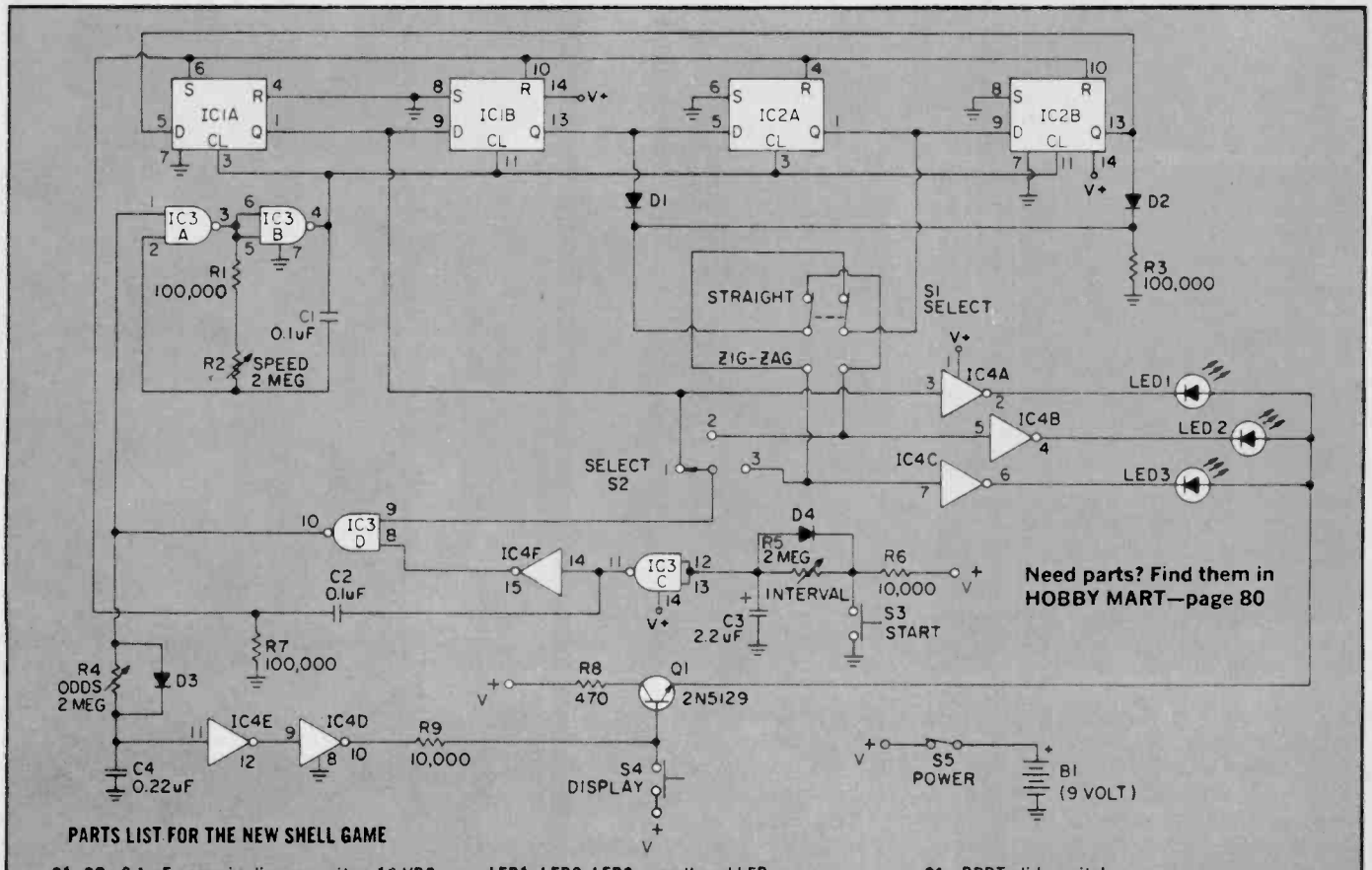
To the right is the full-sized printed circuit board template for New Shell Game.



returns to the low level. The positive portion of the IC3c output is differentiated by the C2, R7 combination which provides a *set* pulse to IC1a and a *reset* pulse to the other flip-flops. The output of IC3c is also inverted in IC4f and provided to IC3d. The other input to IC3d is one of the three shift register outputs routed through *select* switch S2. Thus, when S3 is depressed, the output of IC3d goes high, enabling the clock. The clock is simply an oscillator (made up of IC3a and B, R1, R2, and C1) which is controlled by the output of IC3d. Aside from turning on the clock, the output of IC3d also charges C4 through D3. When the voltage IC4d goes high, and turns on driver across C4 reaches 4.5V, the output of transistor Q1. This furnishes power to the LEDs, allowing them to light when driven by either IC4a, IC4b or IC4c.

At the end of the one-shot interval,

(Continued on page 83)



Need parts? Find them in HOBBY MART—page 80

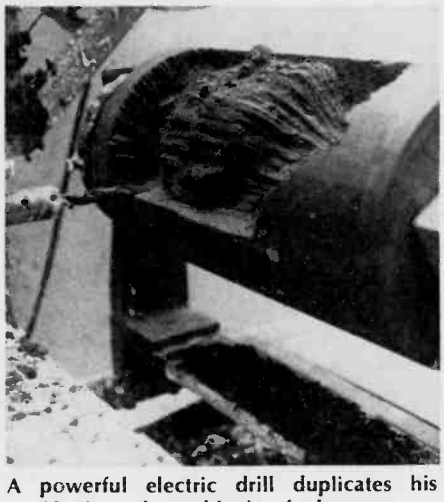
PARTS LIST FOR THE NEW SHELL GAME

C1, C2—0.1-uF ceramic disc capacitor, 10 VDC
C3—2.2-uF electrolytic capacitor, 10 VDC
C4—0.22-uF ceramic capacitor, 10 VDC
D1, D2, D3, D4—1N4148 or 1N914 diode
IC1, IC2—4013 dual flip-flop
IC3—4011 quad NAND gate
IC4—4049 hex inverter w/buffer
LED1, LED2, LED3—small, red LED
Q1—2N5129 transistor
R1, R3, R7—100,000-ohm, ¼-watt resistor
R2, R4, R5—2,000,000-ohm, linear-taper potentiometer
R6, R9—10,000-ohm, ¼-watt resistor
R8—470-ohm, ¼-watt resistor
S1—DPDT slide switch
S2—1-pole, 3-position rotary switch
S3, S4—SPST momentary-contact pushbutton switch
S5—SPST slide switch
Misc.—battery clip, mounting case, hookup wire, knobs, etc.

LIGHT BEAM SCULPTURES

Leg sculptor turns genius to busts

World famous pianist Liberace at a light beam sitting. It only takes five minutes.



A powerful electric drill duplicates his profile in a large block of chromastone.

The rough-hewn block is touched-up by a skilled artist to create a finished work.

□ Sculpture has always been a rather exclusive form of art—after all few could afford a sculptor's services for the amount of time necessary to produce a finished work. It takes a lot of time just to chip-off the old rock enough to get the basic outline of the head before the detailed sculpting could begin. Now, with the help of modern electronics much of the drudgery of sculpture is eliminated.

Mr. F. J. Pechman of St. Louis, Missouri, who is a manufacturer of artificial limbs, has adapted his invention of an artificial limb maker to making sculpture. The device can make a rough-hewn copy of someone's head.

This system is called a Light Beam Profiler and it scans the contour of the subject's head, one degree at a time. The contour is reproduced by an electronically controlled drill bit which follows the features of the subject while cutting into a block of chromastone. The whole process takes about five minutes—once completed an artist smooths out the rough edges to capture the unique qualities of the individual.

Bullock's a Los Angeles area department store has installed one of Pechman's Light Beam Profilers and the machine is in almost constant use. While still not all that cheap, at $750 for a glazed chromastone head and $2,000 for one in bronze, it is a lot less than would be charged by some professional sculptors. The prices vary according to the cost of the material used. ■

PITCH FIX

Salvage those old tape recordings with these low-cost tape-speed controllers

by Jorma Hyypia

IT SOUNDS CRAZY, but you actually need *cheap* tape recording equipment to perform these interesting variable tape speed sound experiments. If you pride yourself on owning only the very best hi-fi tape equipment, disguise yourself and sneak into the local thrift shop to look around for a cheapy portable recorder that is in operable condition.

The tape tricks discussed in this article evolved from attempts to salvage a collection of unlistenable tapes recorded during a cross-country family camping trip some fifteen years ago. The original reel-to-reel portable recorder used during the trip suffered from extreme tape speed instability; my then eight-year-old son sounded like a basso profundo while my spouse came through like a neurotic chipmunk. The objective was to re-record the tapes while compensating for the errors in tape speed in order to recapture more natural voices and sound effects.

In addition to salvaging old tapes, the methods described here can be used to perform many entertaining and educational experiments involving *continuously* variable tape speed. One example: use a microphone to record insect sounds like cricket chirps, then play back at slower speeds to hear the interesting sound patterns that human ears cannot decipher under normal conditions.

The Good Pitch. My old monaural tapes could be played back on our stereo deck by killing sound on one channel. But there seemed no way to vary the tape speed to compensate for the gosh awful sound except, perhaps, by building relatively complicated pulse- or frequency-varying circuitry to change the tape drive motor speed. As it turned out, there was a far simpler solution.

Unlike AC tape drive motors used in hi-fi equipment, the small DC motors in *some* inexpensive portable tape recorders can be controlled by means of voltage reduction. If you have a relatively good, portable recorder, it may have voltage regulating circuitry that will defeat what we are trying to do. What you need is an inexpensive recorder that does not have such regulation.

If the owner's manual that came with your recorder warns that weak batteries will affect tape speed, you are probably in business. There is a simple test you can make to be sure. Load the dry cells into the recorder and make sure the machine plays back the recorded tape in a normal fashion. Then remove only *one* dry cell and use a short piece of wire to bridge the break in the battery circuit. If the recorder plays back at a slower speed, as evidenced by pitch reduction in the sound, your recorder is right for the job. If there is no change in sound quality, your recorder has voltage regulation and is unsuitable for this application.

To provide tape speed control when the recorder is powered by batteries, you need only remove the batteries and form them into an external pack so that you can add a suitable rheostat in series for voltage control. You may have trouble finding a rheostat having a maximum resistance of only 20 to 30 ohms. But not to worry! Make a liquid rheostat by suspending two clean, large nails (spikes) in a tumbler of water in which about a quarter teaspoon of table salt has been dissolved. Connect one lead from the battery pack to a nail, the other to the appropriate recorder battery terminal (watch polarity!); use another lead to connect the second nail to the other battery terminal in the recorder. Now dunk the nails in the salt solution and control the recorder tape speed by simply varying the distance between the two nails.

If your recorder can also be operated off 110-volts AC, and you plan more

than casual experimentation, you can control the power input by means of a Variac or other suitable variable transformer. You can make your own control unit by mounting an ordinary light dimmer and duplex receptacle in a covered junction box as shown. Play it safe by using a three-conductor lead terminating in a grounding plug. You can use the dimmer unit to also control the intensity of table lamps, but don't try to slow down AC motors with it.

Make some preliminary tests to determine just how much you can slow down the tape speed while still getting enough juice through the circuitry to put a strong signal on the tape. Watch the take-up spool at very low speeds. If the take-up stalls while the capstan keeps pushing tape, you'll get a mess of tape wound around the capstan. It's no tragedy if you spot it soon enough; just disentangle the tape gently and manually roll it back into the cassette.

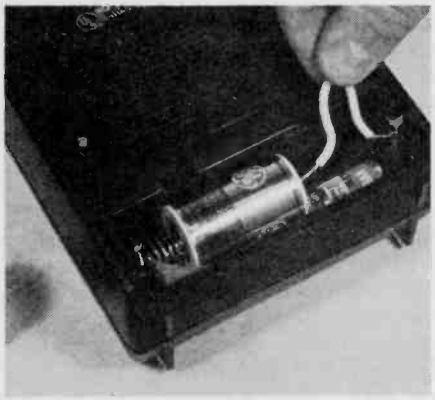
You can now play pre-recorded cassettes at slower than normal speeds. If you want speeded-up play, you must re-record the sound using the modified recorder set to run at less than normal tape speed, then play back at a faster tape speed.

Super Salvaging. If you have old tapes that exhibit off-pitch sounds, chances are that the original equipment had a too-slow tape speed because of weak batteries. Playing such tapes at normal speed raises the pitch to unnatural levels. Here's how to correct such tapes.

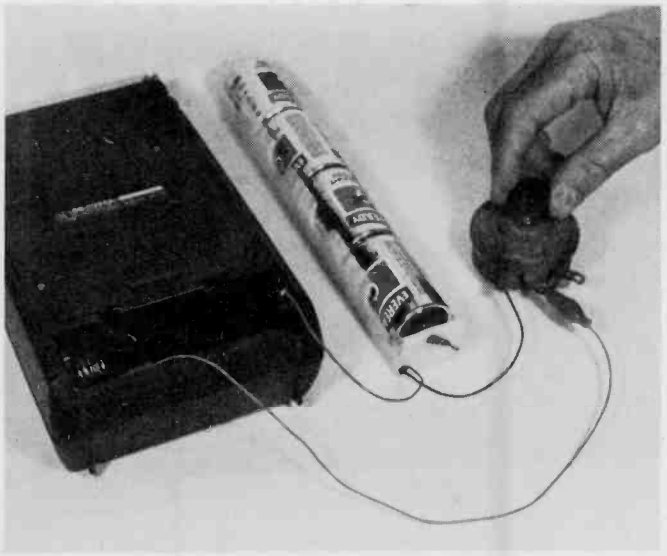
If the original material is on cassette tape, just play back with the speed-controlled machine while re-recording with a second tape deck operating at normal speed. You obviously need to monitor the playback signal to properly adjust the playback during the re-recording process.

If the original material is on open reel tapes (as in my case), you must first make an exact duplicate on cassette tape without attempting any corrections. Then play the cassette duplicate at slower speed while re-recording the output with another machine operating at normal speed.

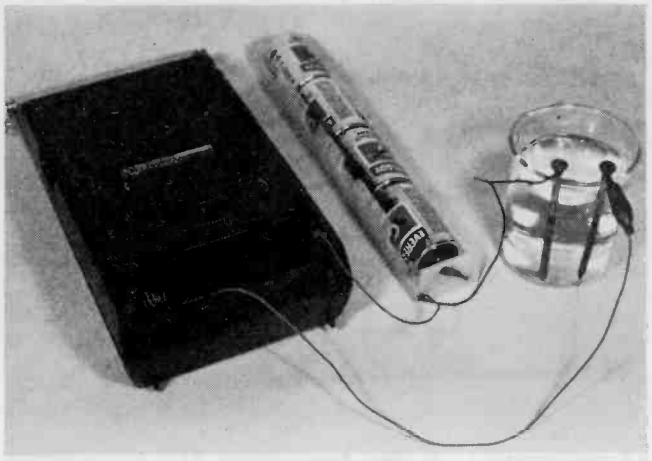
Here's one more tip to simplify the salvaging of tapes that exhibit off-pitch sounds only at intermittent intervals. When the sound is normal, operate both the playback and second tape recorder at normal speeds. When you notice that the pitch is changing, do *not* immediately stop the playback; instead, adjust the rheostat to obtain natural sound through your monitor speaker. Then back up both recorders to the point where the sound went sour and continue the transcription procedure using the adjusted tape speed until readjustment is once again required. ■



You need a recorder without an automatic voltage regulation circuit. Test for this by removing one of the dry cells and then bridging the gap with a piece of wire. If tape speed is slowed, you know you will be able to control the voltage by rheostat.



If you can find a rheostat with a maximum resistance 20 to 30-ohms, that will make a handy speed control for a recorder which is powered by dry cell type batteries.



If you can't find a rheostat, make a liquid one. Suspend two large nails in a salt solution. You will be able to change voltage by varying the distance between the two metal nails.

A light dimmer connected to a duplex receptacle, in a junction box, can be convenient voltage controller when the recorder is powered with 110-volt AC. Note grounding plug on three-conductor cord.

The Smart Power Supply

by Bob Powers

Keeps tabs automatically on current and voltage levels

When working with various electronic projects, it's easy to get carried away with too many current-eating components, which can overload a power supply. Our Smart Power Supply solves this problem with its built-in LED ammeter, which always tells you what the current draw is.

The supply delivers a regulated 5 and 8-volt output at up to 1-amp, and you'll never be in the dark as to how much current is being drawn. 4 LEDs display the amount of current being utilized by the load. Each LED lights respectively to show the level of current being drawn. For example, if ¾ of an amp (.75) is being used, the first three LEDs (".25", ".50", and ".75") will all glow to show that a current of at least ¾ of an amp is flowing. Best of all, the current measuring resistance is an unprecedented 0.1-ohm! What's more, the cost for the ammeter portion of the circuit is only about $5. That's way less than you'd pay for a good mechanical meter.

The 5-volt output is ideal for all of your TTL IC projects, while the 8-volt output may be selected for CMOS circuits, and other, higher-power requirements. The total cost for the whole supply, including the bargraph ammeter, is about $15-20, depending on your buying habits, and choice of parts suppliers.

How it Works. IC4 is supplied by an accurate reference voltage of 5-volts by IC3. IC4 is a quad op amp used in a quad comparator configuration.

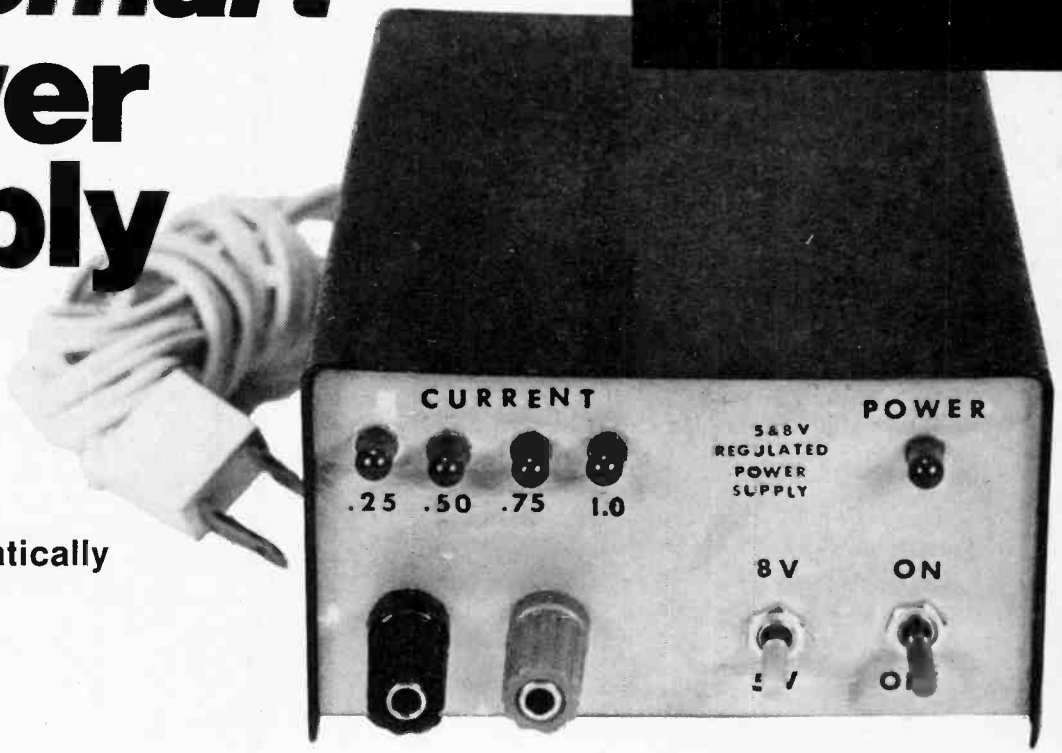
The 4 op amps (comparators) in IC4 are each fed a separate reference voltage by the divider network made up of R1-R4 and R5-R8. These comparators in IC 4 are very sensitive, and they can detect extremely small voltage differences and compare them.

Let's take the first op amp comparator as an example. Its inputs are pins 2 and 3, and its output is pin 1. The reference voltage appearing at pin 3 is compared to the voltage coming into the first comparator at pin 2. When ¼ of an amp or more is flowing thru R10, .025-volts or more (0.1-ohms times 0.25A = .025V) appears across R10, which is enough voltage to equal pin 3's reference voltage, thus turning on the first op am. The output of this op amp is at pin 1, so LED1 turns on to signify that at least ¼ of an amp is being drawn. In a like manner, the other LEDs turn on or off with the changing current. The rest of the circuitry makes up a basic voltage-regulated power supply.

Construction. All of the circuitry, except ICs 1 and 2, can be mounted on a small piece of perfboard. These two ICs must be mounted to the cabinet. In operation, IC1 and IC2 will get hot when the supply is run at higher currents, and they may shut down if the heat is not carried away. The back of the cabinet is the best place to mount ICs 1 and 2, for it allows a large heat dissipating area, while keeping the rest of the cabinet cool to the touch. When mounting ICs 1 and 2, smear heatsink grease between the IC cases and the cabinet, then bolt the ICs down tightly. Connect three long wires to IC1 and 2. These will be connected to the main circuit board later.

If the transformer that you wish to use has a center tap, cut it off or tuck it away. You won't need it. Bolt T1 down to the cabinet. Use heavy gauge (#16) wire for all line voltage connections, and carefully wrap all AC line connections with electrical tape. Use a

As you can see, our prototype was assembled on breadboard, with plenty of room for the components. The parts layout isn't critical.

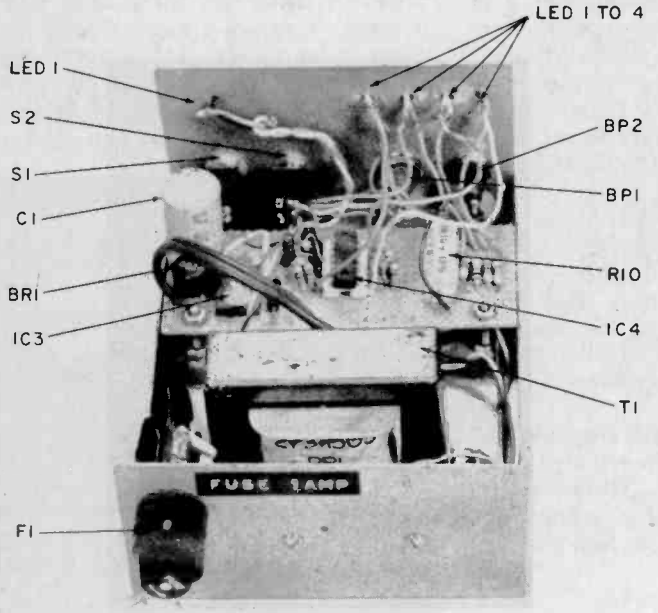


grommet around the line cord exit hole in the chassis to protect the cord from the heat that will be there due to ICs 1 and 2. Tie a knot in the line cord just inside the cabinet hole to prevent it from being pulled out.

IC3, unlike ICs 1 and 2, can be mounted on the perf-board because it will not get hot in operation. You should use a 14-pin socket for IC4. Install IC4 only after all of your wiring to the socket is complete.

Be careful not to make any solder "bridges" between socket pins, as they are close together. When you install IC 4 in its socket, make sure that you observe the correct orientation with regard to pin 1.

After you've installed the circuit board, attach the wires from ICs 1 and 2 to their proper places on the board. Connect the wires to the display LEDs last, and make sure that you observe polarity on each LED. Be careful not to let the LED leads short against the metal cabinet.



Again, parts layout is not critical in this power supply, but feel free to use our idea of where things should go. It's always a good general design idea to keep the power transformer as far away from the rest of the circuitry as cabinet size or practicality permits. Suspend the board above chassis.

Operation. Carefully inspect your wiring on the circuit board, especially the wiring to IC4's pins. This is a very important step, as one misplaced wire here can produce some real odd-ball systems. If everything appears to be in order, turn the unit on. The "power" LED (LED5) should glow.

Connect a voltmeter to the output jacks. Depending on what position switch S2 is in, the voltmeter will read 5 or 8 volts. Throwing S2 to its other position should cause the voltmeter to read the other of the two voltages that the supply delivers.

To test the ammeter section, connect a circuit to the output jacks. With the supply set for 5-volts, a TTL IC circuit would be good for this test.

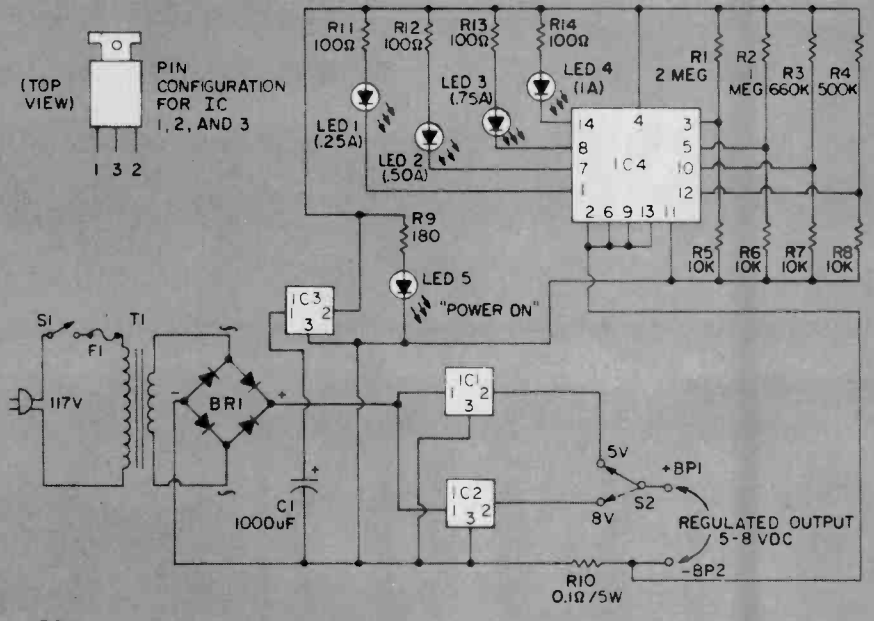
If the circuit that you hooked up draws more than ¼ amp, then one or more of the display LEDs will go on to show you how much current is being drawn.

Conclusion. You shouldn't worry about overloading the power supply, as fuse F1 will limit current draw to a peak of about 1.3-amps momentarily, before acting, and we deliberately overloaded several times in a row, with no damage occurring to the circuitry.

You might wish to attach a solderless breadboard to the top of the cabinet, to act as a permanently-powered breadboard for your experiments, or to construct an output voltage switcher for powering several projects alternately. ■

PARTS LIST FOR THE SMART POWER SUPPLY

BP1, BP2—5-way insulated binding post
BR1—bridge rectifier rated @ 50 PIV 2-Amperes
C1—1,000-μF, 24-VDC electrolytic capacitor
F1—3AG 1-Amp fuse
IC1,IC3—7805 linear voltage regulator
IC2—7808 linear voltage regulator
IC4—LM324N quad op amp
LED1 through LED5—large, red LED rated @ 20 mA.
R1—2,000,000-ohm, ¼-watt resistor
R2—1,000,000-ohm, ¼-watt resistor
R3—660,000-ohm, ¼-watt resistor
R4—500,000-ohm, ¼-watt resistor
R5, R6, R7, R8—10,000-ohm ¼-watt resistor
R9—180-ohm, ¼-watt resistor
R10—0.1-ohm, 5-watt resistor (Radio Shack #271-128)
R11, R12, R13, R14—100-ohm, ¼-watt resistor
S1—SPST switch
S2—SPDT switch
T1—transformer with primary rated @ 120-VAC/secondary @ 12.6-VAC, 2-Amperes



Need parts? Find them in HOBBY MART—page 80

e/e BASIC COURSE IN ELECTRICITY & ELECTRONICS

ELEMENTARY ELECTRONICS takes a look at the horizontal dipole—a simple, inexpensive, yet effective means of transmitting and receiving radio signals. If you can master dipole theory, then you will understand how almost all antennas work—the dipole is the basis for almost all types of modern antenna designs. Use this course to design your own dipole.

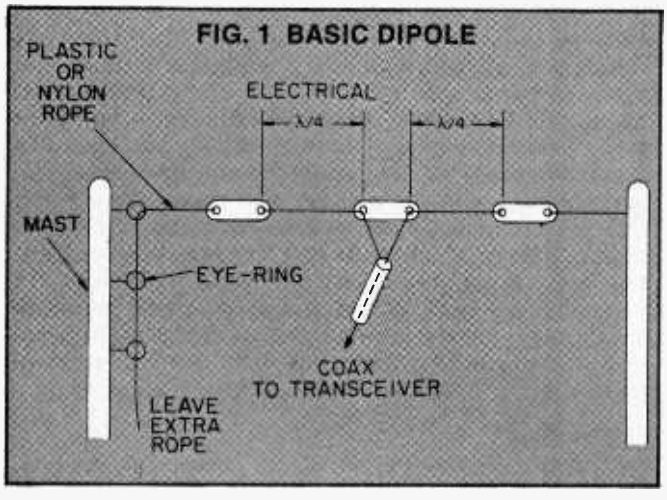
UNDERSTANDING DIPOLES

The most critical part of any radio transmitting installation is the antenna. It is the last element of control in transmission of signals, and the first element in reception. As a cost-saving device, the dipole provides an inexpensive, yet efficient antenna, and the knowledge needed to construct one serves as the basis for understanding all types of radio antennas, whether you build your own, or purchase a ready-made one.

WHAT IS A DIPOLE?

The horizontal dipole is a simple, effective antenna. Antenna wire and accessories for its construction are inexpensive and readily available. It is of a length that makes for efficient use as a receptor of an incoming radio waves. When used as a transmitting antenna, it radiates efficiently and, at the same time, displays a proper impedance to the output of the transmitter.

FIG. 1 BASIC DIPOLE



DIPOLE LENGTH

The **physical length** of the antenna is **related** to the **wavelength** of the signal frequency to be received or transmitted. Frequency in megaHertz, and wavelength in meters are related as follows:

Wavelength in Meters = 300/Frequency in mHz. For example, the wavelength of a 3.75 mHz signal frequency would be:

$$\text{Wavelength} = \frac{300}{3.75} = 80 \text{ meters}$$

A dipole is a **half-wavelength** antenna and, therefore, its theoretical length would be one-half of this value, or 40-meters long. In practice, however, there are capacitive end-effects which cause a dipole that is cut to exactly the so-called "free-space" wavelength to be resonant on a lower frequency than the calculated value. In fact, to make the antenna an **exact** "electrical" half-wavelength long, it is necessary to shorten the physical length by **5-percent.** Hence the dipole length for 3.75 mHz resonance would be:

$$\text{Dipole Half-Wavelength} = 0.95 \times 40 = 38\text{-meters}$$

Since the dipole antenna is fed at the center and separated into two quarter-wavelength segments, as shown in Fig. 1, each side of the antenna would be 19 (38/2) meters long.

Physical antenna length for each quarter-wave segment of the dipole can be obtained by multiplying the 19 meters times the meters-to-feet conversion constant of 3.2808, obtaining a value of 62.34 feet.

A conversion from metric to linear length results in a very simple equation that can be used to determine the length of the quarter-wavelength segment of a dipole:

$$\text{Length in Feet} = \frac{234}{f(\text{mHz})}$$

A hand calculator is an aid if you wish to make your own antenna calculations.

QUESTIONS

Q1. What factor accounts for the 5% difference between the theoretical length and the electrical length of a dipole?

Q2. Compute the length of a dipole which will be resonant at 3.9 mHz.

Q3. Compute the length of a dipole which will be resonant at 7.225 mHz.

Q4. Compute the length of a dipole which will be resonant at 29.6 mHz.

Q5. Compute the length of a dipole which will be resonant at 14.325 mHz.

ANSWERS

A1. **Capacitive end-effects,** which are created by proximity to other objects in the immediate area such as support masts, etc.

A2. **120**-feet

A3. **64.78**-feet

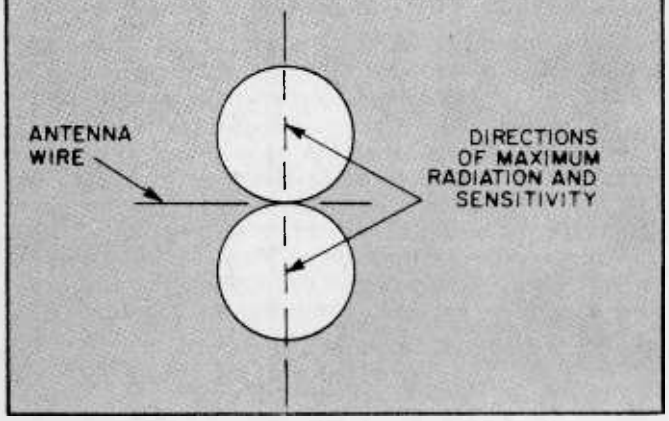
A4. **15.82**-feet

A5. **32.66**-feet

DIPOLE DIRECTIVITY

The horizontal dipole is **directional.** As a transmitting antenna, it sends out maximum radio energy (radiation) in the two directions broadside (**perpendicular**) to the antenna wires (Fig. 2). As a receiving antenna, it displays maximum sensitivity to radio signals arriving from the **same** two directions. Radiation and sensitivity taper off at angles away from the perpendicular, declining to a minimum in the direction along the line (parallel) of the antenna wire. The response pattern of Fig. 2 is a theoretical one. The antenna **does** radiate energy at other angles and is sensitive to incoming signals as well. The extent of the differential depends upon a number of variables including type of antenna, proximity of ground, nearby metallic structures, propagation conditions, transmission line system, etc. It is a fact though, that **maximum** radiation and sensitivity occur perpendicular to the antenna wire and minimum in the direction of the antenna wire. The figure-eight pattern is itself rather broad, and it is only at angles near to the angle of the antenna wire that the response is sharply down.

FIG. 2 RADIATION PATTERN



DIPOLE ANTENNA COMPONENTS

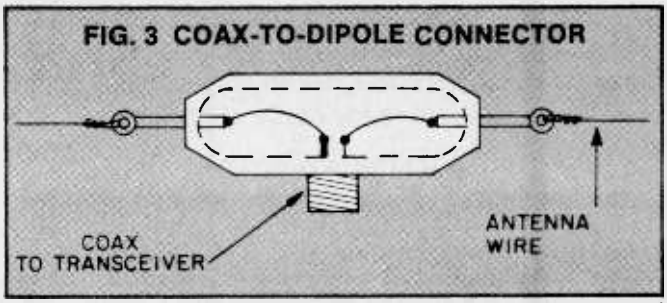
Essential components of the dipole antenna are: antenna wire, dipole center connector, end insulators, support rope, transmission line, and other accessories as needed. The antenna wire can be the popular 7-strand, #22 type, which is common and inexpensive. When it can be found at low cost, our personal preference is for #14 or #16 solid, insulated wire. A good-quality, insulated wire gives you added safety and weather protection. Insulation in **no way interferes** with the radiation or pick-up of signal.

Available end insulators are usually made of porcelain and are 1.75 to 3-inches long. They are oval-shaped or rectangular, some having a ribbed construction. Two holes are provided, one for the antenna wire itself and the other for the support line. Support line can be nylon rope or strong plastic clothes-line with a nonmetallic core. To make it easy to lower the antenna, for cleaning or experimentation, the support line at one end can be fed down through eye-bolts to ground level, as shown in Fig. 1.

A **coax-to-dipole connector,** Fig. 3, is the **ideal** method of linking the dipole antenna to the coaxial transmission line. This connector provides a durable and reasonably weather-proofed connection, providing for convenient connection and detachment of transmission line. An alternative plan is to use an end insulator at the center. The two conductors of the transmission line can be attached firmly, soldered and taped to the antenna wire on each side of the center insulator.

Use good quality coaxial line, either 50-ohm or 70-ohm. Preferred types are RG-58A/U (50 ohms) or RG-59A/U (70 ohms) for low power applications. RG-8A/U is recommended for higher-powered applications, and installations where a long feed line, from antenna to transmitter, is necessary.

FIG. 3 COAX-TO-DIPOLE CONNECTOR



ERECTION OF DIPOLE

Plan your installation according to length, height, and directional orientation. You **must** consider the space required by the antenna, and where the line must be brought into the house.

Safety and **performance** are **important** criteria. For safety reasons, keep the antenna clear of power lines. Be certain that if the antenna falls when erected, or while under erection, it cannot fall across electrical wires. Make certain that **under no circumstances,** can mast or wire come in contact with power lines if you lose control of the mast or antenna. Keeping clear of power lines also improves the antenna performance. You will pick up less power line noise on receive. On transmit, you will radiate the least signal into the power lines, minimizing loss and possible interference with home entertainment units such as television receivers and high-fidelity amplifiers.

QUESTIONS

Q6. Along what axis is the dipole antenna most sensitive to incoming signals?

Q7. True or False—Using insulated wire for the dipole elements is not recommended because the insulation creates capacitive effects which can raise the effective SWR.

Q8. True or False—Placing a dipole antenna close to and parallel to power transmission lines aids the

antenna in transmitting and receiving because the lines act as additional antenna elements.

ANSWERS

A6. The axis **perpendicular** to the line of the antenna wire.

A7. **False**—Insulated wire has little or no effect at all.

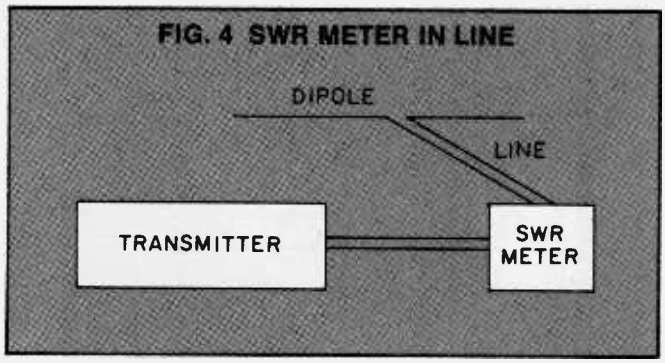
A8. **False**—It can adversely affect the SWR, and may introduce power line noise and hum into the receiver.

TUNING WITH AN SWR METER

An SWR meter connected between transmitter and transmission line, Fig. 4, can be used to measure the **resonant** frequency of a dipole. To go a step further, the antenna can now be trimmed or extended if it does not resonate to the desired frequency. The results can be observed on the SWR meter, as the antenna resonant frequency is moved up or down the band. Since it is **easier** to trim off rather than to add on wire length, cut the initial antenna wire longer than specified value for the particular frequency, in order to catch up with any variables that might influence resonance. A practical example will demonstrate an acceptable procedure.

Assume an antenna is to be cut for 7150 kHz in the 40 Meter Amateur band. This suggests a dipole length of 32-feet, 9-inches. Cut **each** dipole element to 33-feet, which would be for a resonant frequency of 7100 kHz. Erect the antenna on a temporary basis.

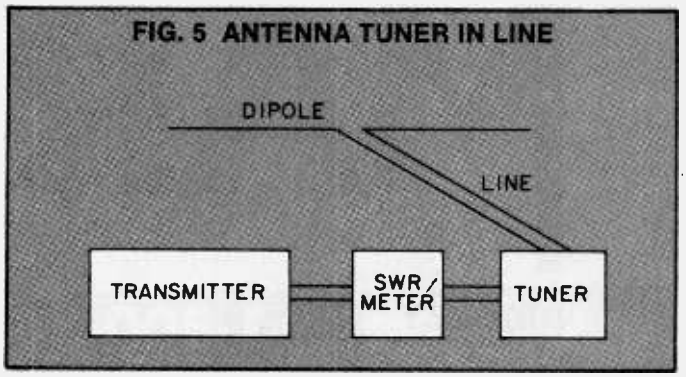
Measure the SWR every 25 kHz between 7025 and 7225. Set the readings down in a table form of frequency vs. SWR. Determine the precise frequency at which the SWR reading is minimum. This would be the resonant frequency. Then, trim accordingly.



ANTENNA TUNERS AT WORK

The **primary** function of an antenna tuner, Fig. 5, is to provide a proper match between your antenna system and transmitter. In so doing, your transmitter sees a proper load and is able to operate at the optimum conditions of its design. The tuner **does not** alter the performance of the antenna or the SWR on its transmission line. Rather, it makes certain that an improper SWR does not result in unfavorable operation or possible damage to your transmitter.

A tuner makes the dimensioning of a horizontal dipole antenna less critical. It extends the range of operation of the antenna that will provide an ideal match to the transmitter. For example, an 80 Meter dipole cut to 3750 kHz, will be made operable over the entire 80 Meter band from 3500-4000 kHz. The electrical performance of the antenna will not differ greatly from an antenna cut precisely to some specific frequency on the band. Even though the SWR on the transmission line might be rather high at the band extremes, the transmitter itself will look into an optimum load.



QUESTIONS

Q9. **What function is served by an SWR meter?**

Q10. **Where in the transmission line should an antenna tuner be placed?**

Q11. **True or False—An antenna tuner will correct the SWR of an improperly cut antenna, as far as the transmitter is concerned.**

ANSWERS

A9. The SWR meter tells you what **percentage** of transmitter power is being **sent out** of the antenna, and what percentage is being **reflected back** to the transmitter.

A10. An antenna tuner should be placed **between** the **antenna** and the **SWR meter,** so that it can be adjusted to show **minimum** SWR to the transmitter's output stage.

A11. **True.** However, the SWR in the transmission line will remain **unchanged,** and the antenna will not be as efficient as one which is dimensioned **correctly.**

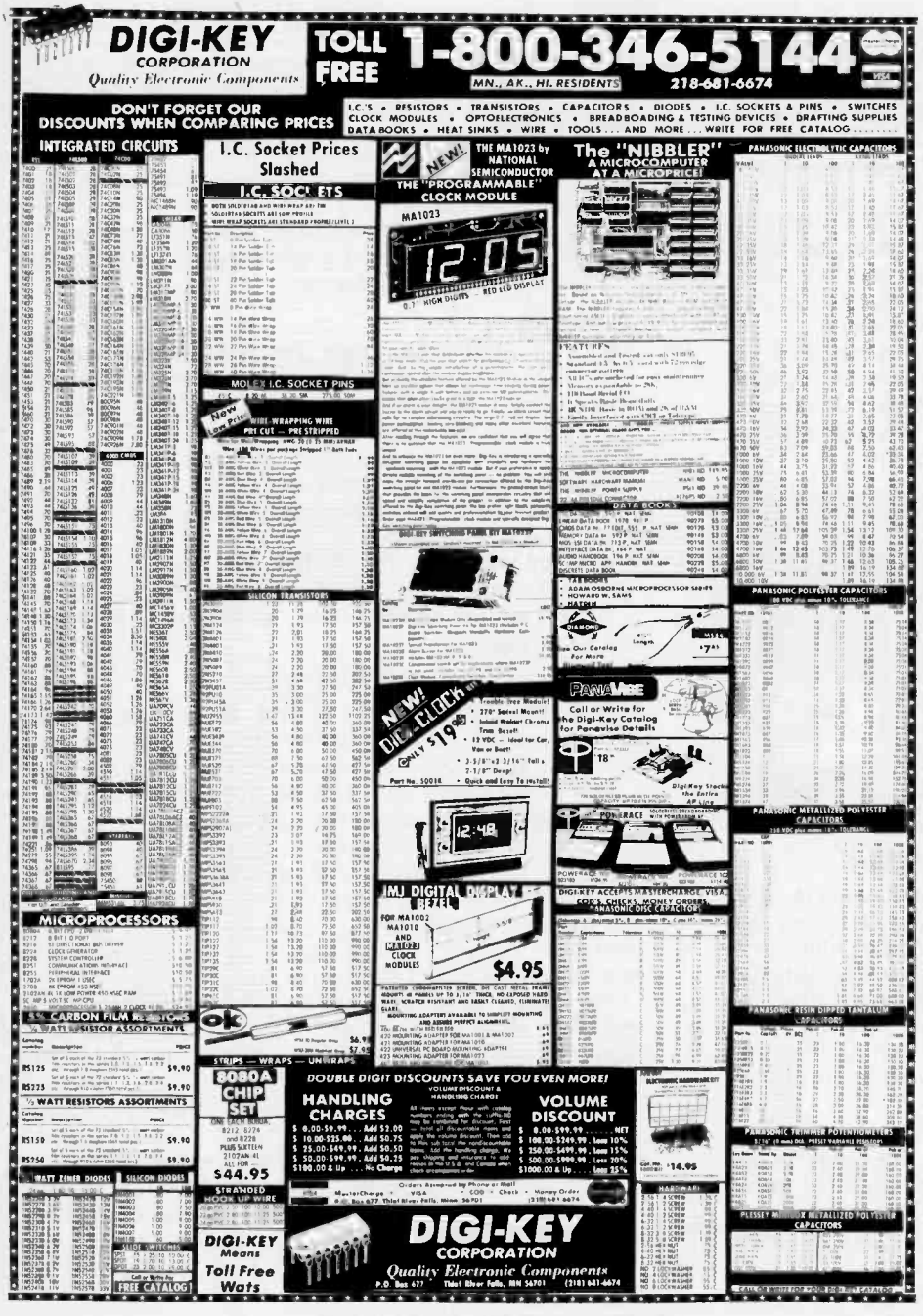
CONCLUSION

The horizontal dipole, as we mentioned earlier, forms the basis for most of the other modern types of antennae. If you were to examine the driven element of a **beam,** you would find it to be nothing more than a **simple dipole** with adjustable tuning tips at both ends. It is even posssible to make a three or four-element beam by **paralleling** several **dipoles** with fractional wavelength spaces between them. Of course, if you are not in the position to "grow" your own antenna farm due to space limitations, a single dipole's performance is not to be laughed at.

The dipole itself can take on other physical configurations, such as a "vee;" an "inverted vee;" a "sloper;" or even a "vertical" dipole. In upcoming issues of ELEMENTARY ELECTRONICS, we plan to discuss these other configurations in detail, so keep your eyes peeled.

The horizontal dipole is indeed a versatile antenna, giving good performance at low cost. It should be dimensioned properly, and should be used with an SWR meter to evaluate its performance. ■

ELEMENTARY ELECTRONICS HOBBY MART



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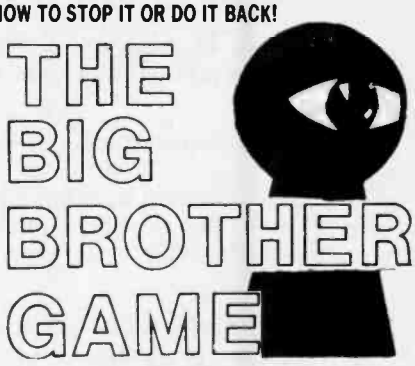

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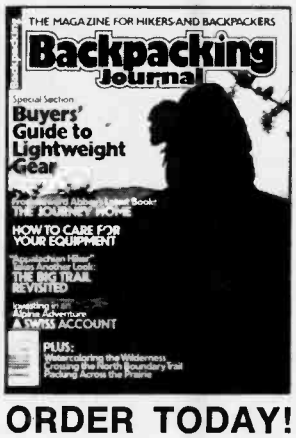

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250	25	.32	.33
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Polar DX

(Continued from page 69)

tions used for communications between the various bases in the Antarctic. One of the most commonly used frequencies for these stations is 8997 kHz. Transmissions are in single sideband (SSB) and are most often heard between 0600-0800 GMT. Among the most commonly heard are NBY at Byrd Station, NQU at Siple Station, NPX at the U.S. Navy's South Pole Station, and NZCM, the Antarctic communications center located at McMurdo Sound. If you hear any of these stations, you can report to them in care of Antarctic Support Activity, FPO New York, New York 09501.

Australia also operates several bases in Antarctica which are linked by radio. The most commonly reported frequency is 15845 kHz, usually around 0300 GMT. Among the stations that can be heard are VNJ at Casey Base and VLW at Mawson Base. If you hear either of these stations you can report them to the Australian Overseas Telecommunications Commission, GPO 32-36 Martin Place, Sydney Australia.

A final way to catch Antarctica is via station NΦICE, a military affiliate radio service (MARS) station which operates near various amateur radio bands. This station primarily runs phone patches from military personnel in Antarctica to their families in the United States. A commonly reported frequency is 13997 kHz, using the upper sideband (USB) mode. You can report reception to MARS Radio Station NΦICE, Antarctic Support Activity, FPO New York, New York, 09501.

None of the stations discussed so far can be termed "easy." Yet all have been heard throughout North America on simple equipment. Patience and determination are more important in tuning the polar regions ■

Crystal Detectors

(Continued from page 62)

not use a variable capacitor for tuning. You make the taps while winding the coil, by twisting the wire, at the proper turn, to form a small loop of about ¼ to ½-inch in diameter. Wind your coil so that connections can be made to the wire at each end of the coil.

Now, use a little cement on the coil around each tap to strengthen it. When the cement is dry, use fine sand paper to clean away the insulation, so a bare copper loop will be exposed. Fasten your coil form to the board with cement, or with thumb tacks thru the bottom of the box. Connect the wire at the bottom of the coil to the ground lead that runs between the cat whisker and the ground terminal on the board.

Next, prepare two short lengths of wire (about 10-inches long). Solder one end of one wire to the antenna terminal and solder a small alligator clip to the other end. Take the other piece of wire and solder it to the headphone terminal, and then solder the other alligator clip to the other end of this wire.

Operation. Now your set is finished and the fun begins. Connect an antenna and ground to the terminals, and connect your headphones to the other two terminals. You will use the two small alligator clips to tune your set. Clip the one from the headphone terminal to a tap near the upper end of the coil, and the one from the antenna terminal to a tap near the lower end of the coil. Move the end of the cat whisker over the galena crystal until you find a sensitive spot where you can hear a station. Now move the alligator clips up and down the coil to get maximum volume. You will be surprised at the clarity and tone of the signal. You see, a crystal detector doesn't amplify, so it doesn't distort the signal. This is hi-fi sound in its purest form.

This is truly a basic crystal set. It has but one tuned circuit, therefore it is *not* selective. In fact, if you live near several strong broadcast stations, you may hear more than one signal at a time. While not intended to be the centerpiece of your home's sound system, you have learned, by building it, crystal theory and some of the history of radio development during the early part of the century.

As you listen to your crystal receiver, you will get a feeling of satisfaction akin to the thrill the experimenter of the early 1920's got when he built his first crystal set. ■

Antique Radio Corner

(Continued from page 56)

play along with your old radios. Meters of this type are fairly easy to find in flea markets, junk shops, garage sales, and antique shows. I have about 15 different kinds of nickle-plated brass meters, both voltmeters and ammeters that I purchased for 50-cents to $3.00 each. If you haven't started to collect meters of this type, I recommend that you start looking for them. They were most popular from 1920 to 1928.

That's all for now. We'll be back next time with more information for antique radio and wireless collectors. If you have any problems with old radio equipment, just drop me a line in care of Elementary Electronics magazine and I'll do my best to help you out. ■

Octavizer

(Continued from page 34)

force, you can play in different octaves.

When viewed on an oscilloscope, the output signal changes shape as shown in the diagram when the *blend* control is rotated. As you can see, at midsetting of the *blend* control, a step approximation to a ramp wave is generated. This signal can be filtered to produce a realistic reed-type sound.

A standard foot switch can be used for the *cancel* control. If not available, one can be made using a push on-push off SPST switch and a length of audio cord.

As you familiarize yourself with this new tool, you will find it an interesting and useful special effects device. ■

New Shell Game

(Continued from page 71)

the output of IC4f goes high. IC3d, however, will not go low and turn off the clock until *both* it's inputs are high. When the output selected by S2 goes high, IC3d goes low and stops the clock. C4 discharges through R4 into the near ground potential of the IC3d output with a time constant set by the value of R4. When the voltage across C4 decays to 4.5V, IC4d goes low, which turns off Q1 and removes power from the LEDs.

Switch S1 reverses the stage 2 and 3 connections to provide either a straight (1-2-3-2) or zig-zag (1-3-2-3) lighting sequence. Depressing S4 forward-biases Q1, allowing display of the static contents of the shift register.

With values as specified, the *interval* time can be as long as 3 seconds, the last LED on-time of up to 0.3 seconds, and the clock speed can be varied from 1 Hz to about 40 Hz. Power, which is applied through switch S5, is supplied by a single 9 volt battery.

Construction. While any standard means of construction, such as perf-

(Continued on page 86)

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New Shell Game

(Continued from page 83)

board or wire wrap, may be used, a PC board is recommended. Solder all components onto the PC board, using as little heat as is required to make a good solder joint. Observe the indicated polarity for all diodes, C3, and the ICs. Be careful when handling the CMOS ICs to prevent static damage. IC sockets may be used if desired. You can use the excess component leads to form the fourteen jumpers identified by "J" in the component layout diagram. After the PC board has been completed, interconnect the controls and switches to it as indicated. Any standard case may be used to house the project. The only restrictions are that the LEDs should be visible to both player and operator, display switch S4 accessible to the player, and all remaining controls visible only to the operator.

Use. A general description of the operation procedure is as follows:

1. Set *select* switch S2 to position 1, 2 or 3.
2. Set S1 to *zig-zag* or *straight.*
3. Adjust *speed* control R2, *odds* control R4, and *interval* control R5 as desired.
4. Press *start* switch S3. As soon as S3 is depressed, the LEDs will sequence, starting with LED1, in the pattern and at the speed selected. The sequence will continue for the interval chosen, whereupon the LED selected will remain on for the time chosen by the setting of the *odds* control.

Initially, the operator should set a slow speed, medium interval and high odds. As the player becomes more confident, the control settings should be changed in an effort to fool the player. The controls can be set so that the last LED to illuminate does not appear to come on at all. With the *odds* control set to minimum, the *speed* and *interval* controls can be set so that the on-time of the last LED will be so short that (in a normally lighted room) it will not be seen. The proper settings will cause the interval to end during the low portion of the clock signal. Since this cannot be determined without monitoring the internal signals, the operator must develop a "feel" for the controls to obtain the desired effect. This effect should be used sparingly lest the player catch on. Although the game should not be used for gambling, non-monetary betting (with poker chips or the like) can make the game more entertaining. It is advisable to turn the unit off when not in use, to conserve battery life. ■

Bizarre DX

(Continued from page 36)

as Radio Americas) had all closed down while man first circled the Moon in Apollo 8. Many avid shortwave listeners monitored the event not just on TV but via the Voice of America as well, and those SWL's who were also stamp collectors picked up Apollo 8 first day covers such as the one shown in this article. But even here, as we subsequently learned from some quasi-confidential documents, weird things were happening behind the broadcast scenes. These involved the VOA relay at Wooferton, England which is operated by the BBC.

A statement from the Voice of America dated Feb. 24, 1969, concerning the all night operations which began at Midnight GMT Dec. 24, 1968, reads as follows . . . "Because of the tremendous world interest in this first manned flight to the Moon, it was decided in early December that the VOA would cover the flight at various stages throughout the entire night." In other words, the decision for all out coverage of the lunar mission was made well in advance.

However, in an interoffice BBC memo dated Dec. 23, 1968—after the Apollo 8 blastoff on Dec. 21—to supervisory personnel at their international transmitter sites (including Wooferton), reference is made only to "minor" changes in station schedules to cover "important aspects of the Apollo flight mission" while in fact a later BBC memo acknowledges that "numerous" alterations in schedules indeed were made to cover "all phases of the Apollo 8 moon shot."

It's clear from these documents that Washnigton kept its plans for all out coverage from the BBC staff until reasonably sure of the mission's success. While such caution might have been justified from a public relations point of view, advance knowledge of the resulting schedule alterations would have made everyone's job a little easier.

Voice of America transmissions are still easily logged from BBC's Wooferton site, if you know where and when to listen. Try 7200 kHz at 2200 EST sign-on and 7205 kHz at 1730 EST sign-off. There used to be a BBC ID at sign-on and sign-off, and in fact Wooferton was the last VOA transmitter site which gave any clue to its location on the air but now even these announcements have been dropped. Send your reception report to the Voice of America, Washington, D.C. 20547, but be sure to ask them to specify the transmitter site on their QSL card.

The Two Koreas. If DX'ers have trouble getting the VOA to specify transmitter sites, the problem is minimal compared with the situations encountered when attempting to verify Korean stations. Radio Pyongyang in the North regularly verifies reception of its international services for SWL's in every part of the world except the U.S. Their respones to American QSL requests is very unpredictable. If you have a friend in Canada, and your own address doesn't work, try setting up your own courier service when reporting Pyongyang's North American beam at 0600 and 1800 EST on 11535 kHz. However when it comes to home service transmissions, Pyongyang will not QSL for anyone. This means that all their really interesting DX frequencies (655, 2850 kHz, etc.) are unverifiable.

The QSL situation with Seoul's Radio Korea is just the opposite but every bit as bizarre. In 1977, rumors were circulating that Radio Korea was still relaying the quasi-clandestine transmissions of Radio Free Russia (which at one time were also aired by Radio Caribe). In order to check this out we queried an organization called the Korean Short Wave Listeners Association (obviously an arm of the South Korean government). In response we received four propaganda booklets, a KSWLA pennant, a fully filled in and endorsed membership certificate in the KSWLA (even though we did not apply for membership), and, most amazing of all, a signed QSL card. (Amazing because we hadn't even reported reception!)

The reader can readily judge for himself how much that sort of QSL is worth but for those who would rather hear Radio Korea before "verifying" it, try 9525 kHz at 0500 EST. Oh yes, they never did answer our question about Radio Free Russia. ■

Kathi's CB Carousel

(Continued from page 63)

would indicate 29.9651. To avoid any possible confusion, a large LED channel indicator (1 through 40) is also provided. Since the counter indicates the receiver frequency independently of the transmitter, you get an accurate picture of any tuning adjustments made by the clarifiers. For example, if the station you are working is drifting upwards, you would see the frequency readout change, for example, from 29.9651 to 29.9663, as you used the clarifiers to keep the station tuned in.

(Continued on page 88)

LITERATURE LIBRARY

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

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

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

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

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

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

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

387. *Technical Electronics Corp.* has interesting kit and wired products, and parts for projects. Get on their mailing list.

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

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

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

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

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

381. *Fordham Radio's* handy catalog covers test instruments, tools, parts, home and car audio products, scanners and lots more. Get your free copy today!

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

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

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

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

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

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

302. Big catalogs are coming back. *Burstein-Applebee* will send you theirs. It's a parts bonanza every experimenter would want to see. Latest catalog is over 200 pages.

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

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

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

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

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

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

308. Your guide to equipment for radio communication is an informative product booklet offered by *R. L. Drake Co.* Hams and SWLers alike should scan this 20-page shopper's guide.

310. New and used personal computer machines, and peripherals you never dreamed existed, or were available are in the *Newman Computer Exchange* catalog. Get yours today.

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

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

314. Cover the Ham bands from 80 to 10-meters with one classy rig—*Swan Electronics'* 100-W 100 MX mobile transceiver. Get the details direct from *Swan*.

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

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

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

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

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

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

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

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

356. Now you can get the "Break-through Book" with its 105 innovations in breadboarding and testing. *Continental Specialties*. The break-through is twofold—products and price!

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

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

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

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

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

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

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.

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

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Kathi's CB Carousel

(Continued from page 86)

The instant you transmitted, of course, the display would indicate your transmit frequency.

Performance. Operating performance is as good as the rig's looks. The transmitter put out exactly 4-watts AM and 11 watts PEP for SSB. Modulation was limited to 100% using *umax* type limiting, meaning the signal is not clipped and distorted, but is compressed so as to retain the modulating waveform. This results in particularly clean modulation, even if you have the mike gain wide open and are shouting into the mike. Best results are attained, in terms of reducing background noise pickup, by cranking up the microphone gain just enough to peak the modulation meter at close to 100%. I would not suggest running the mike gain full open under any circumstances.

The receiver had a worst-case (AM) sensitivity of 0.5 uV, with 70 dB of razor-sharp adjacent channel rejection. Even more importantly, the SSB opposite sideband rejection was better than 60 dB, and I could actually work a station on the lower sideband while two other stations were working on the upper sideband. I don't know about them, but I wasn't getting any interference from their signals—the 2000GTL really slices off the interference. AGC action for an input range of 2 to 10,000 uV was 9 dB.

Conclusion. Overall, the Cobra 2000-GTL ranks as one of the very best superbase stations I have ever used or seen. If you're looking for top quality and performance in a superbase this is it.

For additional information on the Cobra 2000GTL, circle No. 44 on the reader's service coupon. ■

DX Central

(Continued from page 22)

the Frog-Seven—several years ago, has also introduced a big brother with electronic digital readout. It is the FRG-7000 model. And SONY has its digital entry, the ICF-6700, with a LED-type numerical frequency display.

Released through the more than 5,000 Radio Shack stores early in 1979 was the first Realistic receiver to feature electronic digital readout. It is called the DX-300, and if it has anywhere near the consumer acceptance of Radio Shack's longtime SW favorite, sans digital readout but still available in the stores, the DX-160, it will do well, indeed.

If you've found traditional receivers a pain because of the time and effort involved in determining (often just guessing) at accurate frequencies, maybe one of these new breed of sets is for you.

Andorra, Anyone? Radio Andorra, some veteran DXers will remember, dates back to the late 1930's. Tiny Andorra is a 700-year-old country, a "principality" high in the Pyrenees Mountains between Spain and France, jointly ruled by both countries.

Feedback. A letter from Frank C. Ammann, Sioux City, IA, asks about the location of the Voice of America and the American Forces Radio transmitters:

"I listen to these programs quite a bit and am curious as to where the programs are coming from."

First, Frank, AFRTS, the American Forces Radio and TV Service, has its programs aired by the Voice of America transmitters. The VOA has transmitters at Bethany, OH, and Dixon and Delano, CA, but its big guns—six, 500 kw, six, 250 kw and six, 50 kw transmitters—are at Greenville, NC. There are also VOA relay SW transmitters in Great Britain, Greece, Liberia, Morocco, Philippines and Sri Lanka (the former Ceylon).

Lloyd Penny, a Canadian reader from Toronto, has a question about obtaining QSLs, confirmation cards from stations he hears.

"Should I write and ask the VOA, BBC, Radio Moscow and other international broadcasters with countless frequencies, for a QSL card for every frequency on which I hear them? Or should I just send a report for one frequency? I'm a real QSL freak," Lloyd continues, *"but they'd probably be sick of seeing my reports for more and more QSLs."* Good question, Lloyd, and I'll give you my opinion. Send a good report on one frequency and ask for a QSL card to confirm that report. Then, after that, send the station periodic reports to report reception conditions and tell them how you're enjoying the programs. But I'd advise skipping the request for duplicate, triplicate, multiplicate QSLs from the same station.

In terms of broadcasting, Andorra, like tiny Luxembourg, offered a flag of convenience in a continent that, until relatively recently, had little to do with commercial broadcasting. It was possible for European advertisers to promote their products over such commercial stations in little countries like Andorra.

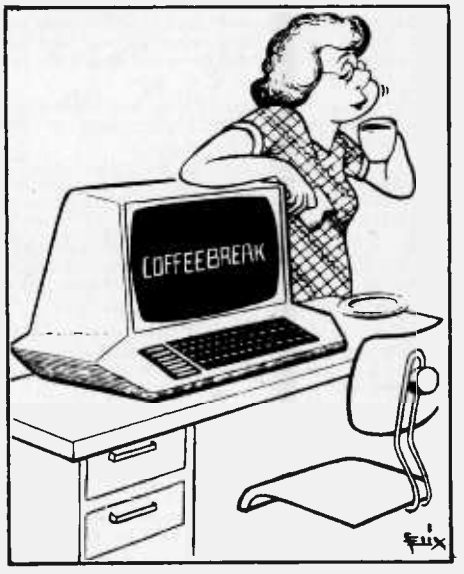
But then, some years back, it ended. Radio Andorra left shortwave, and for SWLs, Andorra became a memory for oldtimers only.

But on a rather sporadic basis, that changed not too many months ago. Various European organizations purchased air time, and Radio Andorra fired up its old SW transmitter. The latest trial effort has been by a Swedish organization which has run programs called "Radio Scandinavia" over Radio Andorra's transmitter.

The latest series of Radio Scandinavia airings began in February during the European evening hours (afternoon in the U.S. and Canada) on Radio Andorra's 6,215 kHz frequency. However, at this writing, there is a rumor that Radio Andorra sees a rebirth of interest in European commercial shortwave radio, and is planning to upgrade its transmitting facilities with a mighty 500 kilowatt SW monster! Now, mind you, it's rumor, but it has been described to me by a European source as a "rather definite plan" which could come about by autumn of 1979.

What's the big deal in getting umpteen identical (except for the frequency, date, time of reception) QSL cards from the same broadcasting outfit?

And, let's face it, QSLing listeners' reports is becoming a greater and greater burden on the stations these days. Major stations have been sending out tens of thousands of QSL cards a year. Some, such as Radio Canada International, have come up with new QSLing policies which limit the number they will send out to any given listener in a year. It is entirely possible that under the crush of requests for QSLs, some large broadcasters will give up verifying listener reports entirely. So, Lloyd, and others with the same question, my advice is to keep in touch with the stations, but settle for only one QSL from each. ■



Anixter Mark Heliwhip

(Continued from page 24)

three stations in England one after another, from a friend's driveway.

Twenty Meters is a bit harder, since the competition is largely kilowatts and beams. But even on Twenty the Heliwhip acquitted itself very well. Forty and Eighty are just a bit troublesome for mobile work, because the actual radiating efficiency of the antenna drops fairly low. After all, a half-wave dipole on Eighty meters is 130 feet long, and the Heliwhip is only 6 feet long. Moreover, bandwidth tends to narrow down a bit with mobile whips; Anixter-Mark claims about 50kHz for a 2 to 1 VSWR on Eighty. We measured about that, but the use of a compact SST T-2 antenna matcher allowed us a much broader bandwidth. On the lower bands the Heliwhips worked out at least as well as any other mobile antennas we have seen.

The Big Bonus. We also experimented with using the Heliwhip series as an apartment and/or portable antenna for use under adverse, space-limited conditions. For this trial we disassembled the heavy duty trunk-lid mount, and fastened the heavy steel bracket directly onto our apartment's metal window frame. It's more solid than it looks in the photo, although you might not want to go swinging on the Heliwhip, some thirty stories up. We tried it out first on Forty Meters, a band that it's virtually impossible to rig an antenna for in such a limited space. Loading the antenna to 100-watts with a Heath SB-104A, we got an SWR of about 2 to 1, which was quickly brought down by the use of an antenna tuner. Don't forget, there was no attempt to use a counterpoise, or to tune the antenna itself, so that's not bad at all. Results were astonishingly good. On CW we were able to work just about anybody we heard, and when the interference on phone wasn't too bad we did pretty well also. Eighty worked out well also, especially on CW, but because of bandwidth on this band an antenna tuner is pretty important.

Things really got hot on Twenty, Fifteen, and Ten Meters. Especially on Fifteen and Ten, with SWRs always below 2 to 1, we were able to work European stations regularly, and with excellent reports. Virtually everyone we talked to was amazed to learn of the sort of antenna setup we were using. This is an excellent, versatile, and very good-looking system. (There is an equally well-designed CB version which we did not test.) The prices are: HW-10 and HW-15, $14.25 and HW-20, HW-40 and HW-80; $15.50. The three-band HW-3 is $27.75. Anixter-Mark's address is 5439 West Fargo, Skokie, Illinois 60076. For more information, circle number 50 on the Readers Service Card. ■

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

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Lend a Hand

Look through your old files and see if you have the printed material that some of our readers need. Please help. Thanks.

Δ RCA Radiola 18, Model AR936; needs general service data and schematic diagram; Ivan I. Rotkowitz, 8107 Milbird Garden Drive, Baltimore, MD 21207.

Δ Triumph Oscilloscope Wobbulator, Model 830; needs schematic diagram and descriptive info; David L. Davis, 604 Oakwood Ave., New Smyrna Beach, FL 32069.

Δ Hallicrafters 8R40 receiver; needs operator's manual and schematic diagram; Tim Murray, 1545 Lawrence, Eugene, OR 97401.

Δ Superior Model 77 VTVM; needs schematic diagram and manual; Jack Vincent, 223 Orange St., Oakland, CA 94610.

Δ RCA Carfone base station (Chassis No. MI-31372B); urgently needs scematic diagram and service manual; Roger Williams, 6710 Virgilian St., New Orleans, LA 70126.

Δ Hammarlund 6-channel CB transceiver, Model CB-214; needs schematic diagram; Robert Crossland, Box 736, Vanderbilt, PA 15486.

Think Big

The switch for my car's rear window defroster keeps wearing out. How come?

—R. A., Fayette, MS

You're controlling a lot of juice. Each time you make and break the circuit, an arc eats away at the switch's contact points. Most switches are usually rated at 3A, and auto switches at 5A, which is too little. Look for a 10-ampere switch, preferably a double-pole, double-throw type, and parallel the switch contacts into the circuit. Now, with a 20-ampere rating, the switch should last.

Radiates Too Far

My neighbor's FM wireless intercom can be heard in my house. He is not jamming any FM stations, but shouldn't those units have limited range?

—K. N., Denver, CO

They do! It may be that both you and your neighbor share a common power drop from the utility. Or, maybe your FM antenna is beamed through his house. Try installing a line isolation transformer on your FM receiver's AC line. If that doesn't work, try hiring yourself out as a remote control baby sitter to him.

Cuban TV

I became interested in television DXing after reading an article Breaking the TV Distance Barrier in the May/June 1977 issue of ELEMENTARY ELECTRONICS. *I'm now a tv DXer with many U.S. stations verified. Now here's my problem! I recently received a few Cuban television stations to which I have no idea of where to send my reception report. Hank, could you please help me in finding the information concerning the addresses of these Cuban television stations that I have received?*

—D. C., Martinsburg, WV

The government's Institute Cubano de Radiodifusion controls broadcasting in Cuba. There are some 28 tv stations on the island, transmitting programs from three government networks. You could address your letter to the Central Headquarters, Television Nacional, Edificio Radio Centro, 23 y M, Vedado, Habana. Cuba.

Mr. Clean Head

Hank, how often should I clean my cassette tape heads?

—E. R., Juneau, AK

A dirty tape head wears quicker than a clean one. I use a cassette head cleaner that makes a 10-second pass. The maker suggests cleaning after 10 hours of equipment use. I prefer 3-4 hours. Periodically I use a liquid cleaner on the heads, guides, rollers, etc. I blow dust out with a freon blower used by photographers. How long is periodically? Well, I clean the heads before each recording session or once a month, whichever comes first. To keep the heads clean, keep tape stored in the plastic boxes in which they are bought. Keep the tape door closed at all times, and dust the room and area near the cassette deck often.

Whata Skip

I turned on my receiver to an FM station (WQUE-FM New Orleans). On this particular day, the station was not coming in (I live 100 miles away from it) so I twiddled the dial a bit and encountered a very strong signal from another station. I listened to this station and did not think anything strange until the news broadcast. The weather report said that the temperature was –23°, and I knew I had stumbled onto quite a find. The station identified itself as WQFM in Milwaukee. Needless to say, I was quite amazed. The station faded out about ten minutes later. My question is, how did I receive this station?

—S. W., Hattiesburg, MS

Blame it on skip of an unusual type. The upper atmosphere was disturbed and ionized, causing this unusual skip. The cause of the disturbance could have been a meteor shower, solar storm particles, or maybe a natural phenomenon which we don't know about. That the skip *does* happen is attested to by your signal report and reports from reliable listeners hearing other events. Unfortunately, these events do not recur, nor are they predictable.

It Can't (Shouldn't) Happen!

Here in Minneapolis we have a 10-watt community radio station which is KFAI at 90.3 MHz on the FM band. I am using a standard indoor dipole antenna and would like to pull in more signal. I tried an outdoor antenna but this makes matters worse, due to overloading by powerful stations. What type of filter, booster, etc., can I use?

—K. L., Minneapolis, MN

The FCC assigns frequencies so that nearby FM stations will not interfere with one another. I suspect your receiver is not of good quality. If you can't use a better FM receiver, connect an FM directional antenna and point it at the station you want or, if its location is unknown, rotate the antenna to the strongest signal. You may eliminate interference from stations behind and to the side of the antenna's main reception lobe.

Noisy Antenna

I suspect my CB antenna is defective but can't prove it. While moving on poor roads at 55 mph, I get erratic static which disappears at low speeds, on smooth roads, or when parked. How can I locate the trouble?

—J. N., St. Louis, MO

Disconnect the antenna cable at the CB set and connect an ohmmeter to its coax center lead there, and also at the top of the antenna. This is impossible to do with fiberglass sticks. The ohmmeter should read about 3 to 5 ohms. Now shake the antenna, gently tap the antenna mount with a rubber mallet, jump on the bumper, and, if necessary, road test the car across railroad tracks. If you have a faulty connection, the meter will swing to the high resistance reading on impacts. Don't drive the car and watch the meter at the same time. Usually, the antenna loading coil goes bad. Sometimes, it's the solder connections in the coax lead-in. Inspect everything you can to pinpoint and eliminate the trouble. For fiberglass antennas, use the SWR meter to detect erratic SWR, while travelling.

Father Knows Best

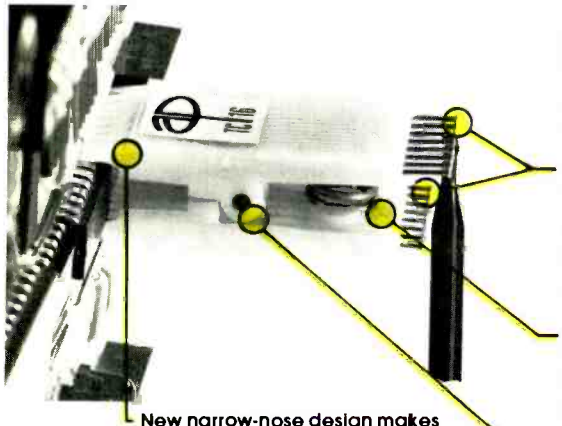
My dad says that I cannot modify my 5-watt CB rig to 10 meters until I get my ham license. (I flunked the code test twice). I am using a No. 47 lamp as a dummy load, never connecting the rig to an antenna during transmitter tests. Can you write a letter to my dad telling him I'm 100% legal?

—A. J., Bronx, NY

I can't! Your No. 47 lamp radiates RF waves to some degree. Even if you used a commercially approved dummy load, some RF would leak out of the set. Listen to your dad, and get that license first! ■

NEW.

Meet Super Grip II, the great new test clip from A P Products.



New narrow-nose design makes it easy to attach on high-density boards. And now you can test ICs with only .040" between opposing legs.

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Open-nose construction enables probe at IC leg.

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Contacts are gold-plated phosphor bronze. "Contact comb" construction separates contacts with precision. No shorts.

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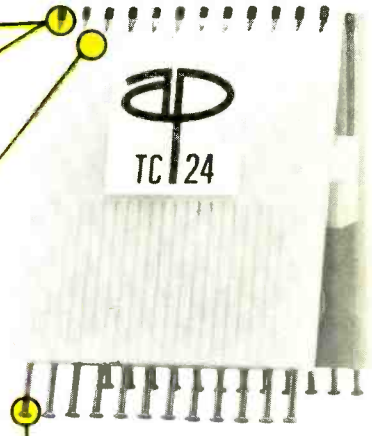

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