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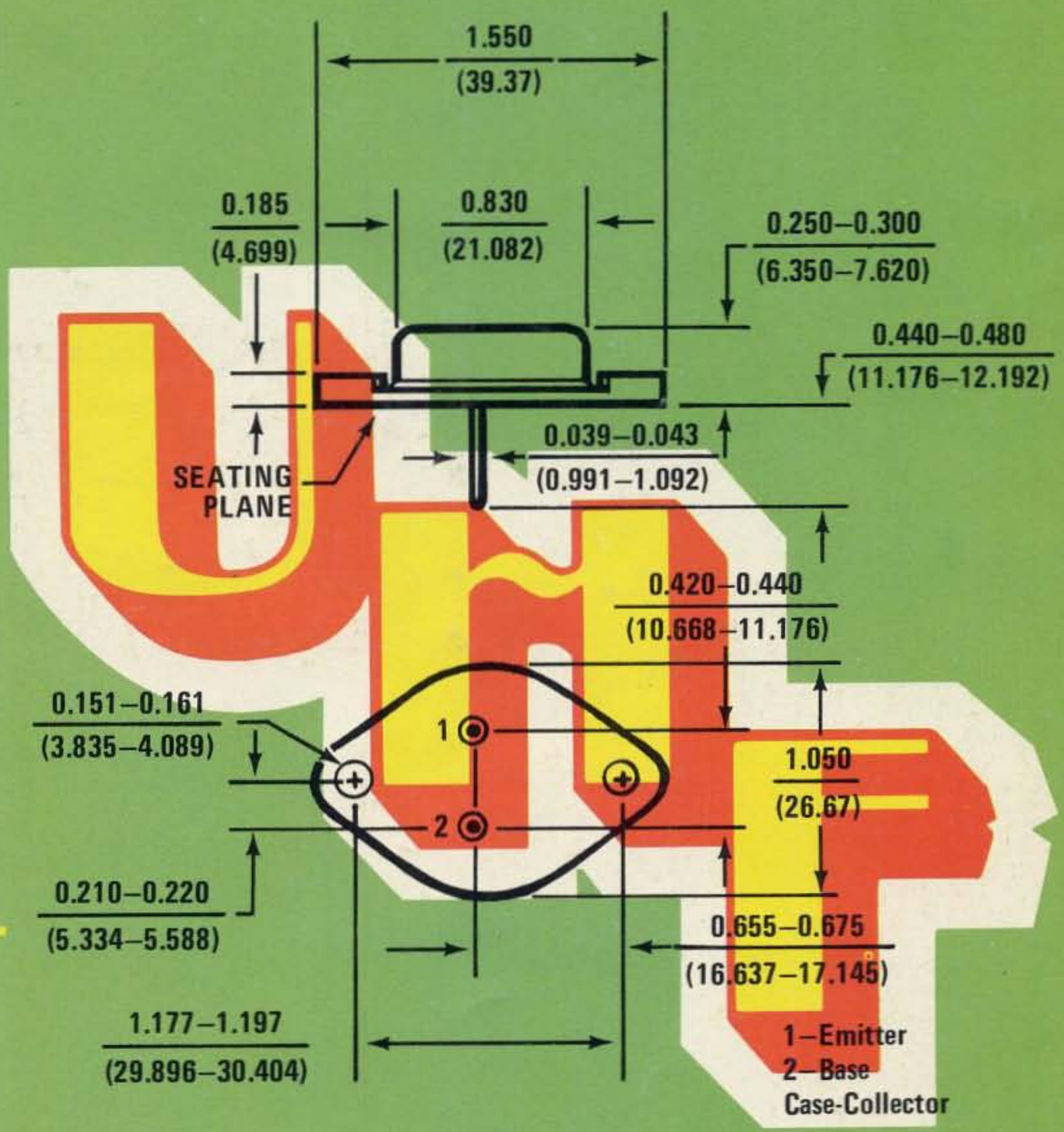

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MARCH, 1979 VOL. 35, NO. 3

The Radio Amateur's Journal

FEATURES

DEPARTMENTS

Zero Bias an editorial

Invariably at every hamfest I attend someone steps up to the *CQ* booth and asks me about Scratchi and the Scratchi Column we used to run. Why did we stop running it and is it possible to start it up again? I start by saying no and then try to explain the rational behind my answer.

For those of you too new in amateur radio to know Scratchi let me digress for a moment to fill you in. Scratchi was a mythical character of Japanese origin who lived out west. The monthly column was in the form of a Letter To The Editor whereby he related bizarre tales of amateur radio in broken english. The humor was in the tall tales which sometimes involved members of his family, his girl friend, and particularly his explanation of events in his inimitable style of english. It was sort of an amateur radio quasi-oriental Amos and Andy.

Well, I explain, just as Amos and Andy is no longer apropos and considered in bad taste for obvious reasons, Scratchi is by some standards offensive and derogatory. The author who conceived of Scratchi and supplied us with columns could not be construed in any way of intentionally deprecating oriental people or fostering anti feelings. It was good natured fun as we all agreed and we reached a point where we felt, and I say we collectively not editorially, that the time for Scratchi had past. And so, he was retired.

I do understand the counter-arguments that perhaps we took it too seriously or that we may be overly sensitive to a situation that really doesn't exist but I think not. On the other hand I did not find Scratchi that much of a monumental slur of orientals but there was something about running it every month that did give me a twinge. So, like Amos and Andy, Bill Dana's Jose Jiminez, the "Frito Bandido" right on down to Lum and Abner we said goodbye to stereo-typical characters who were "funny" just because of who they were.

As I keep saying, times change and hopefully people mature to newer ideas and situations. In retrospect, we can appreciate what went on years ago in amateur radio but we certainly can't return to those glorious days of the Class A and B licenses. We can't bring back the heyday of the ARC-5 or the Globe Scout 680. So it is with people, and our impressions of what any group should be like. I imagine many of us grew up with *National Geographic* and old worn copies of *Trader Horn* thinking that Africa was one giant jungle filled with hostile natives, strange deadly animals and missionaries who are periodically consumed by both. Even today there are Europeans who think that everything west of Chicago is frontier filled with cowboys and Indians in one continual shoot-em-up.

Well, *National Geographic* has changed, becoming more relevant to the point of contemporary journalism. The media has changed due to either internal decision or pressure by special interest groups and so why should amateur radio be any different? In the time between this writing and your reading, hundreds of thousands of amateur radio contacts will have been made that encompass the entire globe. We as amateurs, certainly among all peoples, should be aware of what it's really like in another country or another culture. We can almost at will "drop in" via radio to someone's home and find out first-hand about them and they about us.

This is the long way around to explain what happened to Scratchi and why he really doesn't belong in *CQ* anymore. Times have changed and so have we.

On The Other Hand

I guess the second most asked question about *CQ* at hamfests is the whereabouts of our Surplus Column. Well, there is no geopolitical or socio-cultural reason for this column leaving other than we ran out of surplus. I would be glad to publish articles on surplus that were up-to-date and not a rehash of some 1950's piece. Since WWII, the U.S. has seen fit to limit the production of military communications equipment to smaller and smaller amounts and more and more specialized units. So, what is available today is highly sophisticated equipment in very short supply that bears little relationship to current amateur needs. There are just so many things that you can do to that afore mentioned ARC-5 or BC-453 keeping in mind that they are approaching their fortieth birthday. They still make excellent inexpensive Novice rigs however and can be continually recycled for several more generations of newcomers

On the other hand, if you've managed to ferret out some particular goody that's in reasonable supply, write it up and send it in. That also goes if you've found a novel conversion or use for one of the older workhorses that show up from time to time. Basically though, there isn't enough material to support a continual monthly column.

Our March issue seemed to shape up predominently about antennas. It didn't start out that way, but March signals the approach of warmer weather here in the east and so thoughts begin to stray towards utilizing the warm weather towards good use. First the graph paper is brought out and our property large or minuscule is surveyed by eye for the umpteenth time to see if there is possibly enough room to squeek in a new array. Catalogs are dusted off, ads scanned and perhaps a few trips to the local amateur emporium are planned for the near future.

Hardware stores are consulted concerning the availability of various kinds of tubing, screws, nuts and bolts. Plans continue throughout the summer, optimizing gain figures and mechanical feasibility. Caution and cost are thrown to the wind as the excitement grows. Look out Honor Roll, an r.f. scourch is coming.

Typically, leaves begin to fall, the air gets somewhat brisk and pumpkins are ripening on the vine. Sleet replaces the gentle rain and puffs of snow descend to become hoarfrost as you make your first ascent to the roof or tower. Humming the strains of "I'm dreaming of a white Christmas" almost without thinking you do ponder about how you are going to bend your frozen fingers enough to thread that 8/32 bolt. There must be a better way you think as that's about the only thing you can think through the numbing winds. Sitting high upon your perch you can see across the roof-tops other amateurs huddled and wrapped working on their antennas. All of you, covered in snow, frozen stiff are witness to the fact that it really is WINTER that is antenna weather and not summer.

So, henceforth I am suggesting to the Editors of all the amateur magazines that special issues concerning antennas or issues heavily weighted towards antennas be printed around November. I will try to do the same. This will go a long way to shift the antenna season to the warmer months like summer where we were all lead to believe it wall all the time. Think about it. 73, Alan,K2EEK

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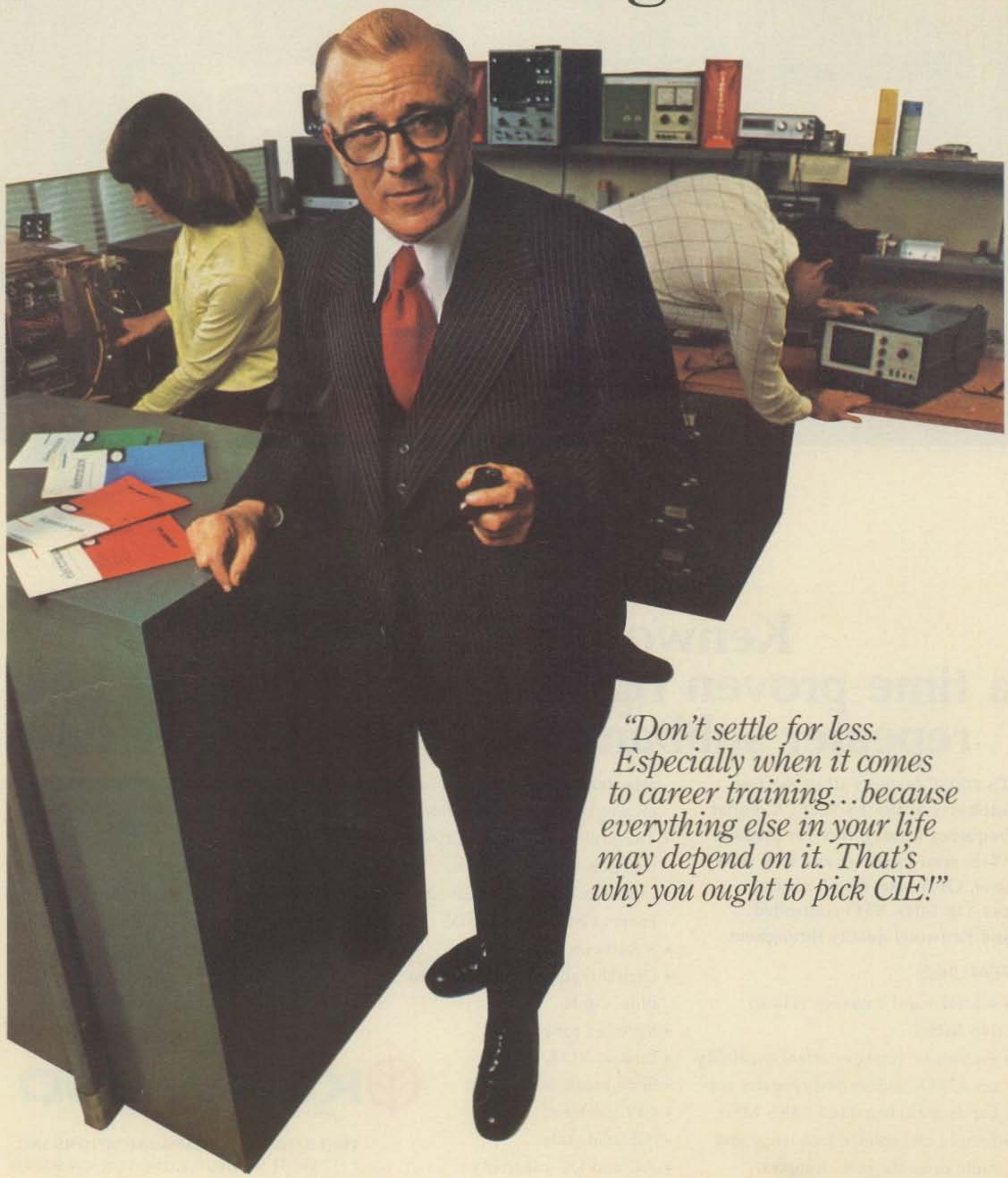

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No-11-12

Announcing

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• **Charlotte, NC** – The Mecklenburg Amateur Radio Society, W4BFB, would like to announce the ARRL sanctioned 1979 Metrolina Hamfest and Convention to be held at the Charlotte Civic Center. Dates have been set for March 24-25, 1979. For further information, write or call: Kenneth W. Winston, Jr., WA4OBO, Mecklenburg Amateur Radio Society, Inc., 2425 Park Rd., Room 023, Charlotte, NC 28203, (704) 364-7685.

• **Quakertown, NJ** – On March 17, 1979, the Cherryville Repeater Association will hold its Annual Hamfest. The event will be held in the Field House of Hunterdon Central High School, just north of Flemington, New Jersey on Route 31. There will be over 200 sellers' tables and displays from major manufacturers. Door prizes will also be awarded. For more info, contact: Sandford G. Franklin, Chairman, Hamfest Committee, Cherryville Repeater Association, Inc., RD 3, Box 336, Milford, NJ 08848.

• **Jefferson, WI** – The Tri County ARC Hamfest will be held on March 18, 1979, at the Jefferson County Fairgrounds, (formerly at Whitewater). Advance tickets are $1.50. Reserve 6 ft. tables $2 in advance, 6 ft. space-$1. Send SASE to: Glenn Eisenbrandt, WA9VYL, 711 East St., Fort Atkinson, WI 53538.

• **Vero Beach, FL** – The Treasure Coast Hamfest will be held on March 17 and 18, 1979, at the Vero Beach Community Center. Prizes and drawings will be featured. Admission is $3 per family. Talk-in on 146.13/73, 146.52/52, 222.34/94. For more info, write: P.O. Box 3088, Vero Beach, FL 32960.

• **Waukegan, IL** – The Libertyville and Mundelein Amateur Radio Society (LAMARS) will hold its second Annual Lamarsfest on Sunday, March 25, 1979, at the J.M. Club, 708 Greenwood Ave. Doors open at 7 a.m. There will be plenty of free parking and dozens of door prizes. There will also be a large indoor flea market. Tickets will be $2 at the gate, $1.50 in advance, children under 10 years free. Talk-in on 146.94 simplex. For further info, write: LAMARS, (please include SASE) at 1226 Deer Trail Lane, Libertyville, IL 60048, or call (312) 367-1599.

• **Muskegon, MI** – The ARRL Great Lakes Division Convention and Hamfest will be held on March 30-31, 1979, at the Muskegon Community College. This event will feature manufacturers' exhibits, technical forums and a large Swap/Shop. For additional info, contact: MAARC, P.O. Box 691, Muskegon, MI 49443 or H. Riekels, WA8GVK, (616) 722-1378/9.

• **Painsville, OH** – The First Annual Lake County Hamfest, sponsored by LCARA, will be held on April 1, 1979, from 8 a.m. to 4 p.m., at the Lake County Armory, located on the NE corner of the Painsville Fairgrounds, Route 20 (35 miles east of Cleveland). Talk-in on 52.52 and 147.81/21. Write or call: LCARA, P.O. Box 868, Painsville, OH 44077, (216) 257-4486. ▣

Our Readers Say

A Worthy Cause

Editor, CQ:

I would like to take the opportunity to thank you for donating sapce to PCF for the purposes of running our ad. Thanks to you and some of the other amateur radio publications, PCF has raised over $6,000 since the ad first appeared. While that amount is not sufficient to fund all the projects we would like, it is certainly more than enough to keep the doors open and the Foundation functioning.

Kenneth S. Widelitz, WA6PPZ
President and Executive Director
Personal Communications Foundation

Thanks, Bill!

Editor, CQ:

I want to thank CQ Magazine for publishing Bill Welsh's articles on Amateur Radio Station Grounding in the Novice section. I have known something about good grounding since I was first licensed in 1923, but Bill's articles are the first I have seen which not only tell why but how to do it in particularly clear terms for the amateur. I have applied some of his ideas and now my station is better than before. This is a real service on the part of both of you to ham radio.

Charles M. Brelsford, K2WW
Rochester, NY

A Cheaper Alternative

Editor, CQ:

I was pleased to see James Fisher's article on all-band antennas in the November 1978 issue of CQ, but was dismayed to see that he described a suitable tuner for a center-fed antenna as being so costly and difficult to build and use.

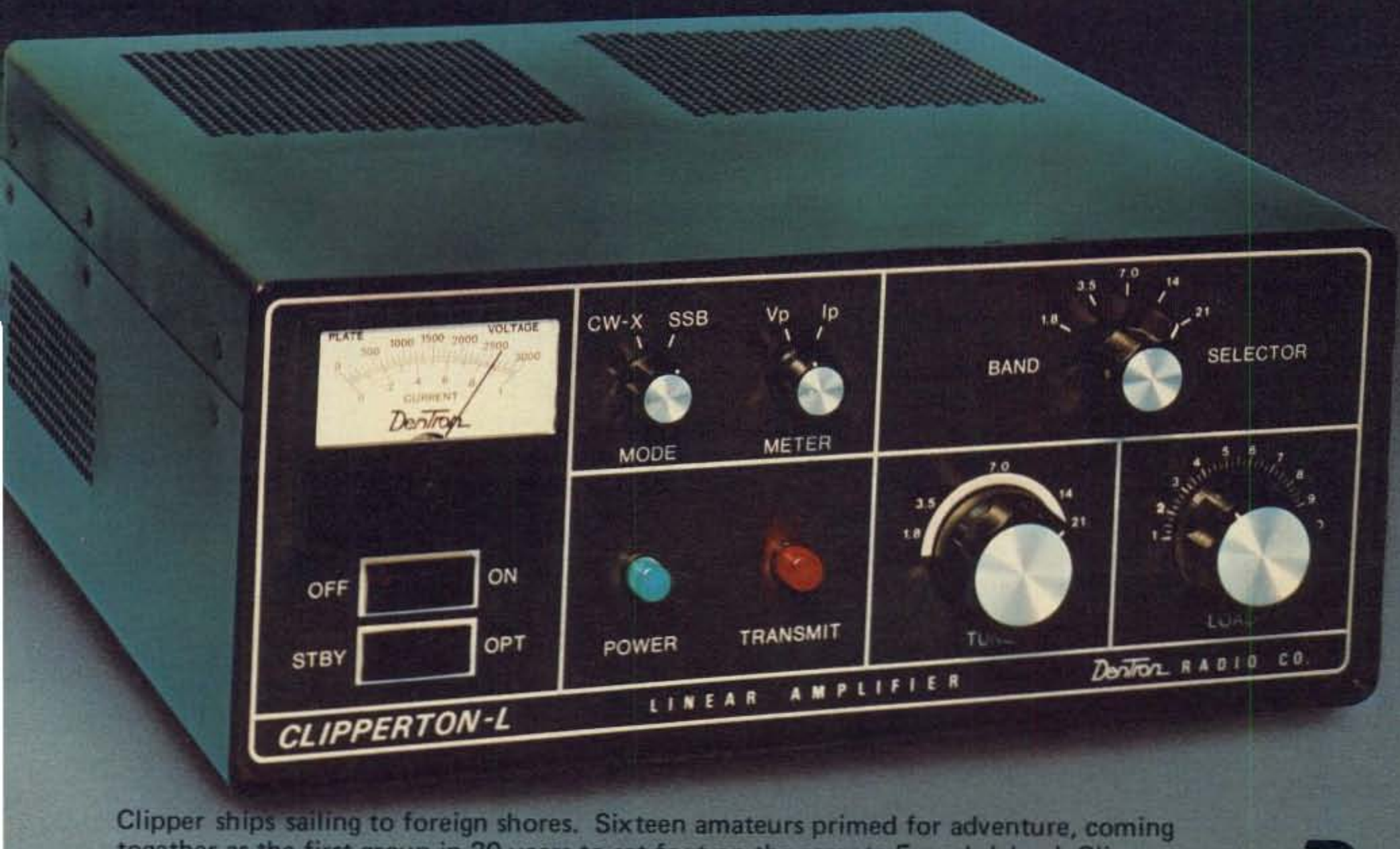
An appropriate tuner is simple to build and operate. Mine is a T-match, a modification of the ultimate transmatch described by Walter Maxwell in QST, August, 1976, p. 15. This design was chosen on the basis of parts on hand. It uses a switch to change inductance, but could be more economically constructed using a clip lead to tap the coil at appropriate points. Included in the tuner, is a balun made from a kit available from Amidon Associates, 12033 Otsego, North Hollywood, CA 91607. It matches the balanced load (antenna) to the unbalanced tuner output. I run 300 watts on c.w., and it does not arc.

The antenna is about 150 ft. long, made of no. 14 house-wiring wire (insulated) and presents no hazard to children or pets. It works very well on 160, 80, 40, and 20 meters. I haven't tried it on 15 or 10 meters. It is very inexpensive, effective and a simple antenna, which replaces a multiplicity of folded dipoles. The XYL likes it, too!

Dave Moorman, K9SW
Downers Grove, IL

▣

DXpedition...The Ultimate Fantasy



Clipper ships sailing to foreign shores. Sixteen amateurs primed for adventure, coming together as the first group in 20 years to set foot on the remote French Island, Clipperton. Their goal: 30,000 QSO's in just 7 days.

If you're like most of us, a rare DXpedition is more a dream than a reality, but the Clipperton Linear Amplifier from DenTron brings the thrill of a DXpedition to you.

The Clipperton-L™ was inspired by the famous DXpedition on which 3 MLA-2500's were used. We built the Clipperton with 4 rugged, economical, 572 B's in the final to provide a full 2KW PEP on SSB and 1KW CW on 15 through 160 meters. With features like hi-lo power selector for equal efficiencies at 1 or 2 KW, a power transformer that is vacuum impregnated, wide spaced tuning and loading capacitors, built-in ALC and an improved whisper-quiet cooling system, the excitement of crashing a pile-up can be yours.

Clipperton-L suggested price $599.50.
FCC type accepted.

CIRCLE 16 ON READER SERVICE CARD

DenTron
Radio Co., Inc.
2100 Enterprise Parkway
Twinsburg, Ohio 44087
(216)425-3173

Dedicated to making amateur radio more fun.

GET MORE THAN YOU BARGAIN FOR

at a TEN-TEC franchised dealer

Buying amateur radio equipment is more than looking for the best price. It's all the extras you get from an involved, active dealer who has your best interests at heart—a TEN-TEC franchised dealer . . .

- **FREE HELP — GOOD ADVICE**
  Investing in amateur radio equipment is a substantial move in personal finances, so it pays to get all the advice and help you can. Your TEN-TEC dealer has been franchised because he's the kind of expert we want to serve you—knowledgable, honest, willing to spend the time you need to make the right decision.

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  Part of the joy of buying anything is taking it home with you. Once you've made up your mind, there's usually no need to wait for delivery with a TEN-TEC dealer. He will either have your model in stock (if it is an established one), or be among the first to receive new products.

- **FAIR PRICES**
  Your TEN-TEC dealer is in business to make a living. His best price will be a fair price—one that is satisfactory to both of you. That way he will stay in business to provide all the services you want . . . new products, stores of needed items for emergencies, help for beginners, and just being there when you need him.

- **FREE WARRANTY SERVICE**
  The TEN-TEC warranty is one of the most liberal in amateur radio, simple to understand, and fair. And your TEN-TEC dealer is ready to provide complete warranty service to your satisfaction—most of the time without your having to return anything to the factory.

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  Your TEN-TEC dealer won't forget about you if trouble arises. He's right there with the facilities to get you back on the air quickly. And he does it all at reasonable cost.

You can count on your TEN-TEC dealer—he's franchised by the TEN-TEC factory because he's a man who is ready to help—to give you more than you bargain for.

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Sure you can buy a cheaper linear . . . But is that really what you want?

You can buy a so-called "maximum legal power" linear for quite a bit less than the price of an ALPHA. What makes the ALPHA worth more . . . or the other model less?

TALK TO AN ALPHA OWNER — Notice how scarce used ALPHA's are? Owners are rarely willing to part with them, and will be delighted to tell you why.

CHECK ETO's TWO-YEAR (limited) WARRANTY — Others give you 90 days. But EIGHT TIMES as much protection is only part of the ALPHA warranty story: there's also a clear message about durability.

NO ALPHA 76/374/77D OWNER HAS EVER BURNED UP A POWER TRANSFORMER, despite our No Time Limit (NTL), full power key down rating. Maybe it's because our '76A transformer is nearly TWICE the size of those in competitive desk-top amplifiers and is cooled by ETO's full-cabinet, ducted-air system to boot.

LOOK INSIDE AN ALPHA — the difference in quality and ruggedness is conspicuous. *Big* coils . . . axial-flow ceramic triodes thoroughly cooled by a centrifugal blower . . . yet ETO's new acoustic-isolation blower system makes the ALPHA 76A series now even quieter than ever before.

EFFICIENCY, versatility, ease of operation, resale value — the story of ALPHA superiority goes on. Before you decide on a new linear, get all the details from your dealer or ETO direct. And ask for our free guide, *"Everything You Always Wanted to Know About (Comparing) Linears . . . But Didn't Know Whom to Ask."* Finally, do talk to an ALPHA owner . . . look for him on top of the nearest pile-up.

ALPHA/VOMAX can boost the "talk power" of any rig up to ten times or more. The new SBP-4 *split band* speech processor uses the only system *more effective than rf clipping* — AND distortion is extremely low so your voice sounds natural. Under tough conditions VOMAX can help as much as most linears. Combine VOMAX *with* a good linear and WOW! It's simple to install and operate with any rig.

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CIRCLE 12 ON READER SERVICE CARD

Imagine All The Places You Can Tuck ICOM's Remotable IC-280. (Think small.)

The **IC-280** 2 meter mobile comes as one radio to be mounted in the normal manner: but, as an option, the diminutive front one third of the radio detaches and mounts by its optional bracket, while the main body tucks neatly away out of sight. Now you can mount your 2 meter radio in pint-sized places that seemed far too cramped before.

Measuring only 2¼"h x 7"w x 3⅜"d, the bantam-sized microprocessor control head fits easily into the dash, console or glove box of even the most compact vehicle. Or if those places are already taken by the rest of your "mobile shack," the **IC-280** head squeezes into leftover nitches under the dash, overhead, under the seat or even on the steering column.

But don't be misled by the petite size of this subdivided radio: the **IC-280** is jam packed with the latest state of the art engineering and convenience features. No scaled down technology here!

With the microprocessor in the detachable control head, your **IC-280** can store three frequencies of your choice plus the dial, which allows you to select from four frequencies with the front panel switch without taking your eyes off the road. These frequencies are retained in the **IC-280's** memory for as long as power is applied to the radio, even when power is turned off at the front panel switch. And if power is completely removed from the radio the ±600 KHz splits are still maintained!

The **IC-280** works frequencies in excess of the 2 meter band with ICOM's outstanding single-knob tuning, so you can listen around the entire band without fooling with three tuning knobs. With steps of 15 KC or 5 KC, the **IC-280** puts rapid and easy frequency change at your single fingertip and instantly displays bright, easy to read LED's.

Available Options:

- Touch Tone pad/microphone combination, which fits the mic plug on the radio face with absolutely no modification
- 15' unassembled cable kit for long distance remote mounting of the detachable control head

IC-280
2 meter FM, 4+ MHz
Mobile Transceiver

All ICOM radios significantly exceed FCC regulations limiting spurious emissions.

Specifications subject to change without notice.

IC-280 Specifications: ☐ Frequency Coverage: 143.90—148.11 MHz ☐ Operating Conditions: Temperature: −10°C to 60°C (14°F to 140°F), Duty Factor: continuous ☐ Frequency Stability: ±1.5 KHz ☐ Modulation Type: FM (F3) ☐ Antenna Impedance: 50 ohms unbalanced ☐ Power Requirement: DC 13.8V ±15% (negative ground) ☐ Current Drain: Transmitting: 2.5A Hi (10W), 1.2A Lo (1W), Receiving: 0.630A at max audio output, 0.450 at SQL ON with no signal ☐ Size: 58mm(h) x 156mm(w) x 228mm(d) ☐ Weight: approx. 2.2 Kg ☐ Power Output: 10W Hi, 1W Lo ☐ Modulation System: Phase ☐ Max. Frequency Deviation: ±5 KHz ☐ Spurious Output: more than 60 dB below carrier ☐ Microphone Impedance: 600 ohms dynamic or electret condenser type, such as the SM-2 ☐ Receiving System: Double superheterdyne ☐ Intermediate Frequency: 1st: 10.695 MHz, 2nd: 455 KHz ☐ Sensitivity: 1 uv at S +N/N at 30 dB or better, Noise suppression sensitivity 20 dB, 0.6 uv or less ☐ Selectivity: less than ±7.5 KHz at −6 dB, less than ±15 KHz at −60 dB ☐ Audio Output: More than 1.5W ☐ Audio Output Impedance: 8 ohms

CIRCLE 44 ON READER SERVICE CARD

HF/VHF/UHF AMATEUR AND MARINE COMMUNICATION EQUIPMENT

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NOVICE DELIGHT

Make a Good Start. Begin your ham career with a HF transceiver you can really enjoy now. Get up to 250 watts dc input on 80 and 40, and 200 watts on 15 meters with the Alda 103A.

Enjoy the frequency flexibility of a rock-solid VFO. The convenience of semi break-in keying.

Use the receiver-incremental-tuning (RIT) feature to reduce adjacent-channel interference on CW or SSB. And monitor your own keying easily with the built-in sidetone.

Change bands without the hassle of final-amplifier tuning. The solid-state PA is totally broadbanded.

A Rig to Grow With. After you've upgraded to General, plug in the mic and work the world on SSB. For even more fun, go mobile.

You'll need a mobile mount available at your dealer, or direct from the factory. And while you're at it, order a noise blanker. A big help in copying through ignition noise.

Power for the Alda 103A. The transceiver requires a nominal 13.8 volts dc input at 20 amps. When you operate mobile, just connect the transceiver directly to the battery.

The PS-130 delivers 30 amps regulated and requires 117v or 220v, 50/60 Hz input.

For base station operation, you'll need an ac power supply. The Alda PS-130 will give you full rated power on SSB and CW. The PS-115 will give you full power on SSB and 75% of full power on CW.

The PS-115 delivers 18 amps unregulated and requires 117v or 220v, 50/60 Hz input.

Summary Specifications.

Frequency Coverage . . . . 80, 40 and 15 meters

Input Power

With power from car or Alda PS-130 . . . . 250 watts PEP or dc on 80 and 40 meters, 200 watts PEP or dc on 15 meters

With power from Alda PS-115 . . . . 250 watts PEP/200 watts dc on 80 and 40 meters, 200 watts PEP/175 watts dc on 15 meters

Dimensions . . 3¼ inches (82 mm) high, 9 inches (228 mm) wide, 12½ inches (317 mm) deep

Weight . . . . . 8¼ lbs. (3.66 kg)

Only $495 Base Price. See your dealer or write to us directly for ordering information. Our address is Alda Communications, Inc., 215 Via El Centro, Oceanside, CA 92054. Phone (714) 433-6123.

Here are the prices of optional accessories which you can buy now or later.

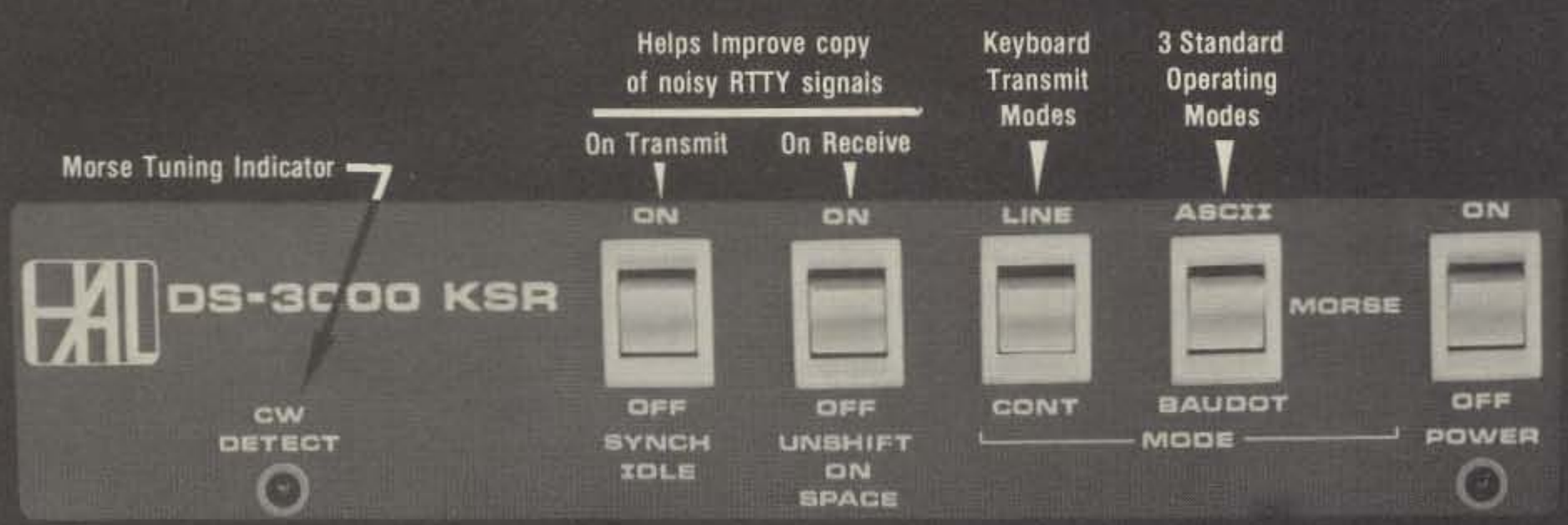
Model HM-1 Microphone . . .	$ 14.95
Model MM-1 Mobile mount .	3.95
Model PC-701 Noise Blanker	39.95
Model PC-801 Dual xtal calibrator, 100 kHz and 25 kHz	19.95
Model PS-115 Power supply	84.95
Model PS-130 Power supply	149.95

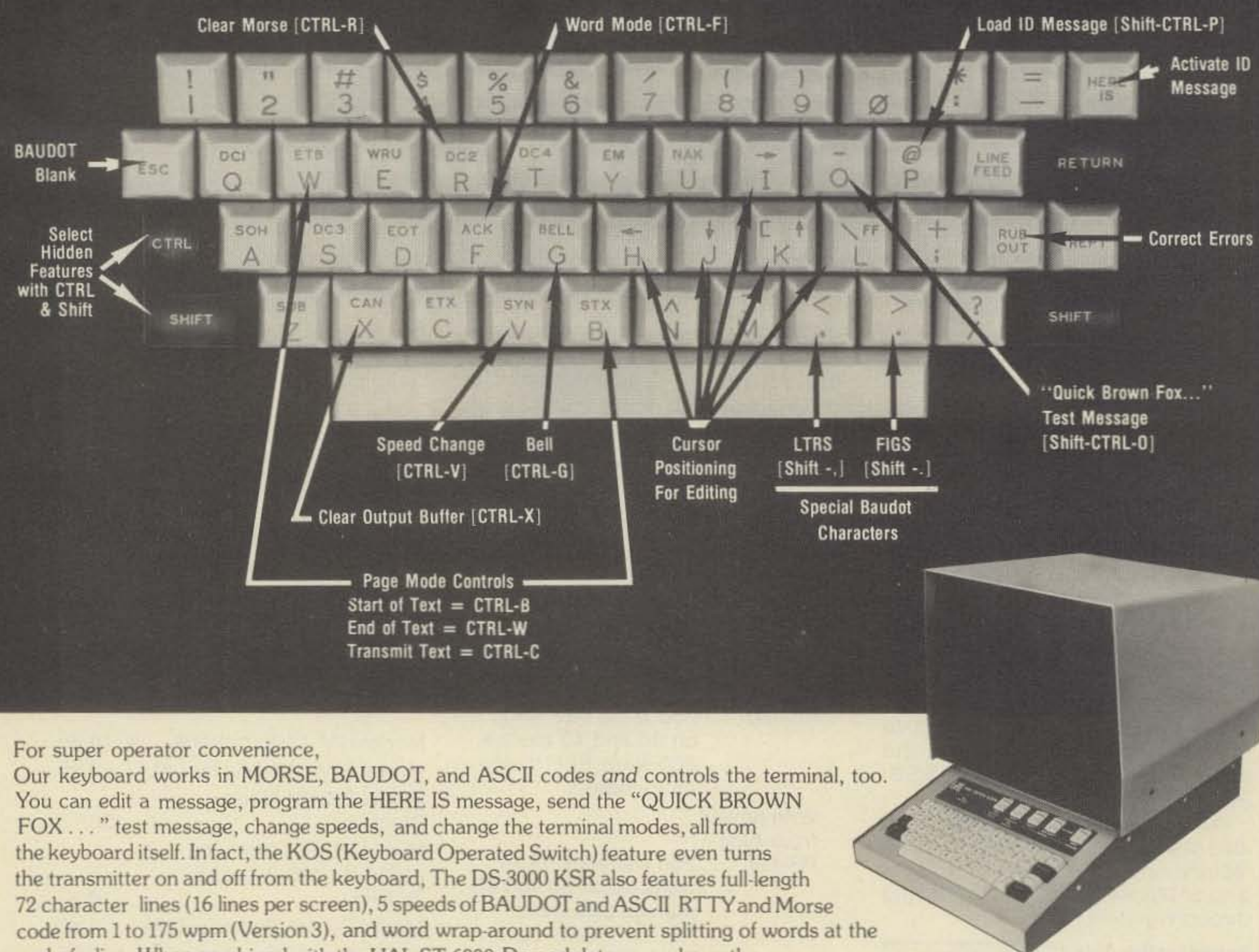
alda 103A

We're proud it's built in the U.S.A.

CIRCLE 1 ON READER SERVICE CARD

Super Terminals with
Hidden Features





For super operator convenience,
Our keyboard works in MORSE, BAUDOT, and ASCII codes *and* controls the terminal, too. You can edit a message, program the HERE IS message, send the "QUICK BROWN FOX . . . " test message, change speeds, and change the terminal modes, all from the keyboard itself. In fact, the KOS (Keyboard Operated Switch) feature even turns the transmitter on and off from the keyboard, The DS-3000 KSR also features full-length 72 character lines (16 lines per screen), 5 speeds of BAUDOT and ASCII RTTY and Morse code from 1 to 175 wpm (Version 3), and word wrap-around to prevent splitting of words at the end of a line. When combined with the HAL ST-6000 Demodulator, you have the ULTIMATE in RTTY equipment.

DS-3000 KSR Version 3 (MORSE, BAUDOT, ASCII) ..... NEW YEAR'S SPECIAL! $1425.00
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ACCEPT NO SUBSTITUTES!

Before you make the choice of a new hand-held, ask about these important features:

1. Is the case fiberglass reinforced Lexan®?
2. Are the batteries convenient for carrying extras?
3. Is the capacity sufficient for a day's operation?
4. Is there a method for conserving battery life when high power is not required?
5. Does it fit your hand comfortably?
6. Do you have a choice of charging methods?
7. Do you have an ample choice of accessories to back up your radio?

If you can answer 'yes' to all of the above, then you've made the obvious choice.
You want a Wilson Mark IV hand-held . . . and accept no substitute for it!

Wilson hand-helds have been known world-wide for exceptional quality and durable performance. That's why they have been the best selling units for years.

The Mark Series of miniature sized 2-meter hand-helds continues the tradition of dependability and operation, but in an easier to use, more comfortable to carry size.

The small compact size battery pack makes it possible to carry one or more extra packs in your pocket for super extended operation time. No more worry about loose cells shorting out in your pocket, and the economical price makes the extra packs a must.

Conveniently located on top of the radio are the controls for volume, squelch, accessory speaker mike connector, 6 channel switch, BNC antenna connector and LED battery condition indicator.

Optional Touch Tone™ Pad available.

MARK IV: ≃ 1 & 4.0 watts

SPECIFICATIONS:

- Range: 144-148 MHz
- 6 Channel Operation
- LED Battery Condition Indicator
- Individual Trimmers on TX and RX Xtals
- Rugged Lexan® outer case
- Switchable Hi-Lo Power
- Current Drain: RX 15 mA
  TX - Mark IV: 900 mA Hi, 400 mA Low
- 12 KHz Ceramic Filter and 10.7 Monolithic Filter included.
- 10.7 MHz and 455 IKz IF
- Spurious and Harmonics: more than 50 dB below carrier
- BNC Antenna Connector
- .3 Microvolt Sensitivity for 20 dB Quieting
- Uses special rechargeable Ni-Cad Battery Pack
- Rubber Duck and one pair Xtals 52/52 included
- Weight: 19 oz. including batteries
- Size: 6" x 1.770" x 2.440"
- Popular accessories available: Wall Charger, Mobile Charger, Desk Charger, Leather Case, Speaker Mike, Battery Packs, and Touch Tone™ Pad.

Illustrated is Wilson's BC-2 Desk Top Battery Charger shown charging the Mark Series Unit or the BC-4 Battery Pack only.

To obtain complete specifications on the Mark IV, along with Wilson's other fine products, see your local dealer or write for our Free Amateur Buyer's Guide.

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Wilson Electronics Corp.

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Prices and specifications subject to change without notice.

CIRCLE 38 ON READER SERVICE CARD

for the experimenter

INTERNATIONAL CRYSTALS & KITS / OSCILLATORS • RF MIXERS • RF AMPLIFIER • POWER AMPLIFIER

OX OSCILLATOR

Crystal controlled transistor type. 3 to 20 MHz, OX-Lo, Cat. No. 035100. 20 to 60 MHz, OX-Hi, Cat. No. 035101.
Specify when ordering
$4.95 ea.

MXX-1 TRANSISTOR RF MIXER

A single tuned circuit intended for signal conversion in the 30 to 170 MHz range. Harmonics of the OX or OF-1 oscillator are used for injection in the 60 to 179 MHz range. 3 to 20 MHz, Lo Kit, Cat. No. 035105. 20 to 170 MHz, Hi Kit, Cat. No. 035106.
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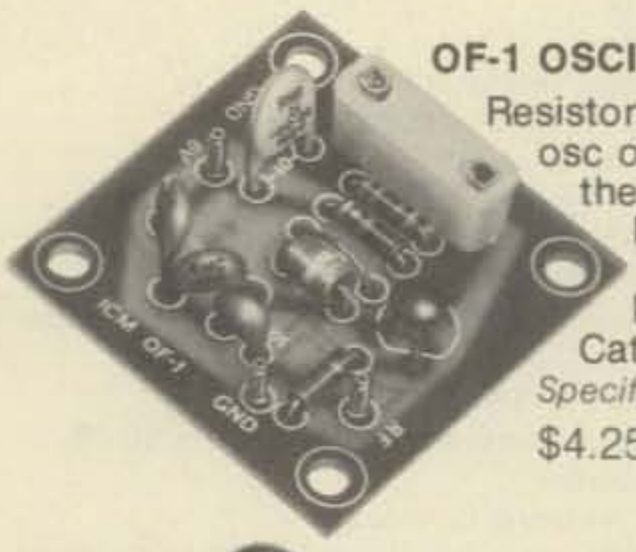
$5.50 ea.



OF-1 OSCILLATOR

Resistor/capacitor circuit provides osc over a range of freq with the desired crystal. 2 to 22 MHz, OF-1 LO, Cat. No. 035108. 18 to 60 MHz, OF-1 H , Cat. No. 035109.
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PAX-1 TRANSISTOR RF POWER AMP

A single tuned output amplifier designed to follow the OX or OF-1 oscillator. Outputs up to 200 mw, depending on frequency and voltage. Amplifier can be amplitude modulated 3 to 30 MHz, Cat. No. 035104. *Specify when ordering.*
$5.75 ea.

SAX-1 TRANSISTOR RF AMP

A small signal amplifier to drive the MXX-1 Mixer. Single tuned input and link output. 3 to 20 MHz, Lo Kit, Cat. No. 03512. 20 to 170 MHz, Hi Kit, Cat. No. 035103.
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$5.50 ea.

BAX-1 BROADBAND AMP

General purpose amplifier which may be used as a tuned or untuned unit in RF and audio applications. 20 Hz to 150 MHz with 6 to 30 db gain. Cat. No. 035107.
Specify when ordering.
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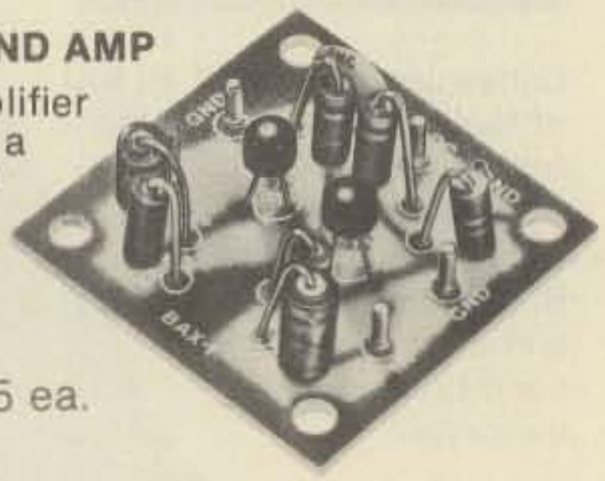

.02% Calibration Tolerance

EXPERIMENTER CRYSTALS

(HC 6/U Holder)

Cat. No.	Specifications	
031080	3 to 20 MHz — for use in OX OSC Lo	
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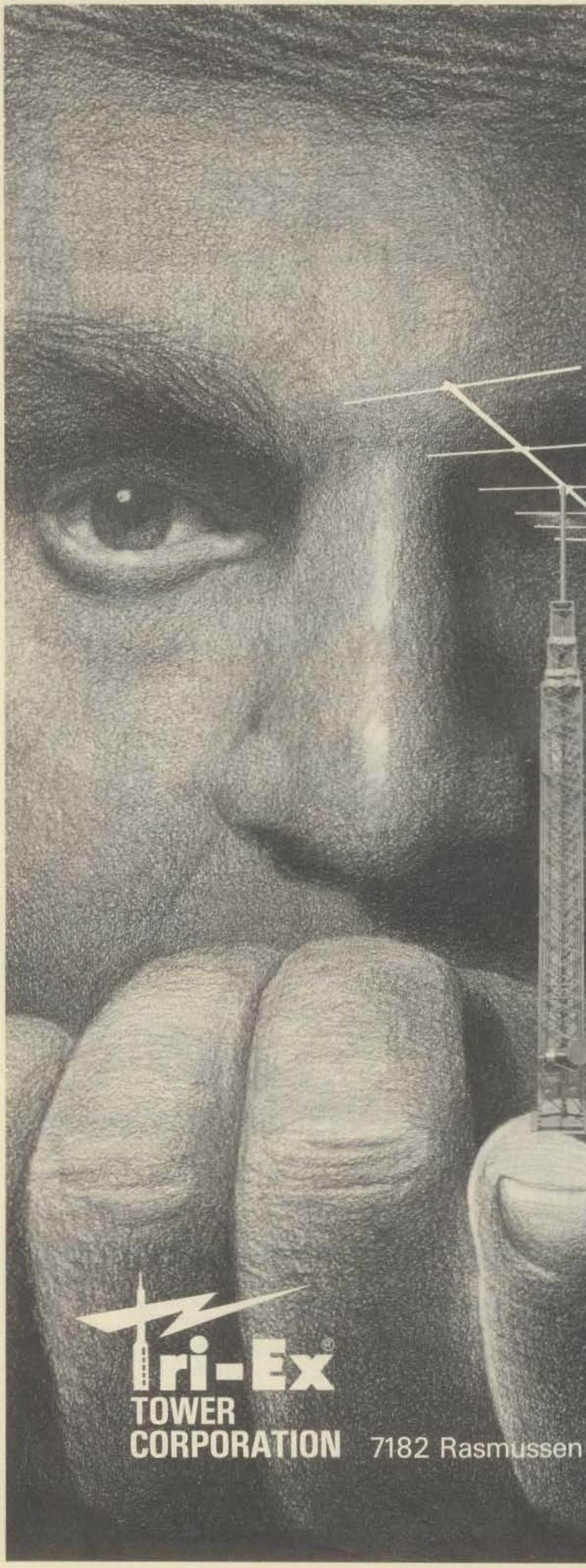

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YAESU'S NEWEST RECEIVER
THE FRG-7000

The FRG-7000—Yaesu's newest receiver features improved selectivity, wider frequency coverage, digital readout, with Yaesu's superb quality of construction.

— SPECIFICATIONS —

Frequency Range: 0.25-29.9 MHz
Modes of Operation: AM, SSB, CW
Stability: Less than ±500 Hz drift for any 30 minute period after warmup.
Sensitivity: SSB/CW-Better than 0.7uV for S/N 10dB AM-better than 2 uV for S/N 10dB (400 Hz 30% modulation)
Selectivity: SSB/CW ±1.5 KHz (−6dB), ±4 KHz (−50dB) AM ±3 KHz (−6dB), ±7 KHz (−50dB)
Power Requirements: 100/110/117/200/220/234 VAC, 50/60 Hz
Power Consumption: 25 VA
Size: 360 mm (W) × 125 mm (H) × 295 mm (D)
Weight: approximately 7 kg.

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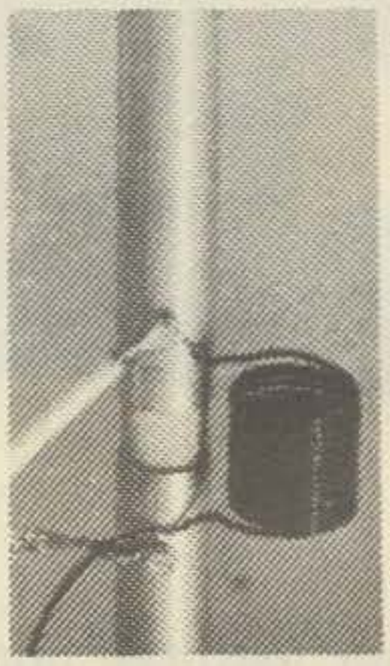
Model HF3V - - Automatic bandswitching 80-20 meters.

May also be used on 10 meters with low VSWR. Same rugged construction as models HF5V-II and HF4V-II. Will not operate on 15 meters without a tuner, but specifications are otherwise identical to those of model HF5V-II except as noted below. Comes complete with mounting post, base shunt inductor for d.c. grounding, RG-11/U matching section, and connectors for PL-259 and any length of 50-53 ohm cable.

Shipping weight: 10 lbs./4.5 kg.

Height: 25 ft./7.5 meters

$72.00



Model HF4V-II - - Automatic bandswitching 40-10 meters.

Entire radiator length is active on 40, 20 and 10 meters (full size quarter-wave resonance on 15 meters). Same construction and 40-10 meter specifications as model HF5V-II except as noted below. Comes complete with mounting post, base shunt inductor for d.c. grounding, RG-11/U matching section, and connectors for PL-259 and any length of 50-53 ohm cable.

Shipping weight: 9 lbs./4 kg.

Height: 25 ft./7.5 meters.

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ELECTRICAL AND MECHANICAL SPECIFICATIONS:

Model HF5V-S - - Automatic bandswitching 80-10 meters.

Shipping weight: 9 lbs./4 kg.

Height: 16 ft./4.8 meters

Power Rating: legal limit SSB/C.W. 20, 15 and 10 meters; 1200 W PEP/500 W C.W. 40 meters; 500 W PEP/250 W C.W. 75/80 meters.

Feedpoint impedance: nominal 50 ohm all bands.

VSWR at resonance: 1.5:1 or less all bands.

Bandwidth for VSWR of 2:1 or less:
10 meters - - 1500 Khz; 15 and 20 meters - - entire band; 40 meters - - 150 Khz; 75/80 meters - - 30-50 Khz.

Wind survival rating (unguyed): 80 m.p.h./128 km.p.h.

Model HF4V-S - - Automatic bandswitching 40-10 meters.

Shipping weight: 8 lbs/3.6 kg.

Height: 14 ft./4.2 meters

Except for operation on 75/80 meters, all other specifications are identical to those given above for the HF5V-S.

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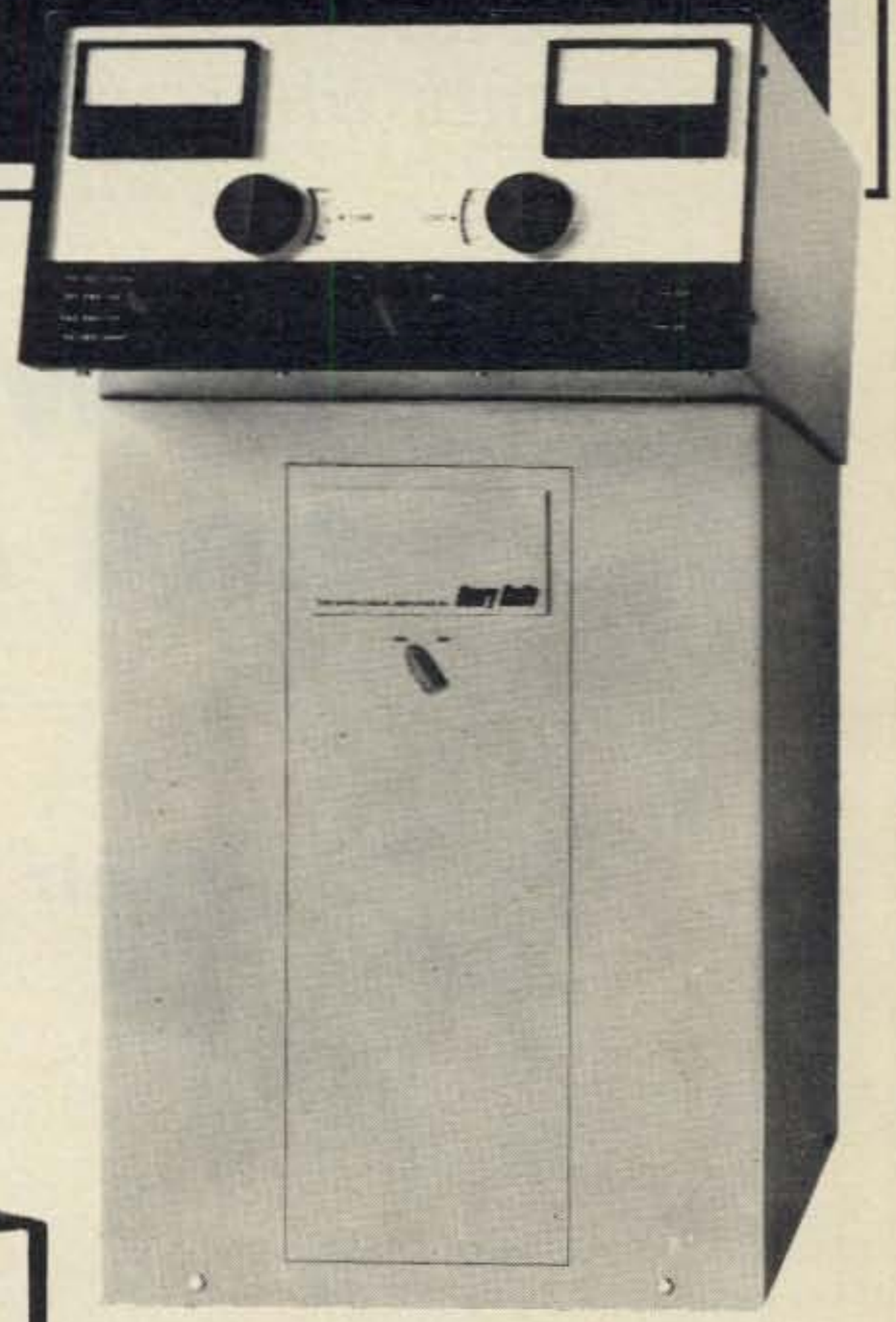

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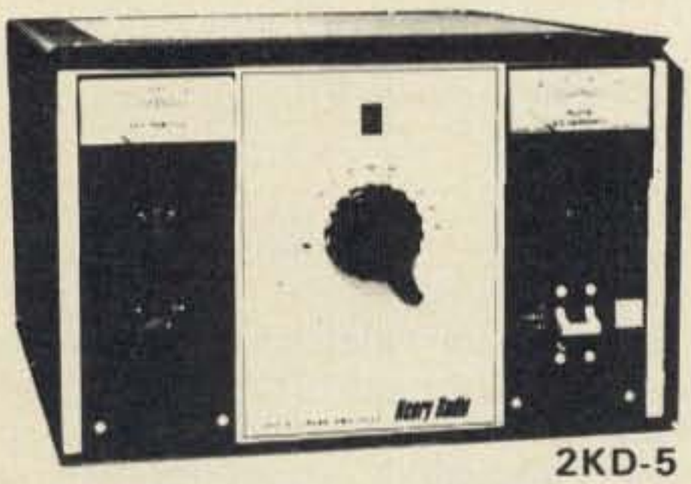

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Amateur interest in the v.h.f., u.h.f. and microwave spectra is on the increase. Design and operating techniques on these bands are, in many cases, substantially different from those on lower frequency bands. In this interesting three-part series author Ash addresses the problems encountered with output components when used up to 510 MHz.

R.F. Power Transistors and Amplifiers

Their Care and Feeding
Part I

BY M.S. ASH*, W6RJO

As the title implies this is an article concerning the practical operation, based on extensive experiential information, of medium power r.f. transistors and their use in r.f. amplifiers for amateur and commercial applications. This is opposed to detailed circuit design and other theoretical considerations of such transistor use which have been covered in a number of articles to date.

*455 21st Place, Santa Monica CA 90402

Fig. 1 - V.h.f. 40-watt power transistor (left); u.h.f. 40-watt power transistor (right). The substance on the underside of the transistors is thermal compound which insures optimum thermal contact with the heat sink for maximum heat transfer.

Everyone is aware of the advent of the solid state age. Transistors have just about replaced tubes in the electronics industry, except for special application areas. However, the technological and economic pressures of today are of such magnitude that even these areas will soon be inundated by the solid state juggernaut. An example of such an area is that of medium power r.f. application. Medium power in this context consists of the range between 25 and 300 watts of key down solid state power amplifier carrier. Such amplifiers almost always consist of from two to six transistors. This includes a driver stage, and/or a pre-driver chain, with a one to three transistor final output stage.

This discussion will focus on six major areas. They include (1) physical and heat transfer aspects, (2) voltage, current, power, cost, and efficiency, (3) printed circut board stripline characteristics, (4) service trouble-

shooting, (5) r.f. power transistor manufacturers' specifications, and (6) r.f. radiation.

Discussion will also center about three frequency bands. They are (a) h.f., 2-30 MHz, (b) v.h.f., 140-175 MHz, and (c) u.h.f., 430-510 MHz, with emphasis upon the latter two bands. The discussion of solid state amplifier operation in these two bands in terms of the transistors per se applies not only to the h.f. band, but includes the microwave bands as well.

Physical and Heat Transfer Aspects

Modern day r.f. power transistors are built with excrutiating attention given to enhanced heat transfer capability. Such transistors are physically capable of such high r.f. power density, in the order of several hundred kw per cubic centimeter, that if they are not sufficiently cooled during operation, they just unforgivingly die away to transistor heaven in milliseconds or less. The transistor is constructed in the manner of an integrated circuit. Up to a few thousand microminiature base and emitter junctions, with a common collector, are laid down on a substrate, with their currents adding so that the whole structure operates at high power, high current, and low applied d.c. voltage. A typical r.f. power transistor input d.c. rating can be of the order of 10 amps at 13.5 volts.

Again, with strict attention paid to heat transfer, some (v.h.f.) power transistors look like dragon flies, as in fig. 1. The head of the dragon fly is the transistor ceramic case. The body is the threaded metal stud and neck, providing heat sink mounting for optimal heat transfer capability to the heat sink. The four wings, juxtaposed in a plane at right angles to the stud body, are the element leads. They consist of one collector lead, with one corner clipped off for lead identification, one base lead opposite the collector lead, and two opposing emitter leads. Grounded or common emitter circuit configuration is almost always used, so that the two emitter leads are immediately soldered onto the printed circuit board ground, as seen in fig. 2.

Another type of power transistor case (u.h.f.) as seen in fig. 1, has no stud body, but consists of a relatively large tub-like ceramic case with a metal bottom to be mounted directly onto the heat sink. Its four leads can be seen jutting out from the case sides, and are juxtaposed like the dragon fly type.

The heat sink is integral with, and occupies about 80 percent of the volume of a typical solid state r.f. amplifier. They are usually made of aluminum, which is anodized mainly to minimize metal exposure to the elements. Their cooling fins are deep so as to provide maximum area for convective heat transfer to natural air currents formed by the heat emanating from the heat sink. This type of heat sink is itself almost all fin. If forced air cooling is employed, the fins can be shallower, thus reducing the overall volume of the amplifier.

These types of transistors essentially dictate printed circuit board construction, and hence usually microstrip design for v.h.f., u.h.f., and higher frequencies. The transistors thread the circuit board at right angles so that their threaded studs neck into the top of the heat sink, and are bolted to the heat sink from the fin side. The transistor leads are soldered to the top side of the board. The circuit board is usually partially two sided, and so its underside is not normally in contact with the heat sink, but shimmed by corner studs so that the transistor leads are horizontally tangent to the board on its top side as seen in fig. 3. Normally, the major portion of heat generated comes from the transistors, so that only they need be in direct contact with the heat sink, with proper thermal considerations including the use of a good grade of thermal compound.*

Since electromagnetic energy is stored in the circuit board dielectric, between the printed circuitry on one side and the ground plane on the other, in the sense of a grounded-half transmission line, only high quality dielectric p.c. boards should be used to minimize dielectric losses. For u.h.f. and higher frequencies, Teflon® dielectric board should be used, even though it costs presently about an order of magnitude more than G-10 epoxy board, for example.

A small torque wrench should be used to fasten the transistor studs to the heat sink. For example, about 8 inch-pounds of torque for a 3/8 inch threaded stud is adequate for optimum heat transfer to the heat sink, and yet not too tight to strain the transistor leads after they are soldered onto the circuit board. Not everyone has this sort of torque wrench, so that tightening the transistor studs with a nut driver, while simultaneously phantasizing about not tightening automobile wheel lugs too tight with a large spanner wrench, during a tire change, should do the trick. The transistors should always be mounted in the heat sink prior to soldering their

*e.g. "Thermal Compound", manufactured by a Wakefield Engineering Co. Wakefield MA 01880, Part No. 120-8

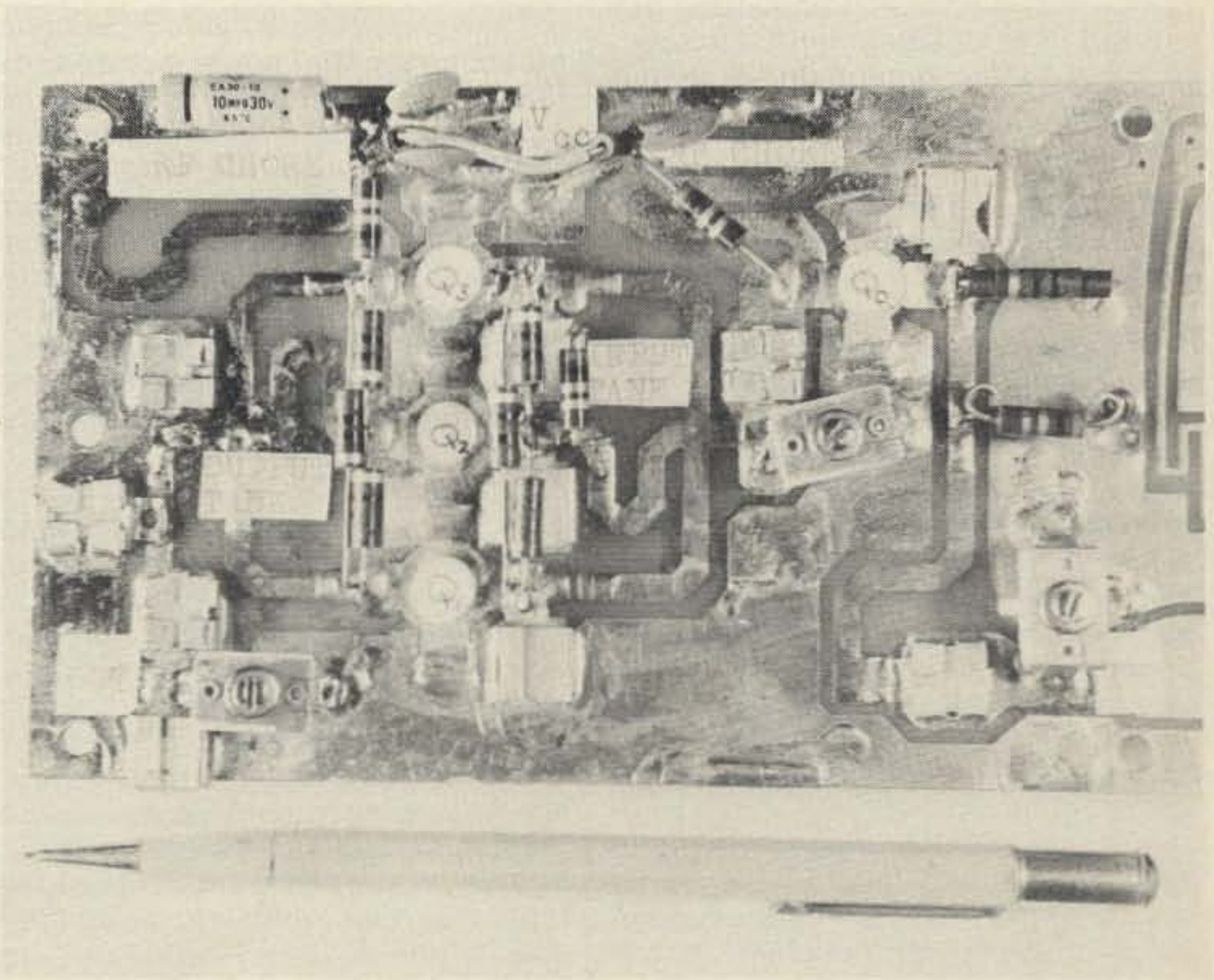


Fig. 2 - Typical printed circuit stripline construction for v.h.f. transistor amplifier. Q_0 is the driver and Q_1-Q_2 are the final amplifier.

leads onto the p.c. board. Further details on this aspect are given in reference 1.

Voltage, Current, Power, Cost, and Efficiency

R.f. power transistors operate at relatively low d.c. input voltages compared to tube equipment. Typical v_{cc} is about 6-30 volts, with currents up to 10 amps per transistor. All circuit impedances are thereby relatively low, 10 ohms is high, except for input and output impedances which are usually 50 ohms. This type of operation has practical advantages and disadvantages, some of which are discussed below.

One practical advantage is that there is simply no d.c. shock hazard. It is difficult to get a d.c. electric shock directly from car battery type voltages and currents. Like a car battery, momentary shorts in the amplifier power terminals produce a lot of sparks, generally with no harm done. Tube power amplifier voltages on the other hand are silent, but can be lethal. However, r.f. burns can be gotten from careless handling of the conducting portions of r.f. power transistor equipment in operation.

Transistor u.h.f. and higher frequency equipment is capable of irradiating naive operators, with what is today termed non-ionizing electromagnetic radiation. This is the case, not because transistors are utilized in such equipment, but simply because the output power in the microwave portion of the r.f. frequency spectrum.

As is well known, not only r.f. power transistors, but transistors in general are very much longer lived than are tubes if handled with care. Transistors are also very much less forgiving than tubes if improper d.c. and r.f. voltages are applied to them in circuitry. Even momentarily applying d.c. input voltage of the wrong polarity to an r.f. transistor power amplifier is about the worst thing a neophyte can do. This glitch immediately zaps all the r.f. transistors, unless very sophisticated defeating circuitry is employed. However, d.c. voltage of the proper polarity is normally applied to the amplifier on standby, with no drive. Tubes are much more rugged in this respect. Old timers can still remember tuning final amplifiers by watching the final tube plates redden in a characteristic manner if off-resonance, while a certain normal reddish color due to over voltage was tolerated.

The specific cost of transistor r.f. output power in dollars per watt is today roughly the same as that of tubes in the frequency ranges under discussion. Specific costs are about $1-$2 per watt of r.f. output, for both tubes and transistors in amplifier applications. V.h.f./u.h.f. commercially built transceiver specific costs are much more, perhaps about $20-$50 per watt of r.f. In this case, however, one is purchasing other transceiver characteristics tham merely power, such as sophisticated frequency determination systems.

Practical r.f. transistor power amplifiers are somewhat less efficient than comparable tube amplifiers due to their additional losses. The additional losses are mainly due to circuit board dielectric loss, less general familiarity with proper v.h.f./u.h.f. microstrip circuit construction, and last, but by no means least, surprisingly little attention and inordinately little common sense applied toward practical heat transfer constructional techniques. A typical class C f.m. r.f. transistor power amplifier is about 60 to 70 percent efficient under the same operating conditions. For example, a typical 100 watt r.f. transistor amplifier will draw about 15 amps at about 13.5 volts d.c. input from the car alternator, and, depending on its input rating, requires about 2-10 watts of drive measured directly at the amplifier r.f. input.

These amplifiers are considered broadband in that power output variations over a small percent of the operating frequency within the design band should be in the order of less than 0.5 dB. This should be, for example, compared to a ±1 dB specification given for the Heath SB104 transistor amplifier transceiver. This specification translates to a spread of r.f. power output from about 79-126 watts for a 3-30 MHz nominal 100 watt rating.

While hopefully not an important consideration in this context but interesting nevertheless, r.f. transistors and transistors in general are very much less resistant than tubes to ionizing nuclear radiation. This includes X-rays, gamma rays, neutrons, and the electromagnetic pulse (e.m.p.) accompanying a nuclear detonation. Transistor beta suffers a large reduction under only mild radiation of this type. Certain military equipment specifications today still call for tubes where transistors cannot be shielded adequately, even though ordinary tube-like applications have long become antiquated in favor of transistors.

Printed Circuit Board Stripline Characteristics

As already discussed, the r.f. power transistor is so constructed that it mates with the heat sink via the circuit board, so that the sink becomes an integral part of the amplifier unit, as seen in fig. 3. Since the circuit board dielectric constants range from about 4.8 for epoxy glass to about 2.55 for Teflon® glass, the speed of the r.f. wave in the dielectric drops respectively by factors of $1/\sqrt{4.8}$ to $1/\sqrt{2.55}$, i.e., from 45.6 to 62.6 percent of that in free space. This means that the wavelength in the circuit board dielectric is shorter by these percentages than that in free space. For example, a two meter eighth wave stub at 150 MHz would not be 25 centimeters (9.8 inches) long, as it is in free space, but 25 × 0.456 or 11.4 centimeters (4.5 inches) long in and on an epoxy board, and 25 × 0.626 or 15.65 centimeters (6.2 inches) long in and on a Teflon® board. The point is that the shrunken wavelength on the circuit board is exploited in the short lengths required for amplifier circuit inductances. In fig. 2, it is seen that both the input and output circuit board "tank circuits" consist of line inductances whose lengths in free space would be far too short to supply the required inductance in this amplifier configuration. Hence, ordinary solenoidal inductances with their relatively increased losses would be mandatory instead. The wiggly line p.c. board tracks at the upper left and upper middle of the circuit board in fig. 2, are simply r.f. chokes. Resistors in parallel with these chokes would then constitute parasitic suppressors. Most v_{cc} input leads are brought to the board from underneath, i.e., between the underside of the board and the heat sink.

The low-ohm small (¼ watt) resistors spanning across the input (base) and output (collector) sides of the final amplifier stage are used for current balancing or ballasting, in the same sense as resistors connected across power supply diodes, and associated capacitors, aid in load balancing.

Postage stamp type low inductance fixed capacitors are used in such amplifiers, as seen on the circuit board of fig. 2 Variable capacitors used are small low loss steatite trimmers.

Teflon® board is actually glass cloth impregnated with Teflon® to make a Teflon® fiber glass, with a relatively low dielectric loss factor of about 0.0004. Similarly, manufactured

G-10 epoxy glass board has a relatively high dielectric loss factor, about 0.0016, so that its use is confined to frequencies no higher than low L band or u.h.f. applications. In the book "Stripline Circuit Design" by H. Howe Jr., Artech House Inc., Dedham, Mass., 1974, G-10 epoxy glass board is relegated to the "other materials" section of his chapter 1 on quality circuit board materials.

An interesting question has to do with the maximum power that a stripline amplifier is capable of producing. For very high power applications, such as megawatt radar amplifiers or special high power military over-the-horizon communication transmitters, stripline systems fall short, so that air or vacuum waveguide and similiar coax equipment must be used. The main reasons are dielectric breakdown within the board, and limiting allowable electric field concentrations at the edges of the board tracks. Approaches to high power can be made by avoiding sharp edged tracks and minimizing high v.s.w.r. to avoid high r.f. voltage nodes.

Peak powers that p.c. board transistor power amplifiers can sustain are not known with certainty because of power measurement difficulties. Observed maximum powers have been on the order of 25-40 kw of r.f. for specially constructed thick (¼ inch) boards in the vicinity of L band frequencies. A practical upper limit on peak power using stripline circuit board construction is estimated to be about 5 kw. Average powers would be somewhat lower, and would depend on allowable temperatures and temperature rise of the board dielectric, as well as the thickness and thermal properties of the track etch material.

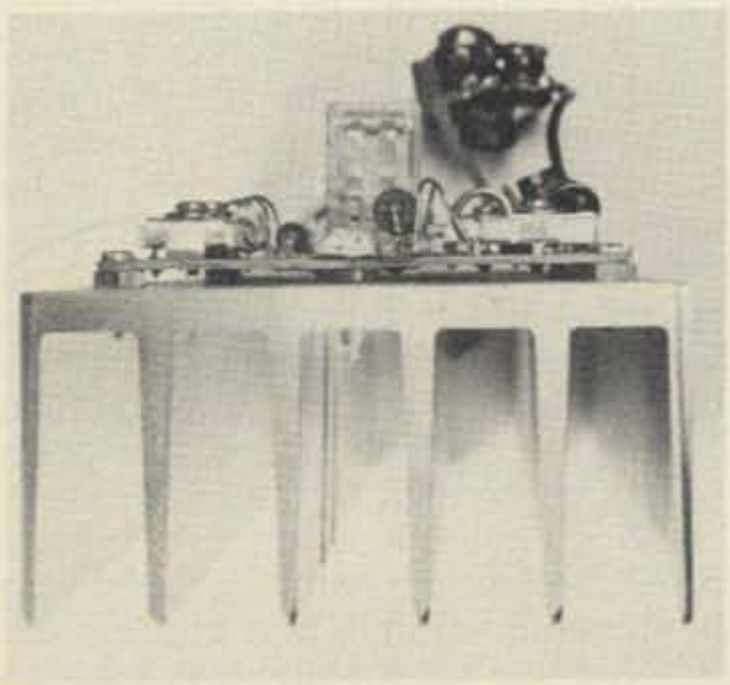


Fig. 3 - Vertical section of a v.h.f. stripline amplifier depicting integration of transistors, p.c. board and heat sink.

Follow up!

More On The Versatile All-Band Antenna Tuner

BY JOHN J. SCHULTZ*, W4FA

The article "A Versatile All-Band Antenna Tuner" which appeared in the August, 1978 issue of *CQ* appears to have struck a responsive chord judging by the number of letters received concerning it. Apparently some newer builders did not fully follow the description presented of the binding post matrix in the article; this brief follow-up article is intended to amplify some of the details of the tuner and to present some further practical hints regarding its construction.

*Tangier (VOA), Dept of State, Washington DC 20520

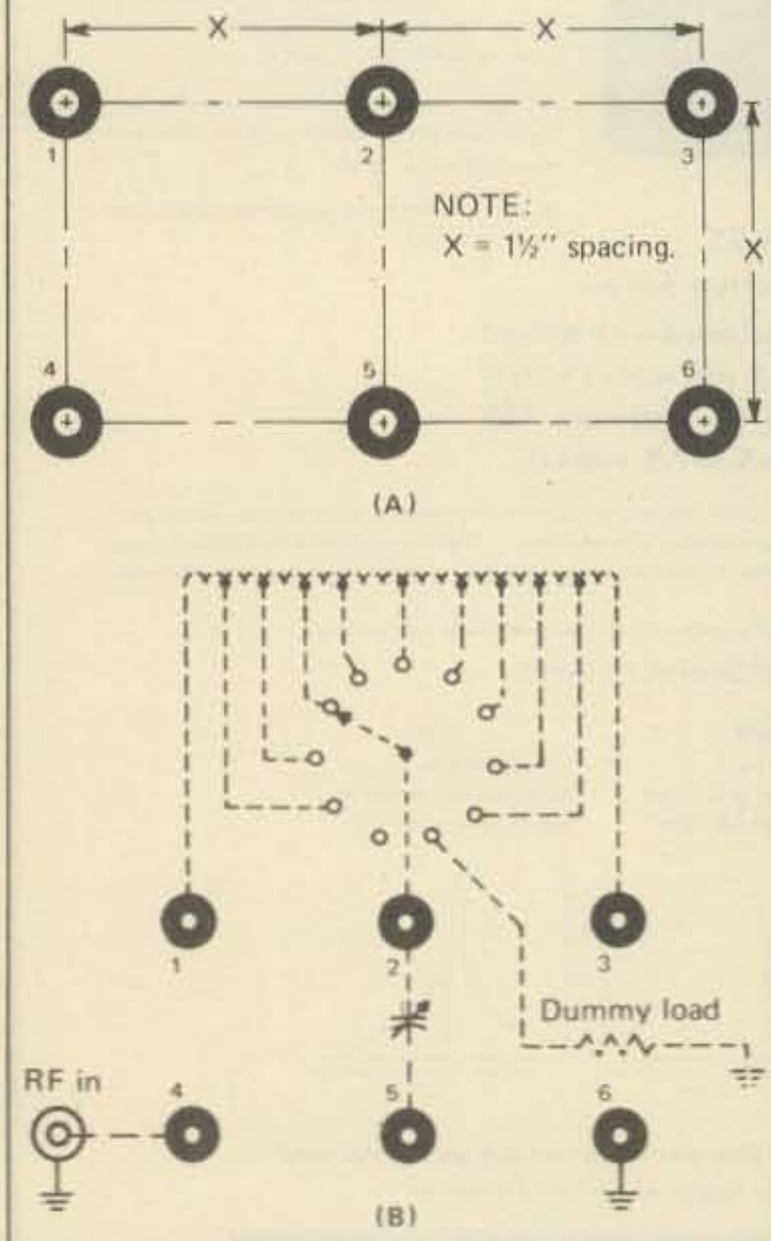


Fig. 1–The binding post matrix as it would be arranged on the outside rear panel of a tuner enclosure (A). At (B) the dashed lines show the internal connections to the components mounted inside the enclosure.

Binding Post Matrix

The binding post matrix is something that one constructs by arranging six ordinary "5-way" insulated binding posts on a suitable panel as shown in fig. 1(a). The panel used would usually be the rear of the housing used for the antenna tuner. The spacing "X" can be any convenient spacing to suit the size of the panel or enclosure available - from ¾ to 1½ inches, for instance. The connections of the tuner components to the matrix is made as show in fig. 1 (b). Binding post #1 is permanently connected to an input SO-239 coaxial connector. Binding post #6 is permanantly connected to ground (chassis ground) and also serves as the connection point for an external ground wire for an antenna system. The variable capacitor, which must be insulated from ground, is permanently connected to binding posts #2 and #5. The inductor is permanently connected to binding posts #1 and #3. The contact arm on the inductor switch is permanently connected to binding post #2. These permanent connections are, of course, soldered to the pins of the binding posts which extend into the antenna tuner enclosure. Now, from the outside of the enclosure, one can interconnect the binding posts by means of "links" to form various antenna matching networks. The binding posts which must be interconnected to form a variety of matching networks is shown in fig. 2. The "links" are nothing more than cutouts from sheet copper to fit binding posts with the "X" spacing. Since only horizontal and vertical interconnections are necessary, all the links can be of the same size. The main advantage of the "links" over ordinary wire interconnections, which also can be used, is that they allow stacked connections at a binding post when necessary. For instance, binding post #1 in the first circuit of fig. 2. The output lead, say to a single wire antenna, utilizes a banana plug so it can be plugged into the top of the desired binding post. If coaxial cable is used on the output, one banana plug can function to connect the center conductor to the desired binding post and another banana plug is used to connect the shield to binding post #6 (ground).

The matching circuits possible with the interconnections shown on the binding post matrix offer a great deal of versitility. More complex circuits, such as pi and T networks, are possible by using fixed values of external capacitors which can be plugged into the mtrix by means of banana plugs.

Inductor

It is possible to substitute an air-wound inductor for the original toroid inductor used. One gains a bit of constructional convenience since coil stock can be used but the tuner becomes a bit larger since more space is needed to achieve the same amount of inductance. In any case, equally excellent operational results can be obtained. For instance, the B&W #3022 Miniductor is particularly suitable. It has 1¾" diameter, is 4' long as purchased from stock and has 8 turns/inch. The stock length has an inductance of 16 „H which makes it suitable for general 80-10 meter use in the tuner. To extend the tuner range to 160 meters, a B&W #3019 Miniductor is suitable (1¼" diameter, 4' stock length and with 16 turns/inch). The inductors are available at $2.35 and $2.15, respectively, from the parts source mentioned in the original article (G.R. Whitehouse & Co.). If a single pole, 12 position switch is used with the inductor and the first position left free and the last position connected to an internal dummy load, there will be ten positions available for tapping the coil. The coil can be divided into 11 approximately equal sections for the tap

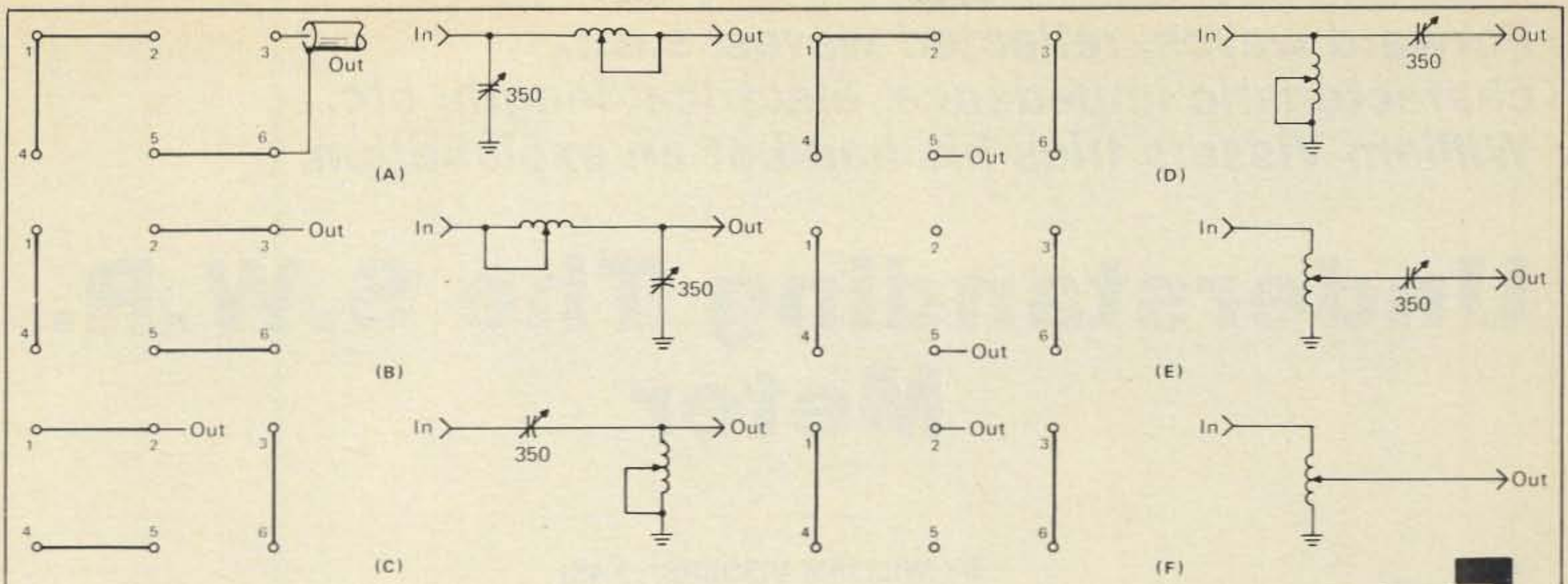
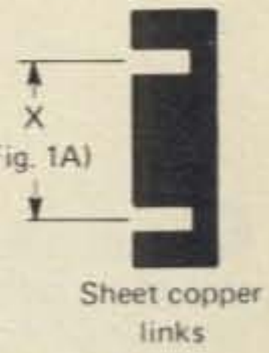


Fig. 2—Five matching networks that can be developed by strapping together the binding posts with links or just with wire.



points although spreading the tap points to be a bit larger on one end and smaller on the other end on the inductor is preferred. The reason for leaving the first switch position free is so the variable capacitor (one side of which is permanently tied to the switch arm on binding post #2) can be used alone in series with an antenna, if desired. The dummy load is wired to the last switch position. By putting the switch in this position and strapping binding post #2 to #5 and #5 to #4, one can access the dummy load alone. If none of these extra features is desired, all 12 switch positions should be used for tapping the inductor.

Dummy Load

Although a single resistor dummy load is preferred, it is sometimes difficult to find the proper non-inductive resistor. A quite satisfactory dummy load can be fabricated by paralleling 16 820 ohm, 2 watt carbon composition resistors. The combination will present about a 51 ohm impedance for use with the usual 52 ohm transmitter output impedance. The resistors themselves total only 32 watts dissipation but they are suitable to handle the output of any 100 watt class transmitter, provided power is applied only for short periods for tune-up purposes. One should not construct the resistors in one long, parallel chain but rather in two eight resistor groupings as shown in fig. 3. This is easily done on a small 2″ – 3″ piece of perforated board stock. If the resistors are tightly grouped together and the wiring kept short, performance will be good down to 10 meters.

Switches

As was mentioned in the original article, steatite insulated switches are preferred, if one can obtain them at a reasonable cost. But the Mallory #311112J or 32112J inexpensive instrument switches (both 1 pole, 12 position) were reported as providing excellent service up to the 150 watt transmitter output level as long as one does not keep the transmitter keyed while changing switch positions.

Balanced Line Output

Coupling into a balanced line is possible, of course, by using a plug-in balun on the binding post matrix. The Amidon balun kit is readily available and one can house it in a small, unshielded enclosure with two fix-spaced banana plugs on the input side to fit into the binding post matrix and two terminal posts on the output side for transmission line connection. Note from fig. 2 that the balun can then be plugged directly into the output of five of the six matching networks shown. That is, one banana plug going to the "out" binding post and the other one to the #6 (ground) binding post.

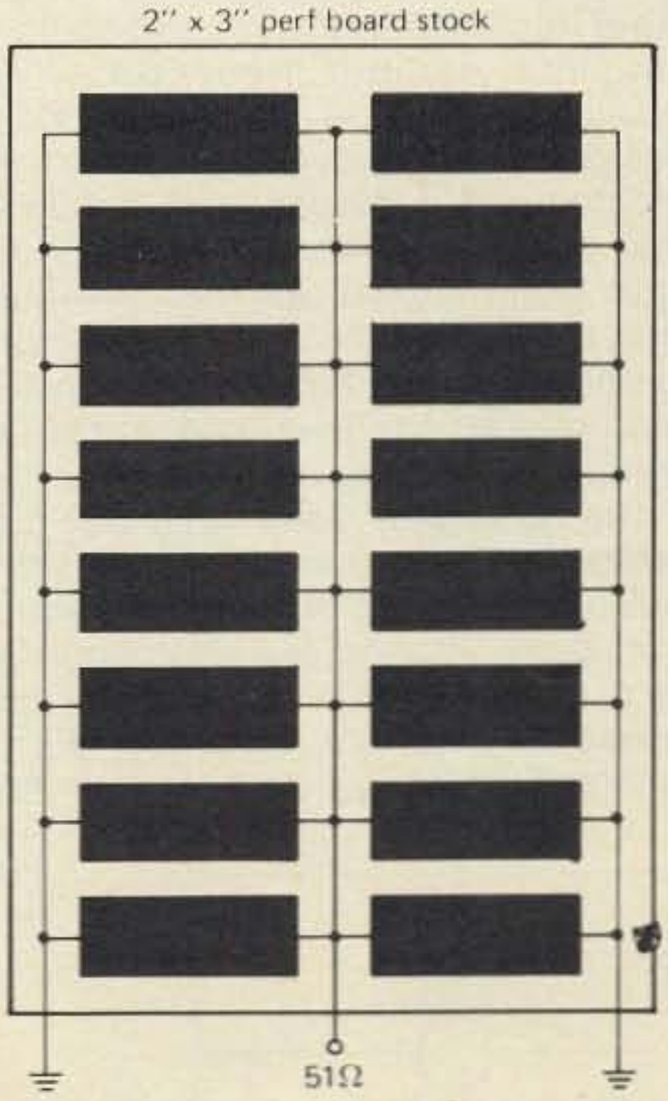


Fig. 3—Arrangement of sixteen 820 ohm resistors to form a dummy load. The two grounds shown should be close together, or better yet, each ground lead should go to the same ground point.

Tuning

The fact that the antenna tuner provides such a variety of interconnections had lead to a bit of confusion on the part of some users. This can be avoided if one first tries the first two matching networks of fig. 2, notes switch and capacitor positions and then goes on to trying other circuits, adding external fixed capacitrs, etc. The criteria is to achieve a 1:1, or nearly 1:1, s.w.r. between the transmitter and the tuner while simultaneously achieving a match to the antenna which wastes a minimum of power in the tuner. Generally speaking, the matching network that utilizes a minimum of inductance and a maximum of capacitance to achieve a clearly tunable match to an antenna (as indicated by the s.w.r. meter between the transmitter and tuner) will be the best one. Having a dummy load available is a great convenience in this process since one can first set up the transmitter working only into the dummy load. Then, when an antenna is being matched, the transmitter output controls are left alone and one can concentrate on adjustment of the antenna tuner settings.

Forward waves, reflected waves, s.w.r., characteristic impedance, electrical length, etc. William Vissers tries his hand at an explanation.

Understanding The S.W.R. Meter

BY WILLIAM VISSERS*, K4KI

Often one of the most difficult things to do is to mentally visualize a somewhat complex physical process. And nowhere is this more true than in trying to understand exactly what a s.w.r. meter or r.f. wattmeter is doing when it measures what is called forward and reflected power, and the subsequent calculation of s.w.r. It sort of reminds me of my dad, an emigrant from the Old Country, who when asked by a local yokel as to how he could prov e
that the world was round, thought a bit, smiled and said, "Well, it's gotta be round, because that's the way the heels of my shoes wear out." And so to avoid believing the right thing for the wrong reasons, I thought it might be interesting to figure out exactly what a s.w.r. meter actually measures.

Too often we are subjected to erudite and learned dissertations on power traveling both forward and backward on our transmission lines. That is about as incomprehensible to me as trying to visualize water in a pipe travelling in two directions at the same time. If we could but visualize and wanted to perform a simple, easily understood experiment, perhaps we'd better understand what goes on when we use our s.w.r. meter. The experiment we will outline will act as if we never heard of travelling waves. At first we won't even mention antennas or transmission lines. In other words we will start with a clean mental slate.

Let's look at the primitive bridge circuit of fig. 1 connected to our transmitter. And as we are going to use 50 ohm coaxial cable for our feedline, let's design our bridge so that each known leg is 50 ohms. We designed our bridge this way because we all know that a s.w.r. meter or r.f. wattmeter of that type is designed for a specific feedline impedance. If you try to use a s.w.r. meter designed for 50 ohms line impedance with some other line impedance you are going to run into trouble right off. Your readings will be incorrect. So I designed it the way I did to avoid any problems. No diodes and networks that couple the meters to the bridge have been shown, as they are common to all s.w.r. meters. I've only tried to show the basic bridge elements to keep this article as simple and yet as comprehensive as possible.

The unknown load will be connected from A to B as shown. And let's pick a simple load to keep our calculations easy. 25 ohms is a good figure so we'll use that. This basic meter can measure what we call E_{ref} for E reflected, and E_{fwd} for E forward. And since any meter which readings voltage can be calibrated to measure power, we now have a basic method of measuring forward and reflected voltages and powers, and calculating s.w.r.

Now right away there are going to be questions. The first one probably is: How can you call the measurements forward and reflected power when we don't have an antenna and transmission line connected, and instead are just using a load connected right at the transmitter. The answer to that one is simple. The bridge doesn't have eyes, and doesn't know that is isn't connected to an antenna/transmission line system with impedance Z. All it knows is that it is connected to an unknown impedance Z and from two voltages called E_{ref} and E_{fwd} we can calculate some data called forward and reflected power, and also something called s.w.r. And these measurements would be exactly the same whether or not the connectors were to an antenna system of Z impedance or to a lumped impedance load of constant Z connected directly to the bridge output. Naturally the impedance Z will have to be the same in both cases to get the same results.

This brings us to a very important point. If we visualize the antenna/transmission line just as an ordinary impedance connected to the simple bridge, and realize that the measurement are just indications of an impedance mismatch, then we don't have to worry about such things as reflections on our line, or such things as power travelling in two different directions. We could if we wanted to call the two voltages by any other name, but as long as convention and practice have designed the two voltages as E_{fwd} and E_{ref}, out of deference to the ivory tower theoreti-

*1245 S. Orlando Ave., Cocoa Beach FL 32931

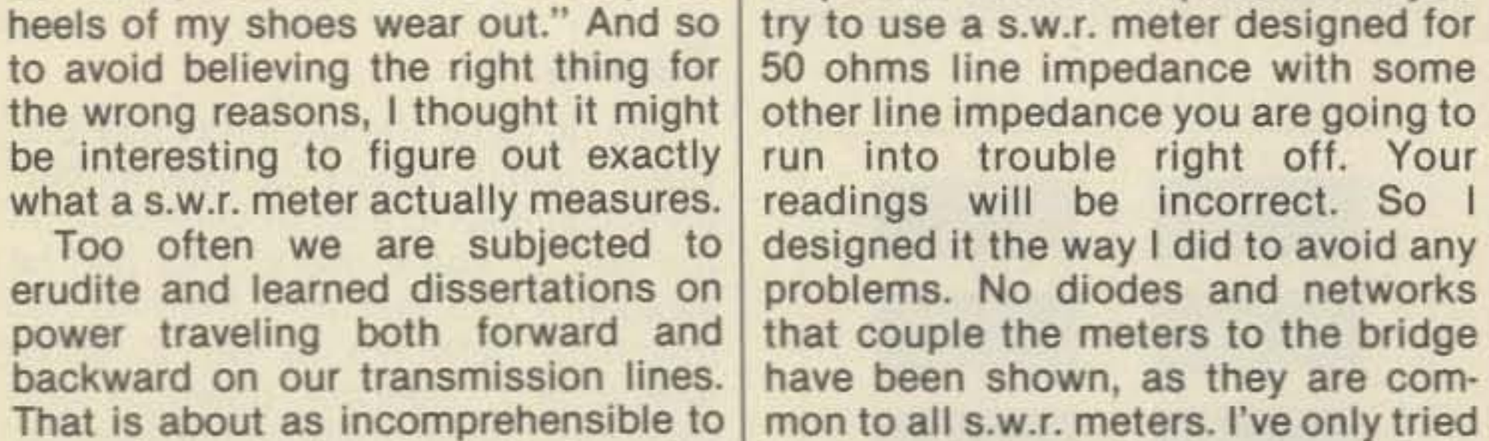


Fig. 1 - A "primitive" bridge circuit.

cians who started it, let's leave the meters be called forward and reverse voltage, or forward and reverse power if we calibrate them that way.

One other immediate objection will be that a r.f. meter that you buy does not have three 50 ohm resistances that will absorb and lose a lot of power. That is absolutely correct. The commercial s.w.r. meters or wattmeters we use and are acquainted with generally are made up of reactance networks and a transformer that takes the place of our three 50 ohm resistors. But their bridge action is exactly the same as the simple meter we have described, as they too wind up with measurements of E_{fwd} and E_{ref}. The commercial units absorb only a minute amount of power. However, since the bridge shown is very easy to visualize and to make calculations with, let's stick to it for the sake of explaining some very basic concepts.

If we assume a transmitter output of 100 volts and if we assume the voltage indicators do not absorb any appreciable power, we can easily calculate E_{fwd} and E_{ref}. The total resistance of the two resistors CD + DE is 100 ohms, so the current through them is one ampere. And by Ohm's Law the voltage across CD will be E = IR = (1) (50) = 50 volts. And the forward voltage is nothing more than the transmitter voltage minus the voltage across CD or 100 – 50 = 50 volts. Now the total resistance of the two resistors GH + AB is 50 + 25 = 75 ohms. And the current through them is I = E/R = 100/75 = 1.333 amperes. Now the voltage across GH can be calculated as E_{GH} = IR = (50) (1.333) = 66.67 volts. And looking at fig. 1 you see that the voltage from D to H, which is the reflected voltage, is actually the difference of the voltages across the two resistors GH and CD, or 66.67 – 50 = 16.67 volts. So the reflected voltage is 16.67 volts and the forward voltage is 50 volts.

Now it is easy to calculate s.w.r. as it is defined as s.w.r. = E_{fwd} + E_{ref}/E_{fwd} – Eref. (reference: *Transmission Lines, Antennas, and Wave Guides;* King, Mimno, Wing; McGraw Hill Book Co.) s.w.r. = 50 + 16.67/ 50 – 16.67 = 2:1. So we have calculated s.w.r. without even having an antenna/transmission line connected! And if by chance you had an antenna/transmission line system whose impedance was exactly 25 ohms, you could connect to your s.w.r. meter and you would get exactly the same results. So you see how easy it is to understand s.w.r. without worrying about the complicated concept of reverse and forward travelling waves. And if now the meters were calibrated in terms of forward and reflected

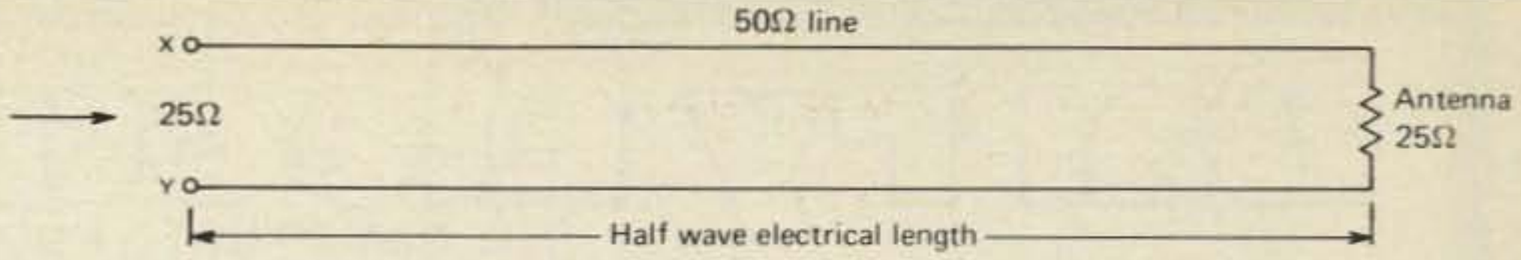


Fig. 2 - A half wave (electrical) length 50 ohm transmission line terminated in a 25 ohm load.

power, we could easily find the forward and reflected power ratio, which varies as the square of the voltage ratio.

Now, if we have changed the line length from a half wave to a quarter wave and the input resistance has changed from 25 to 100 ohms, and we applied the antenna system to our s.w.r. bridge, would the s.w.r. change? The answer may be a surprise. The s.w.r. will still be 2:1 as it was when the load was 25 ohms. The bridge circuit with the 100 ohm load is shown in fig. 4. I won't go through all of the calculations again except to show that the voltage across GH is now 33.33 volts. The voltage across CD is still 50 volts. The voltage from D to H is 50 – 33.33. = 16.67 volts, which is exactly the same as it was when the load was 25 ohms. And as the voltags E_{fwd} and E_{ref} are still the same, the s.w.r. is still 2:1. The signifigance of this perhaps surprising result is that changing the length of the feedline does not change the s.w.r. And isn't that about the easiest proof you've ever seen? And we never even mentioned reflected waves or anything complicated like that.

Our discussion has naturally been limited to a lossless transmission line, no proximity effects, or unbalanced lines which can slightly affect the s.w.r. The aim of this explanation was to go into some of the basics in a simple manner that will take all of the mystery of how a s.w.r. meter works. One last item. If you were either to short points A and B or leave them open you would find that in those two extreme cases that the forward and reflected voltages measured would be both be 50 volts, and the forward power would be equal to the reflected power, the power output would be zero, and the s.w.r. would be infinite. True power under all conditions is equal to forward power minus reflected power.

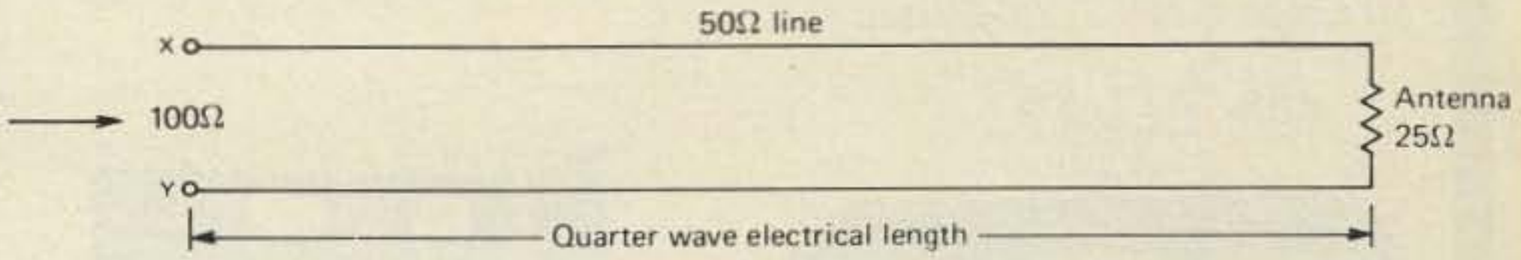


Fig. 3 - A quarter wave (electrical) length 50 ohm transmission line terminated in a 25 ohm load.

And as was mentioned, even though we have shown the examples for resistive loads, the same theory and results will hold for complex loads composed of resistance and reactance, more representative of a true antenna system.

$$P_{fwd}/P_{ref} = (E_{fwd}/E_{ref})^2 = (50/16.67)^2 = 9:1.$$

So we would see on the wattmeters that the forward power would be nine times the reflected power, which is the power ratio for a s.w.r. of 2:1. And this is a handy ratio to know since many manufacturers caution about running their equipment with a s.w.r. of more

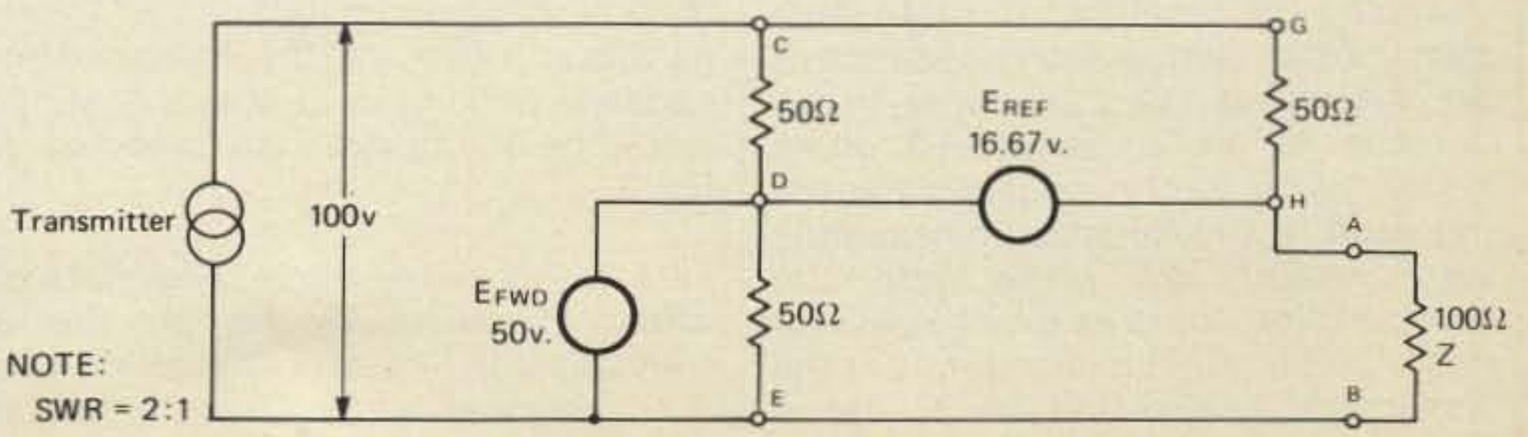


Fig. 4 - Bridge circuit with a 100 ohm load.

than 2:1. The higher the s.w.r. the lower will be the ratio of forward to reflected power.

Feedline Considerations

Without going into a lot of transmission line theory we are all aware that changing the length of the transmission line can change the impedance of the system at the transmitter if our antenna is not a perfect 50 ohms match for the 50 ohm coaxial cable being used. If the antenna for example were exactly 25 ohms and the transmission line is an exact electrical half wavelength, the impedance at the transmitter end would be 25 ohms. This is shown in fig. 2. If we were to measure with a r.f. bridge between points X and Y we would find it to be 25 ohms. And we already know that the s.w.r. for a 25 ohm load is 2:1. Now if we were to shorten the line to an electrical quarter wavelength and again measure the impedance between points X and Y we would be in for a surprise. Even though the antenna was still 25 ohms, the measured impedance looking in at points X and Y would be 100 ohms. This is shown in fig. 3.

Now this rather interesting state of affairs is caused by the fact that a transmission line acts essentially like a transformer whose transformation ratio, among other things, is dependent upon the length of the line. What happens is that changing the line length changes the impedance we see at points X and Y for a given load. For a quarter wave length section the impedance transformation is $Z_C = (Z_{load})\ (Z_{input})$, where Z_C is the impedance of the line, which is 50 ohms. And Z_{load}, which is the antenna, is 25 ohms. If we solve for Z_{input} we would find it to be $Z_{input} = Z_C^2/Z_{load} = (50)^2/25 = 100$ ohms. The example just shown was made simple to illustrate a principle. If a line length other than a quarter or half wave length were used the answers would not be as easy to calculate. Or if the antenna load were not a pure resistance, the calculations would be a bit more difficult.

a monthly feature by

IRWIN MATH, WA2NDM

Math's Notes

A look at the technical side of things

For a bit of a change of pace, we have some interesting circuit applications for you this month. One, at least, I am sure will bring a chuckle.

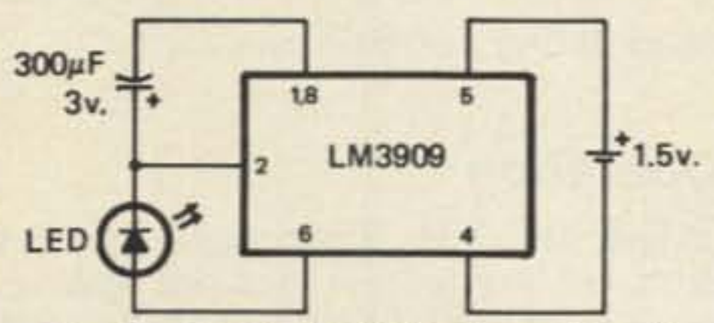
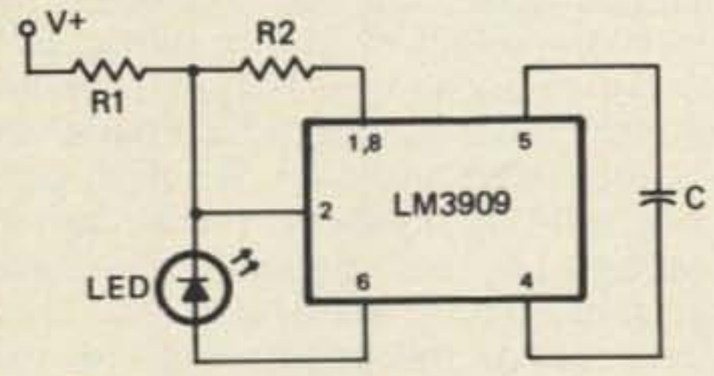


Fig. 1 - Basic 1.5V flasher circuit.

First of these is the use of a widely available integrated circuit flasher, the LM3909. This I.C. is an oscillator designed to drive a light emitting diode directly with an input power of only 1.5 volts DC, fig. 1 shows the basic hookup for the flasher. It is self starting and only requires the application of power to flash the LED at a one hertz rate.

Power consumption is quite low for this circuit and an AA cell will power the device for 3-6 months while a D cell would increase to about 1.5 years! A circuit such as this could easily be encapsulated in epoxy and used as a low cost emergency locating aid (in the dark) for fire extinguishers, boat moorings, or even wired into a flashlight. There is enough room to mount everything under the battery spring.

*5 Melville Lane, Great Neck, N.Y. 11020



V+	Flash rate	C	R1	R2
5-25	2Hz	400µF	1.5K	1K
13-50	2Hz	180µF	1K	3.9K
80-200	1.7Hz	180µF	1K	43K 1w.

Fig. 2 - Circuit for high voltage operation.

For operation on voltages other than 1.5 volts, refer to fig. 2. Here the circuit is slightly rearranged, however, it can drive an external transistor, if desired, to flash an incandescent load or higher power load instead of the LED. This is shown in fig. 3. When using the circuit be sure that the Vext supply and transistor are both adequate for the external load.

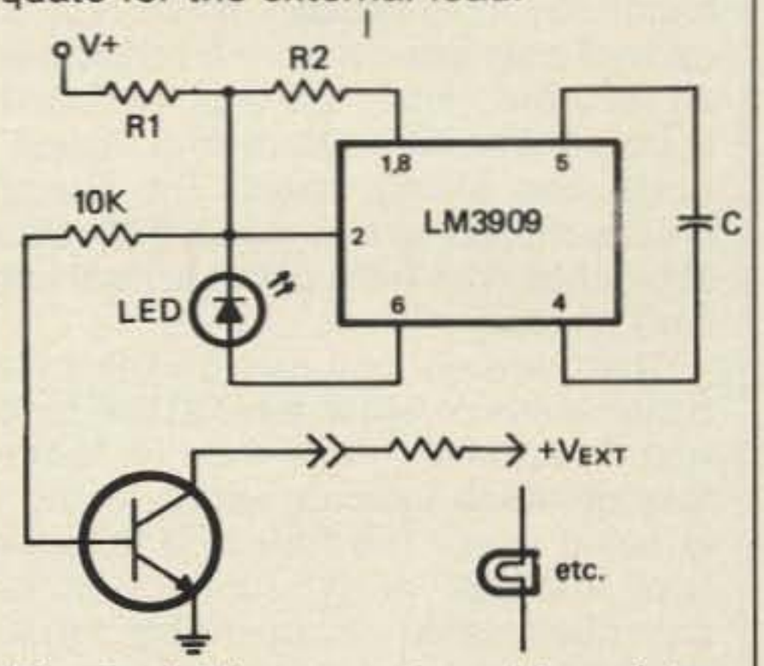


Fig. 3 - Adding an external transistor to fig. 2 for heavier loads.

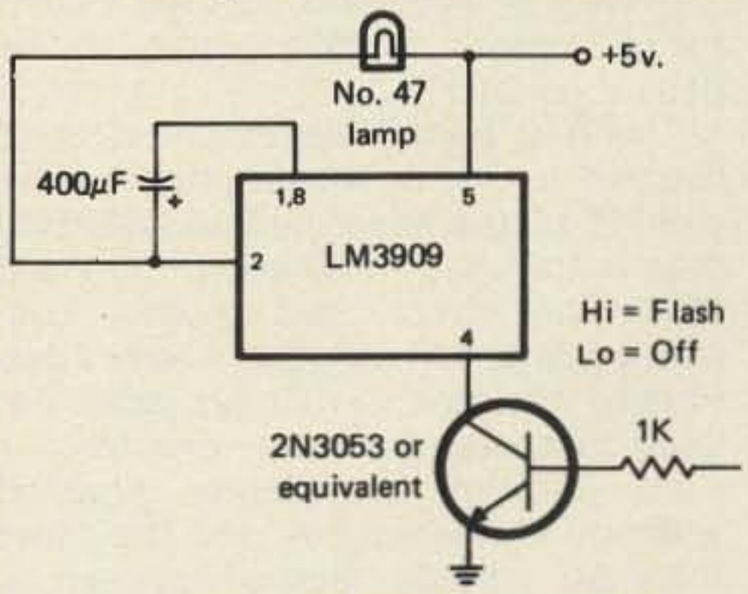


Fig. 4 - Digital logic flasher.

Another application for the LM3909 is shown in fig. 4. Here the device is used as a warning indicator in digital circuits. A high signal turns the external transistor on and flashes the warning light while a low logic level keeps it off. Any NPN transistor can be used instead of the 2N3053 shown but be sure it can handle the lamp load current.

Finally for those who must have a variable flashing rate, we refer you to fig. 5. For this unit we have gone back to the 1.5 volt circuit. By adjusting the 2.5K potentiometer the circuit can be made to flash from zero to 20Hz. Such an arrangement would be a good addition to a toy, or the basis of a continuity tester. This would only require the

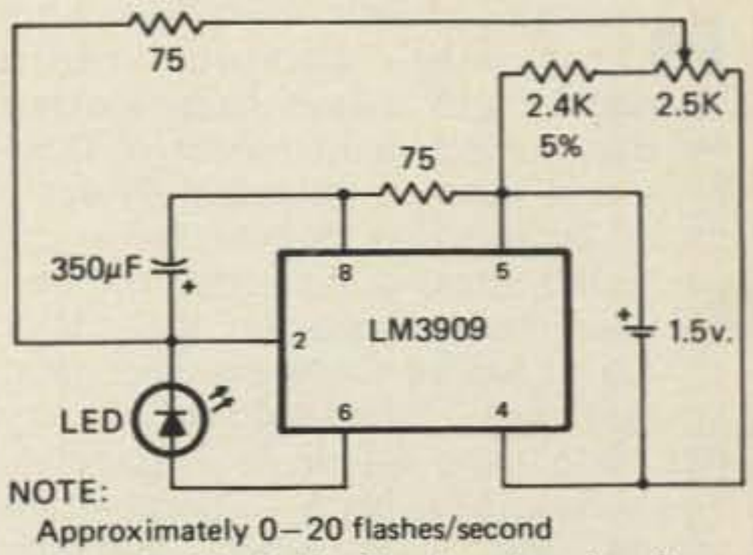


Fig. 5 - Variable flash rate circuit.

test leads to be in series with the 1.5 volt cell. If there is continuity, the LED flashes, if not—no flash.

The circuits given here for the LM3909 have been derived from the National Semiconductor data sheet on the device. There are many more circuits that could be used with the IC and you should get a copy of this sheet if such a device "turns you on."

Now for the chuckle! *MICROWAVES* Magazine, an industrial trade journal, recently (November 1978 issue) published a compilation of unusual circuits that were the result of a contest sponsored by one of their advertisers. One of these is shown in fig. 6. Believe it or not, this device is a fish lure made out of a burned out D.I.P. The leads are bent to look like legs, a fish hook is epoxied to the bottom of the drip and camoflauged with string, and a flourescent tape strip to attract the fish.

I hope the above information is useful to you and would like to hear your comments. 73, Irwin, WA2NDM

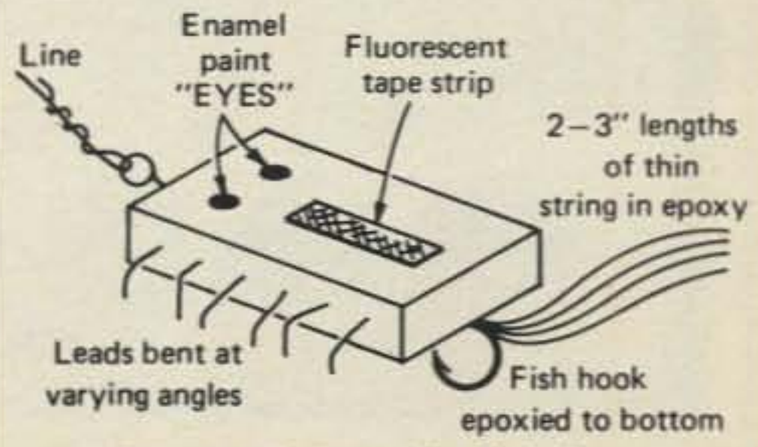


Fig. 6 - Unique dip fish lure.

CQ Reviews: The MFJ-484 *Grandmaster* Memory Keyer

BY IRWIN SCHWARTZ*, K2VG

Historically, amateur radio operators have always been looking for that perfect combination of flexibility and ease of operation in every mode. Today's c.w. station, for example, is the result of a steady evolution of equipment. Consider the major genera of Morse Code sending gear: straight key, "semi-automatic" key (the "bug") and iambic keyer paddles. There have also been some aberrant efforts (the "side-swiper" and the "fingertip" key, for example). Each effort has contributed to the art and science of sending more perfect c.w.

However, the most outstanding tribute to the mode has been the electronic keyer. It, too, has had a long developmental history. From its humble beginnings as a "dot and dash generator" (tubes, of course!) to today's sophisticated multi-functional solid-state units, the electronic keyer has rightfully earned a permanent niche on the amateur's operating bench.

Among today's contributors to electronic keyer development is MFJ Enterprises, Inc. Their latest effort is the new MFJ-484 *Grandmaster* memory keyer. The 484 is a state-of-the-art, versatile and reliable unit.

*Technical Editor, *CQ*

Description

The MFJ-484 *Grandmaster* memory keyer contains fifteen integrated circuits and four random access memories. It is housed in the type of cabinet that has come to be typical of all MFJ products - the familiar baked-paint cabinet trimmed with a "wood" finish and plastic sides. The *Grandmaster* measures a compact 8W x 6D x 2H inches. The front panel is neat and easy to read.

There are six controls on the front panel, some of which have a dual function. In addition, there are five LED's, four of which indicate which memory is being used. The fifth LED tells the user that the "delay" function (to be described later) is operating. Also, there are five momentary switches, of which four are used to select one of the four memories and the fifth is used for a "reset" function (also to be described later.

The rear panel has mounted on it five jacks. One of these, of course, is used to plug a keyer paddle into. Two others are used to select either "grid block" or "direct" keying when connecting the 484 to your transmitter. Finally, the two remaining jacks are used to power the unit - one for 117 v.a.c. (through an adapter supplied with the *Grandmaster),* and the other for a d.c. input voltage of between 12 and 15 volts. This latter jack can be used during portable operation.

The MFJ-484 Grandmaster *Memory Keyer.*

Operation

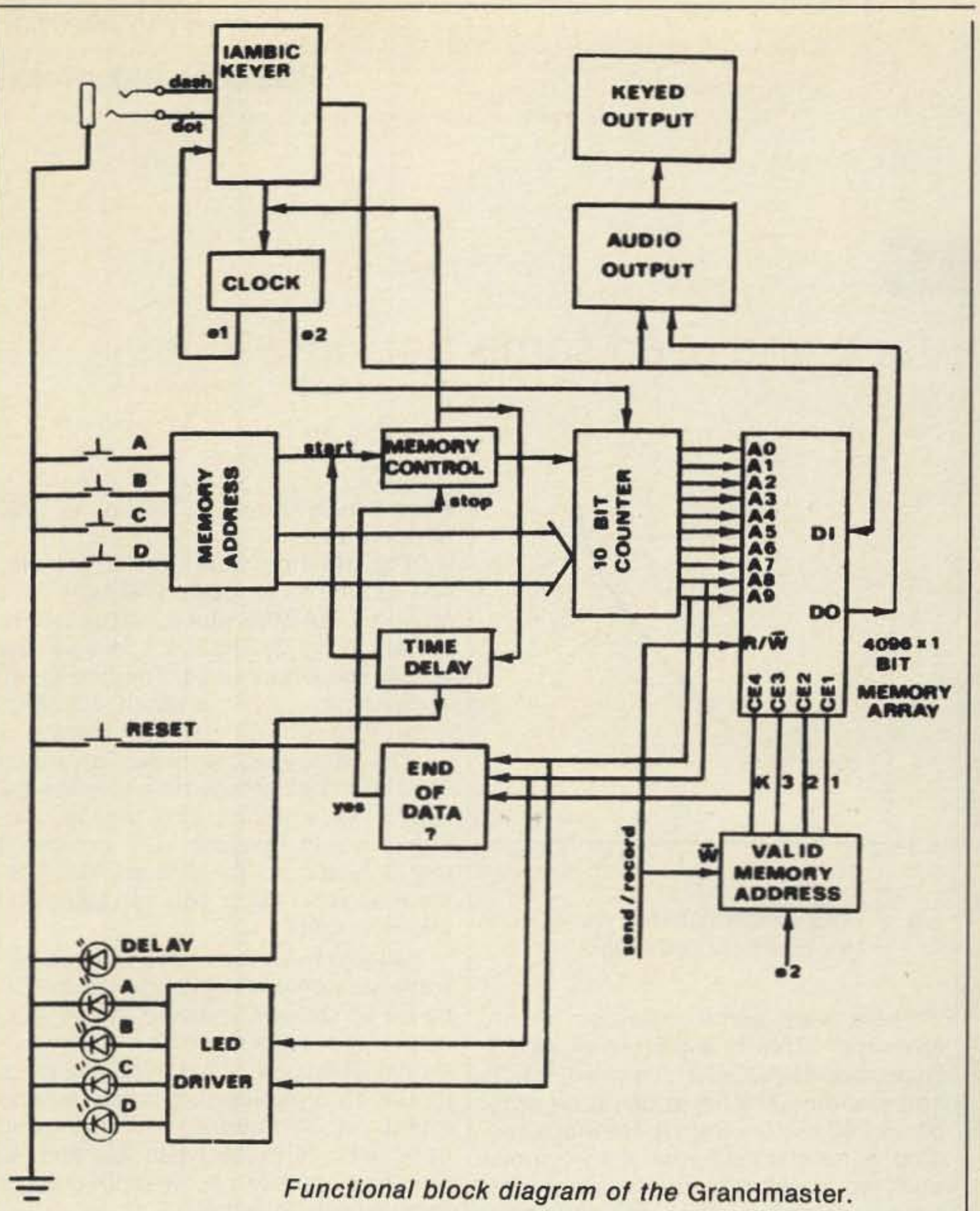
The MFJ-484 *Grandmaster* comes with an instruction booklet that is easy to follow. I learned how to use every function of the keyer in one sitting. It is simple to operate and its flexibility immediately becomes apparant.

The *Grandmaster's* electronics can be divided into two parts. One is the basic keyer and the other is the memory.

The keyer section features variable speed (8 to 50 w.p.m.), a weight control (variable down to "weightlessness' - a strict 1:3:1 ratio), a tone control (to change the pitch of the built-in monitor note) and a volume control which can, as MFJ advertises, supply "room filling volume."

It is the memory section of the 484, however, that makes the *Grandmaster* what is is. There are three *memory select* positions. Each of these three positions is split into four *memory addresses.* The memory select positions are labeled 1, 2, and 3. The memory addresses are labeled A, B, C and D. There are, therefore, twelve different memory "banks" from which the user can choose. If, for example, the memory select switch is turned to 2 and memory address button C is pushed, the message stored in "bank" 2C is recovered and sent. A fourth position on the memory select switch, labeled K, automatically combines memory addresses A, B, C and D for very long messages (up to 100 characters). Pulling out the "weight control" knob automatically combines messages A and B in succession.

Another interesting feature of the *Grandmaster* is that the user can have the unit not only endlessly repeat any stored message, but also separate the repetitions by any amount of time from 0 to 2 minutes. This is accomplished by pulling out the "delay"



Functional block diagram of the Grandmaster.

knob and turning it to the desired delay time.

A "reset" pushbutton will instantly stop the memory from operating. The memory can also be interrupted by tapping the keyer paddle. To start the memory again just push the appropriate message button. In this way, a stored message can be sent over the air and the operator can interject whatever he wants, whenever he wants, manually - a very nice feature.

Since the *Grandmaster* contains a volatile memory (loss of memory when power is turned off) you may think that it must be on all the time to avoid programming it every time you use it. Not so.

A further refinement of the *Grandmaster* memory keyer is its "memory saver." The keyer can be made non-volatile by switching in a 9 volt alkaline battery (not supplied with the keyer) when the power is switched off. In that way none of the program is lost -unless, of course, you *want* to change it. The battery is connected inside the cabinet.

Conclusions

The MFJ-484 *Grandmaster* memory keyer is a very versatile and functional piece of gear for the c.w. operator. It can make contest operation more efficient and it can also simplify the "rote" aspects of a QSO. One memory, for example, might contain a "CQ;" another might contain the QTH; another might contain a description of the station equipment, and so on. You will be in for a pleasant surprise when you use one.

The keyer is well constructed physically and has a nice appearance. It is backed by a thrity-day, full-refund guarantee *and* a one year unconditional guarantee on parts and workmanship.

The MFJ-484 *Grandmaster* memory keyer costs $139.95 and can be ordered directly from MFJ Enterprises, Inc., P.O. 'Box 494, Mississippi State MS 39762 or you can call them (toll-free) at 800-647-1800. For more information circle number 76 on the reader service card. CQ

a monthly feature by

WILLIAM I. ORR, W6SAI

Antennas

Design, construction, fact, and even some fiction

Pendergast and Doctor Livingston I. Presume caught me at my desk looking over the morning mail. They dropped their jackets on the operating table and slowly started to thaw out. It was bitter cold outside. The windows were frosted over and when my two friends opened the door to the shack a scimitar of icy air slashed across the desk, whisking some of the mail to the floor.

I bent down to pick the letters up as Pendergast asked, "Any good DX QSL cards in the mail?"

"No, but there are plenty of bills", I replied.

"Always pay your Doctor's bill first", suggested Doctor Liv.

"I should adopt the Chinese method and only pay doctor's bills when I am healthy and stop paying them when I am ill", I responded.

Doctor Liv ignored the thrust and picked up a letter. "Hey", he said, "Here's a note from that well-known DXer Dick, W3GNQ. What's he got to say?"

*48 Campbell Lane, Menlo Park, CA 94025

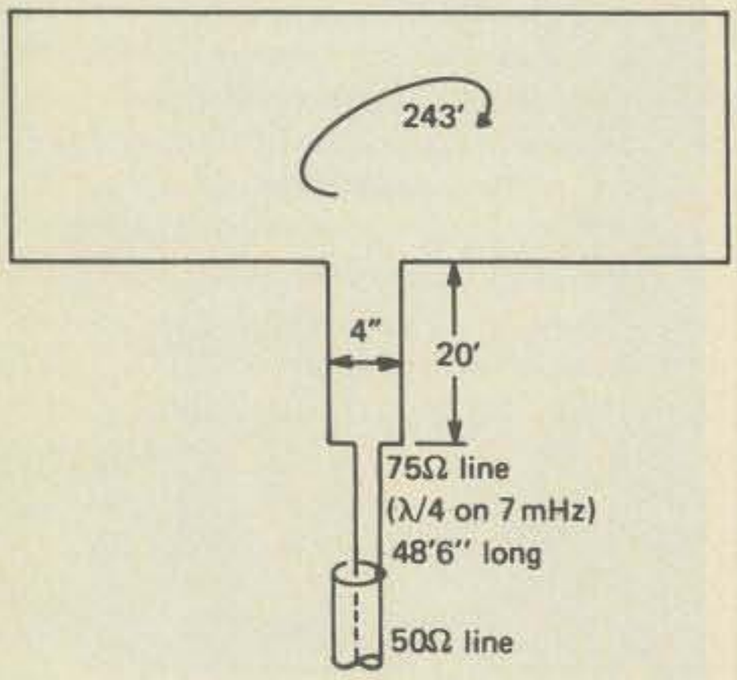


Fig. 1 - The W3GNQ loop antenna for 40 and 80 meters. The 75 ohm line is Amphenol 214-023 or equivalent. It is an electrical quarter-wave length for 40 meters (48'6"). Open wire line is home-made using 4" ceramic spreaders. Antenna wire size is number 12 solid copper.

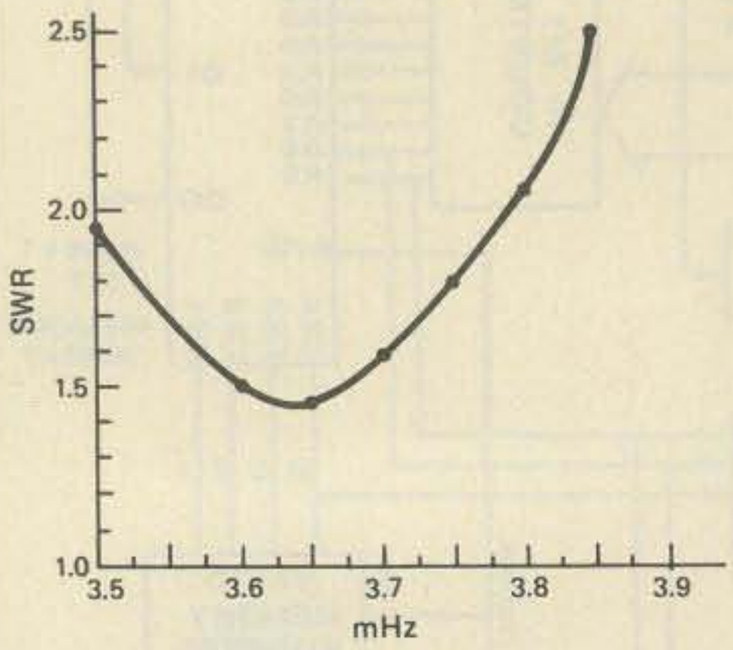


Fig. 2 - Plot of the W3GNQ Quad loop for 80 meter operation.

There were some drawings in the envelope. "This is a picture of W6TC Quad loop at W3GNQ", I replied. "Dick has modified it a bit to use it on *both* 80 and 40 meters (fig. 1). He made the loop a mite bit smaller than normal and fed it with a short, open wire transmission line. Then, the bottom of the line is fed with a 40 meter quarter-wave section of heavy-duty 75 ohm transmission line. Finally, a 50 ohm coaxial line runs to the station".

"It looks as if the loop is slightly shorter than a wavelength in circumference on 80 meters", said Pendergast, as he slowly removed his gloves and held his hands towards the fire.

"That's right", I replied. "This loop is 243' in circumference. But the open wire line is 20 feet long. That adds 40 more feet of wire, so the total amount of wire in the antenna system comes out to be 283 feet. That's slightly longer than a wavelength at 80 meters, but the overall length is annulled a bit because some of the wire is in the transmission line. In any event the system is resonant at about 3650 kHz. As you can see from Fig. 2, the bandwidth of this loop is very good on 80 meters.

"How about 40 meters? That's my favorite band", said Doctor Liv. He had made himself at home and was pouring himself a glass of good California white wine from a bottle in the refrigerator.

"The antenna works on 40 meters, just as well as it does on 80 meters", I replied. "The SWR plot for 40 meters is shown in fig. 3. The s.w.r. is very low across the whole band. The frequency of minimum s.w.r. is about 7.2 MHz. Note that on 40 meters, there's a quarter-wave matching section made of 75 ohm heavy-duty two-wire line between the antenna and the 50 ohm line. I would imagine that you could use a length of 75 ohm coaxial line, such as RG-11/U, if you can't find the two-wire line".

"Do you have to remove the quarter-wave section when you use the antenna on 80 meters?", asked Doctor Liv., as he sipped his drink.

"No", I replied. "That's the beauty of it. The 75 ohm line has practically no effect on 80 meters. You can jump back and forth between 80 and 40 meters, phone or c.w., without doing a thing to the antenna!

"The best form for the loop is square or triangular and polarization is horizontal. For a square loop, each side is 60'9" long. For a triangular loop, supported at the apex, each side is 81 feet long *or* you could make the loop rectangular in shape, say 50 feet high and 143 feet long. The actual shape of the loop is really not so important. You can call this a very forgiving antenna design".

"You can call me Ray. Or you can call me Jay....", began Pendergast. Doctor Liv. quickly put the

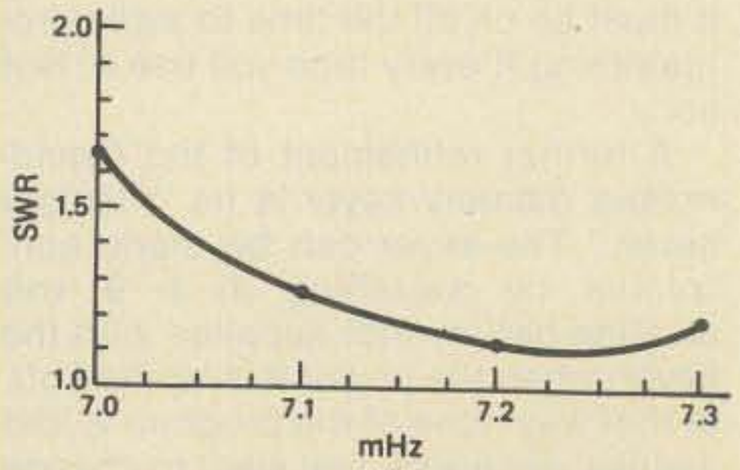


Fig. 3 - Plot of the W3GNQ Quad loop for 40 meter operation.

wastebasket over his head and snapped, "Shut up!". Pendergast tossed the basket into the corner of the room and said, "I was just trying to help".

"Dick says he's had a lot of luck with this simple loop and has worked a lot of DX with it this past season. I think it's a pretty good sky-wire for the operator who wants both 40 and 80 meter operation with one simple antenna".

"I really enjoy working with loop antennas", said Doctor Liv. "I'm putting one up like the version at K7WA. Jim has a small, loaded loop for 40 and 20 meter operation. It is 33 feet long on a side and has loading coils at the high voltage points. He designed the antenna after some investigations conducted by ZL1OI and G3FPQ. It looks like fig. 4.

"Jim adjusted the coils for lowest s.w.r. on 40 and 20 and tuned the antenna with a *Viking Match Box* and a s.w.r. meter for operation on either band. He's only running 75 watts but works plenty of DX on both bands. I think this is a pretty good two-band loop antenna".

"Agreed", I replied. "It has to be good to work DX with only 75 watts. A little experimentation is necessary with the coils as Jim didn't send any data. But all that has to be done is to adjust the number of coil turns for lowest s.w.r. on 40 meters. Twenty meters will probably take care of itself".

Pendergast broke his silence and pulled a letter from his pocket. He tossed it to me, saying, "I just received a note from Bob, WB5QGI. You probably remember him as WB4DPG. He sent in the information on the wire antenna that was given in the February, 1976 issue of this column in *CQ* magazine. Since then, he's moved to Texas. . . ."

"Poor devil", muttered Doctor Liv. under his breath.

Pendergast continued, "Bob has a 33 foot metal tower with a 2 meter ground plane atop it at one end of this house. He's got two sloper antennas attached to the tower, one for 80 meters and one for 40 meters (Fig. 5). And he likes them both".

Pendergast put on his glasses and started to read the letter.

"I haven't seen any simple-simple antenna that equals the sloper for overall performance (he writes). The sloper, if you remember, is a quarter-wave wire, fed at the top, and worked against a metal tower as a ground.

"The 80 meter wire is about 65 feet long. And, as I found out with my first sloper, it is necessary to vary the slack in the wire and swing the bottom end around. This really makes a difference in the s.w.r. measurement. I wonder

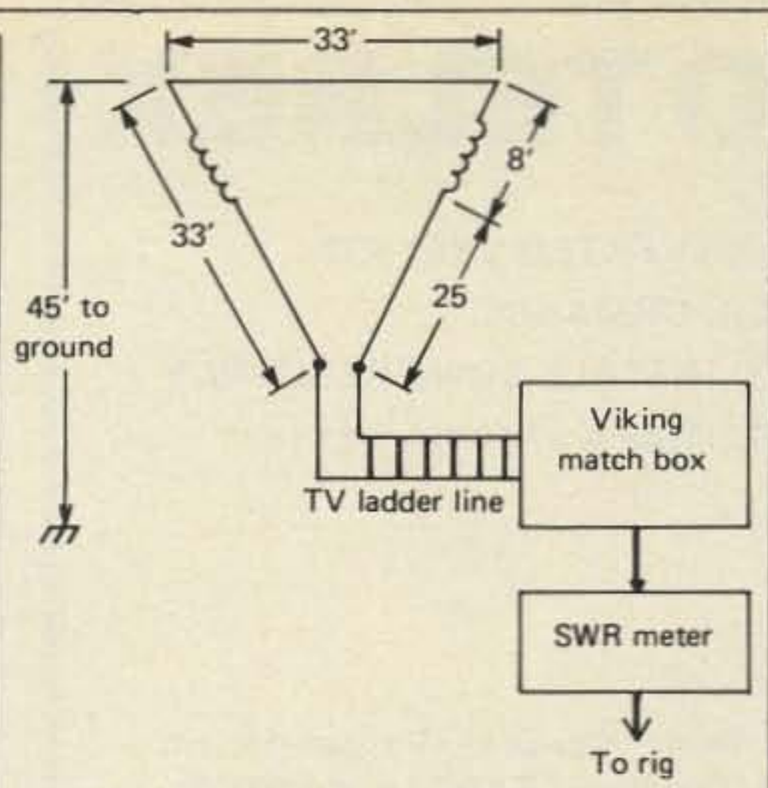


Fig. 4 - The compact 40-20 meter loop antenna at K7WA.

how many fellows who have put up a sloper antenna in "guy-wire" fashion have found it less than satisfactory and considered it a waste of time—all due to not experimenting with it a little? Several amateurs around here, after hearing about my success with the sloper, have put one up and the degree of success seems to vary directly with the willingness to "play around" some with it.

"After I got the 80 meter wire working, I put up a second wire, about 33'4" long, for 40 meters. It is fed in parallel with 80 meter wire and hangs down from the tower, but at an angle of about 45 degrees around from the original wire, looking down from the top. As with the 80 meter wire, it was necessary to vary the amount of slack in the wire and to swing it around a bit until the lowest value of s.w.r. was obtained.

"The SWR on 80 meters is better than 3-to-1 at the band edges and better than 1.5-to-1 from 3.7 MHz. to 3.95 MHz. This is important as I use a HW-104 and this gives me a lot of flexibility, taking into account the broadband capability of the HW-104.

"The s.w.r. on 40 meters is less than 1.4-to-1 at the low end of the band and less than 1.3-to-1 at the high end. I can also use the antenna on 15 meters and on 10 meters, although the s.w.r. on 10 meters is higher than I like. I've also used it on 20 meters, but the s.w.r. runs about 10-to-1 on that band."

Doctor Liv. cleared his throat and said, "I keep hearing that 3-to-1 is the maximum s.w.r. value you can have with modern transmitters. Or maybe even less. Some of the solid state transmitters have a fail-safe circuit that gradually turns off the power amplifier when the s.w.r. value is high. So you put out less and less as the s.w.r. increases. The older tube-type amplifiers don't have that problem. They can work into quite high values of s.w.r., until the limitations of the pi-network output circuit are exceeded. But a lot of amateurs don't realize that if you place an antenna tuner in the line between the line and the transmitter (keeping an s.w.r. meter in the transmitter portion of the line) it is possible to adjust the tuner to take out the greater portion of the high s.w.r. Even when the s.w.r. is very high the antenna can still be usable—even up to s.w.r. values of 10-to-1, *provided* the antenna tuner can match the high s.w.r. to the transmitter. I use a *Drake MN-4* matcher. It doesn't make the antenna any better, or lower the s.w.r. on the line to the antenna, but it makes the transmitter "see" a better load, allowing me to crank up the exciter without exceeding any limits. I wouldn't recommend this scheme with a high power rig, 'cause something may blow up due to high voltages where s.w.r. values are concerned, but at the 250 watt level, things are pretty

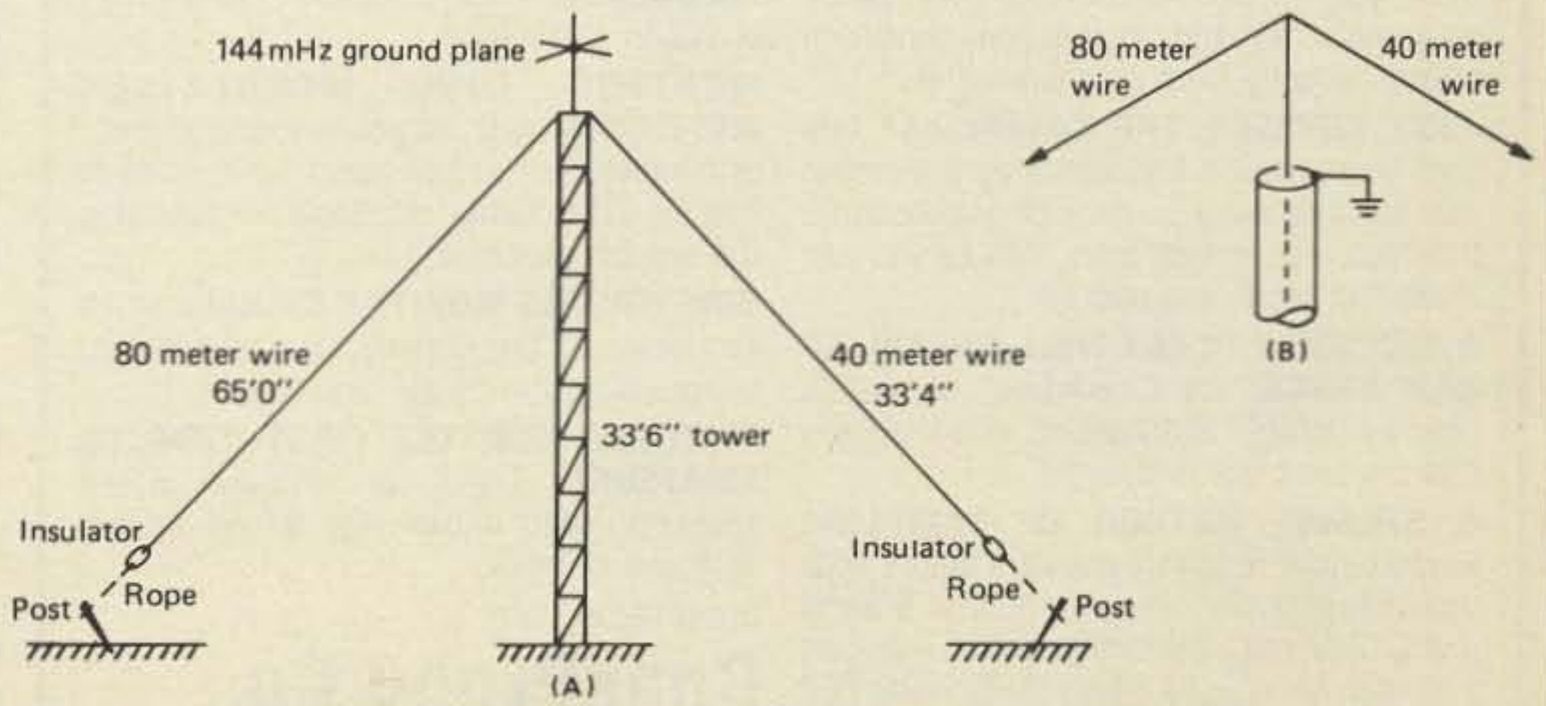


Fig. 5 - a) The WB5QGI slopers for 80-40 meters. b) Shield of coaxial line is grounded to metal tower. Slopers connect to center conductor.

safe. In any event, my tuner permits me to work into outrageously high values of s.w.r. on the antenna system".

"Right, as usual", I replied. "A low s.w.r. on the line is *nice* to have, but not essential. I have a 20-15-10 meter tri-bander beam and the s.w.r. at the edge of the 20 meter band is over 3-to-1. Some of my friends with a similar beam are worried sick about this and they fiddle around with the antenna to lower the s.w.r. Nonsense! That value of s.w.r. isn't significant *provided* the transmitter can accept that value. If the transmitter won't load into a high value of s.w.r., a simple antenna tuner or so-called "match box" between the transmitter and the coaxial line to the antenna will clean things up enough to permit proper transmitter loading".

"High s.w.r. *is* important in the v.h.f. region if you have a lot of line loss, because high s.w.r. boosts line loss. But this is unimportant in the h-f region. And if you are running a lot of power"—he looked at Pendergast who pretended to be intently watching an ant crawl across a stack of QSL cards—" you could flash something over. But with power levels below 250 watts, an antenna tuner permits you to operate your antenna off-frequency with good results. I've even used a 20 meter beam on 15 meters by the addition of an antenna tuner. It didn't set the world on fire, but *at least* I was on 15, and I did work the Clipperton Island DXpedition on 15 meters just that way!".

"You can't keep a good man down", Pendergast said, rejoining the conversation.

Doctor Liv. arose and made motions preparatory to leaving. he hesitated, and said, "How is your new antenna book doing?"

"Thanks for asking", I smiled. "Very good, And a lot of data about slopers and other interesting antennas are shown in the book. I'd give you a copy, but I would rather you bought one for yourself. After all, I'm not a rich dentist".

"Envy is a terrible thing", said Doctor Liv. "But you are rich in spirit, and that's really what counts".

Note: The handbook Doctor Liv referred to is W6SAI's newest work, entitled "The Radio Amateur Antenna Handbook". This 188 page handbook covers interesting antennas from A to Z. Available from Radio Publications, Inc., Box 149, Wilton CT 06897. Price: $6.95 plus 50¢ shipping and handling.

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T.E. White has been building amateur equipment for years. In this informative article he passes on some of his valuable knowledge to those interested in putting together their own v.h.f. or u.h.f. antennas.

Antenna Design And Construction Guidelines For The U.H.F./V.H.F. Amateur Bands

BY T.E. WHITE*, ex-W2JLP, K3WBH/2

In the post-war "golden age" of amateur radio, which lasted until about 1959, the only store-bought equipment usually in the ham shack was the receiver. Transmitters and antennas were nearly always home brewed. Now of course transmitters (or transceivers) have joined receivers as common off the shelf items, leaving only the skywire to be genuinely home-built.

Even antennas are increasingly commercially obtained, which is rather too bad, as, with but a very few notable exceptions, the store bought or mail order variety are made to a price rather than a performance target. They are often shoddily made mechanically, "compromise" in design, and blatantly false in performance claims.

Any amateur worth his salt, who has a tape measure and the ability to perform simple arithmetic, can construct an antenna, at a fraction of the market price, which will outperform, and outlive, nearly anything he can buy. The new v.h.f.-u.h.f. operator in particular should know this before he throws his money away.

There are two simple priorities in building and using a skywire for two meters and higher bands. First is low wave angle or angle of radiation/reception. Second is getting the largest possible "capture area" in order to, in receive mode, induce the highest possible signal voltage and deliver it to the receiver ("If you cant hear 'em you cant work 'em" is communications axiom No. 1). Design for receiving, and transmitting performance will take care of itself.

The way to sensible antenna performance for the "average" and even the considerably-above-average v.h.f.-u.h.f. amateur lies not in putting up 11-, 13- or more element yagis with inflated gain figures and director after director crammed onto the boom. They will last only until the first wind storm anyway. They are useless for receiving and impossible to properly load outside a narrow bandwidth. We will show here how and why the concept of units of small antennas, properly interfed and properly supported, will enable the v.h.f.-u.h.f. newcomer to get started on the right road.

There is no reason to put up one, two, or four giant-length yagis with grotesque feed harnesses flapping in the breeze and exotic matching systems coming apart, when a brace or two of small units, with no requirement for finicky gamma matches, sliding shorts, condensers or other esoterica, will do the job better.

If the reader will keep in mind that two small, 10 dB-gain antenna units or "bays" will outperform one big 13 dB antenna, he will begin to grasp the thrust of this article.

A 6 element yagi (or an 8 element, collinear) is our basic building block because it has a conveniently and easily remembered honest gain of 10 dB, or an e.r.p. (effective radiated power) multiple of 10, compared to the same amount of power fed to a simple dipole. To obtain increased power or signal pickup, if required, we need only remember that each "cloning" or duplication of the basic unit gave us a two fold increase. A 6 over 6 (20X power gain; a 6 × 6 alongside another 6 × 6 = 40X gain, etc., etc.) This building block concept holds true for any multi-element system, be it yagi, collinear, combined yagi-collinear, log periodic or what-have-you.

Fig. 1 illustrates this for various basic configurations. Note that the basic yagi unit is *one* boom-and-elements assembly. The basic collinear unit, to maintain our common

*36 Lake Ave., Fairhaven NJ 07701

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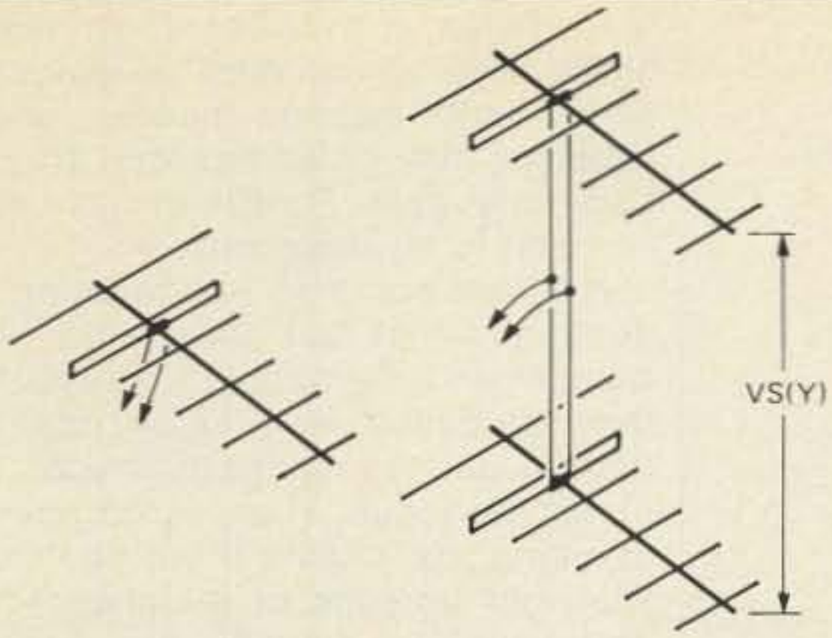
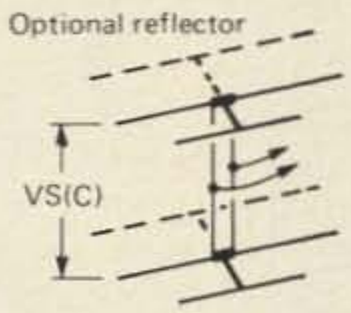


PG = 10X
1 Unit

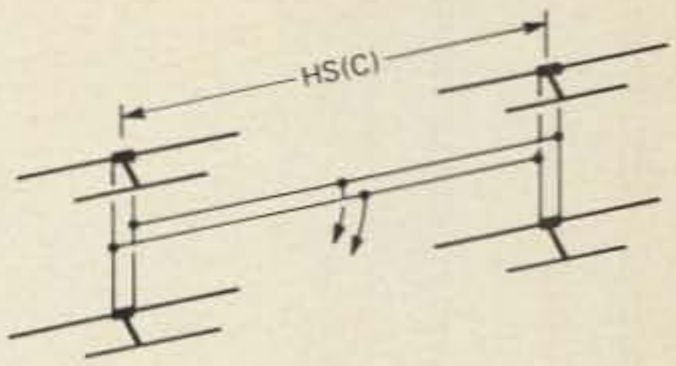
20X
2 Units

40X
4 Units

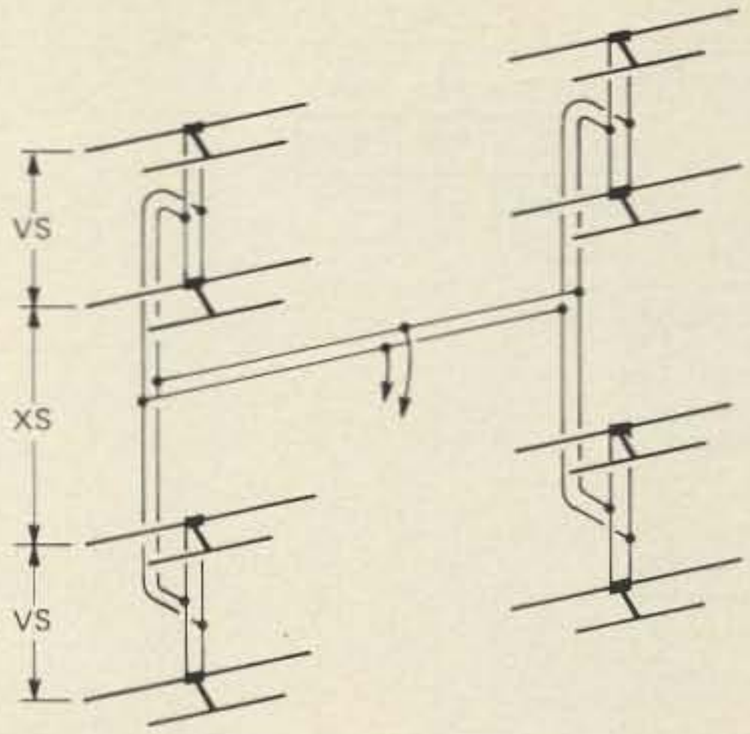
YAGIS



10X
1 Unit

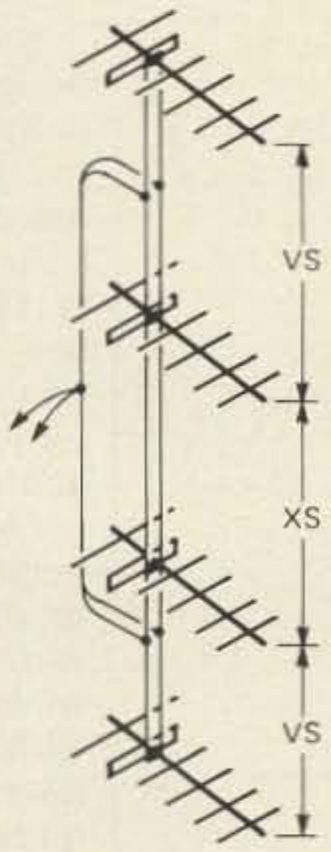


20X
2 Units



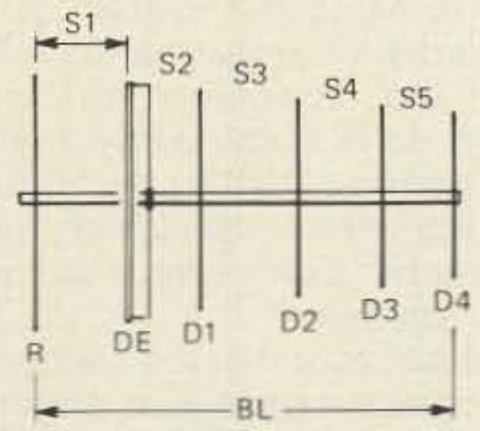
40X
4 Units

COLLINEARS

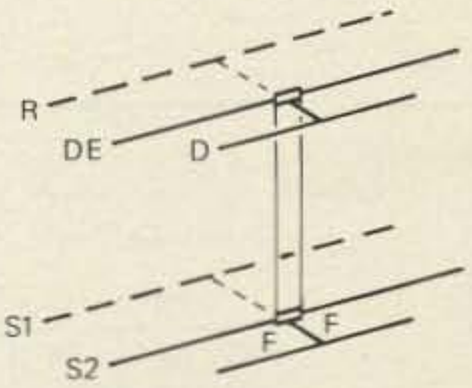


Alternate 4 Units

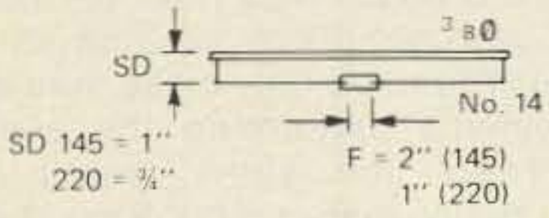
Fig. 1 - The basic "building blocks."



The basic 6 element Yagi



The basic collinear
(with common directors and optional reflectors)



Driven element

MCS	R	DE	D1	D2	D3	D4	BL
145	40¼	38	36	35¾	35	34¾	79
220	26¾	25½	23¾	23⅝	23½	23⅜	49

145	—	17½	10	19	16	16
220	—	10	7	9	11	11

(not recommended for 432)

Elements mount atop boom, not through parasitic elements. ¼"Ø

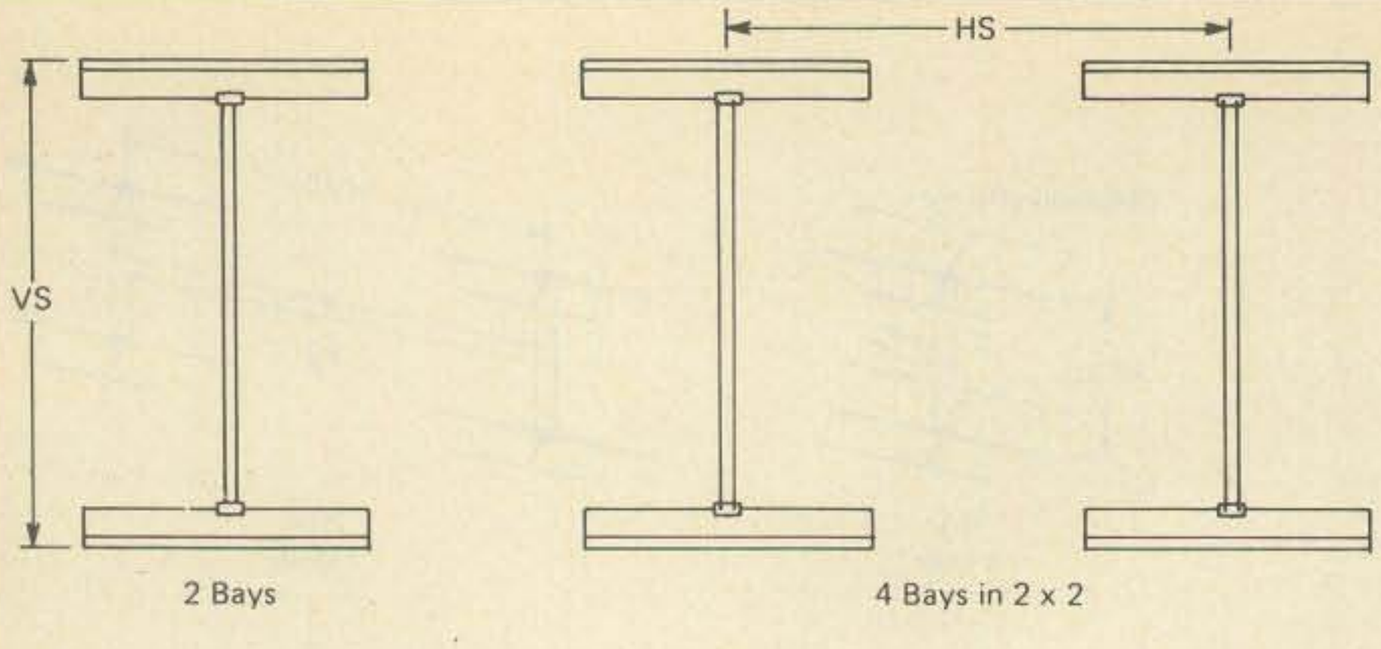
	R	Ea DE	D	S1	S2	F-F	EL Ø
145	78	36	37	12	6	2	¼
220	50	23¾	24	8¼	3¾	1	¼
432	25¾	12	12¼	4	2	1	⅛

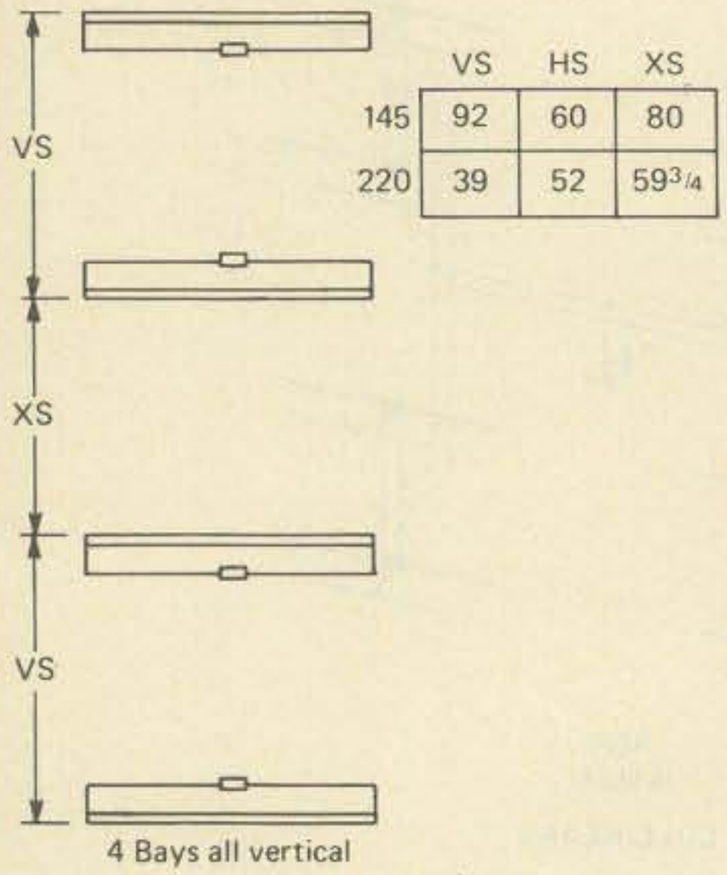
Fig. 2 - The unit details.

10X unit benchmark, is really *two* "assemblies."

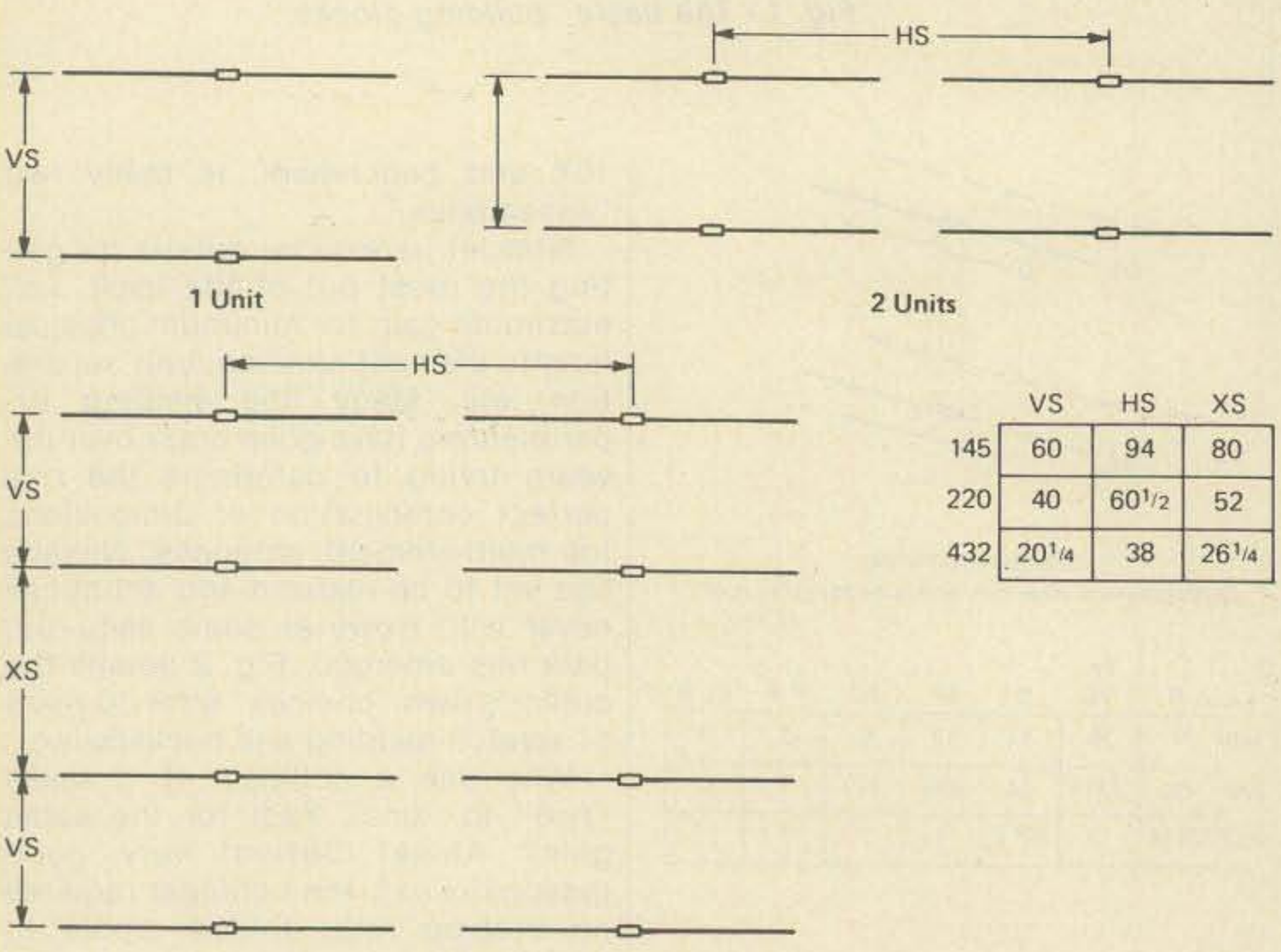
Now let us explore criteria for getting the most out of the least. i.e., maximum gain for minimum physical length, element spacing, unit separation, etc. Many fine amateur experimenters have gone crazy over the years trying to determine the one perfect combination of dimensions for multi-element antennas. Nirvana has yet to be realized and doubtless never will. However some semi-firm data has emerged. Fig. 2 details the author's own "choices" after 30 years of scratch-padding and hacksawing.

Why use a collinear if it takes "two" to "one" Yagi for the same gain? Ah-ha! Several very good reasons! First, the collinear requires no step-up ratio folded dipole to transform its intrinsic impedance. Second, it is a more broad-bandwidth animal. Third, although technically it has the same gain, in practice, because of it's four dipoles per unit as opposed to the yagi's one, it induces or "extracts" from the approaching wave front four times the energy (six-





	VS	HS	XS
145	92	60	80
220	39	52	59 3/4



	VS	HS	XS
145	60	94	80
220	40	60 1/2	52
432	20 1/4	38	26 1/4

Fig. 3 - In (a) the separation of "units" (yagis); in (b) the separation of "units" (collinears).

teen times the voltage) in receive mode. Also, a "common" director can serve each pair of dipoles, and a reflector may be added for 1 to 2 dB additional gain. For 3/4 m this critter is much to be preferred.

Now we come to the "cloning" or duplicating of our units into practicable and servicable "arrays," as they are called. Here again, misinformation and commercial "hype" can cloud the issue. There is no point in stacking our blocks if we don't pick the right spreads or distances, high and wide, to actually get our prestated multipliers. There are rules here, too.

Some long-long yagi artists have adopted a rule of thumb that vertical height is ¾ of boom length. Not so for we poorer people in the six element class! Maximum realizeable gain for us occurs when VS(Y), Fig. 1, is .15λ *more* than boom length. And on the collinear side, VS(C), we get a bonus in terms of reduced supporting structure size, for we need only .75λ to achieve our stated gain.

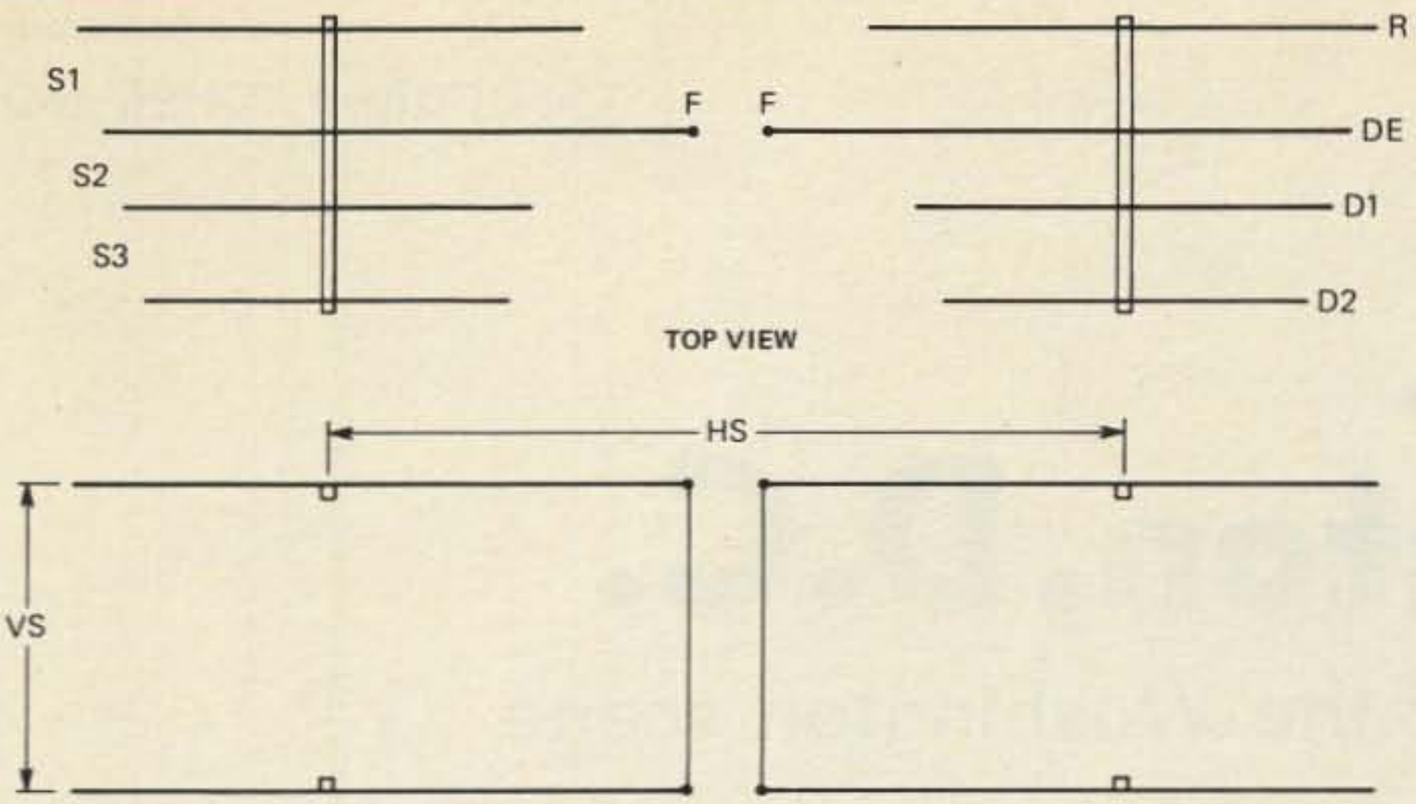
Fig. 3 tabulates proper spacing for height and width of all our "MU's" or *multiple units*. The "alternate" 4-stack vertically of yagis is recommended where sharpness of horizontal beamwidth is not important but where lowest possible wave angle is required. This is rather "tall," however, for the beginning two meter amateur, as it adds up to 22′. The middle stacking dimension (XS) is 1.0λ in both yagi and collinear 4-unit cases.

Now that we have covered the building block theory of skywire stringing, there remains the system of feeding your array, or array-of-arrays. The first thing the newcomer to v.h.f.-u.h.f. should do is throw away any leftover coax and so-called "u.h.f." fittings (PL-259, e.g.) from his lower frequency operations. Don't even *think* of using them "up here."

Instead, invest in the needed quantity of one-inch open wire ladder line for any of the arrays discussed here that you wish to build. They have all been chosen with simplicity of feed as a criterion. You need only make sure all feed systems performing the same function are the same length. It doesn't really matter how long they are as long as they're symmetrical.

Fig. 1 shows all the harness arrangements. Just make sure they are well supported mechanically and do not shift the in wind. In the 40X all-vertical yagi and in the 40X collinear, where lines are parallel to other lines, a distance of 6″ or more should separate them. Run good quality 300 ohm twinlead to the rig and install baluns there, *not* at the antenna.

As our "last exclusive" there is one



	R	DE	D1	D2	S1	S2	S3	VS	HS	F-F
144	40	46 7/8	36	35 3/4	15 3/4	11 1/4	14 1/4	60 3/4	57 3/4	2
220	26 3/4	31 1/4	23 3/4	23 5/8	10	7	9	40	38	1
432	13 5/8	15 7/8	12	11 7/8	5 1/4	3 3/4	4 3/4	20 1/4	19 1/4	1

Fig. 4 - A four-bay yagi using extended driven elements.

more array, fig. 4, which is worthy of notice because it gives you something for nothing. Instead of having to feed each array with its own leg of a harness, here one parallel line feeds two units! And the compactness of the antenna belies its very good gain. While up to 6 elements (4 directors) sensibly can be used in each bay, we show here a shortened version, for economy of material for the beginning amateur.

The secret is in using "extended-length" driven elements, but retaining "regular size" parasitics. This is one case where a yagi can be used effectively on ¾ m., since frequency response is slightly broader than with a "standard" yagi. The v.h.f.-u.h.f. newcomer would do well to construct this beam. Just remember that as in any side by side array, support members which parallel the elements must be non-metallic.

Best DX!

a regular feature by

THEODORE J. COHEN N4XX

dateline... Washington, D.C.

The ins and outs of the Washington scene

FCC begins study of Radio Frequency Interference (RFI)

On November 14, 1978 the Federal Communications Commission (FCC) began its inquiry into the problem of RFI, and the need for Government regulation, to reduce the susceptibility of electronic equipment to signals from nearby radio transmitters.

In preparing for the release of a comprehensive Notice of Inquiry (NOI) in the matter of RFI, the Commission noted that while it has improved transmitter standards through the enactment of rules and regulations, interference complaints are virtually unchanged over the past three years.

Of the interference complaints received by the Commission, 73% involve alledged interference to electronic home entertainment equipment. In general, this interference is associated with the operation of CB, Amateur, Broadcast, and Land Mobile transmitters. In addition to electronic home entertainment equipment, the Commission noted that other devices such as pacemakers, electronic braking systems (such as those used on trucks) and explosive devices are also subject to malfunction as a result of RFI.

The Commission added that a high percentage of the complaints received on RFI were apparently related to deficiencies in the design of the electronic device which experienced the interference, and that in many cases, the installation of filters eliminated the problem.

It was recognized by the FCC that if RFI immunity standards were imposed on the electronic industry through Government regulations, any cost increases involved would be passed on to the consumer. This being the case, the possibility exists that given a choice, the consumer may prefer to purchase equipment which is less immune to radio frequency signals, but which is also less expensive. Regardless, before the Commission would even consider adopting regulations to control the susceptibility of electronic equipment, it felt that it was necessary to define the extent and nature of RFI, as well as the economics and interest involved in resolving the problem. Hopefully, responses to the RFI NOI will provide the FCC with the information it seeks.

The Commission is seeking information on RFI from several groups, including, but not limited to, consumers, manufacturers, and radio operators. As such, specially-printed, color-coded editions of the NOI will be used to identify questions which may be of interest to certain groups. These specially printed editions were made available to the Public in early December, and are available from the Federal Communications Commission, 1919 M St., N.W., Washington, D.C. 20554. Comments are due by May 1, 1979, with reply comments due not later than July 1, 1979.

DX Editor cautions amateurs on WARC

Mr. J. Harvey McCoy, W2IYX, Editor of The Long Island DX Association Bulletin, cautioned Amateurs on the danger in assuming that preparations for the 1979 World Administrative Radio Conference (WARC) were more than adequate to ensure an expansion of our allocations. McCoy noted that the FCC's NOIs on the Table of Allocations, which have proposed additional allocations at 10, 18 and 25 MHz for the Amateur service, are only devices by which the FCC measures Public opinion. He further noted that the Table of Allocations shown in the NOIs represents the non-Government proposals, and that the Government side was preparing its own Table of Allocations. What positions vis-a-vis allocations are carried to Geneva by the U.S. delegation, McCoy said, will derive from a merging of the non-Government and the Government proposals, and the final proposals may or may not be as favorable to the Amateur service as was the case with the FCC proposals.

McCoy also called attention to the fact that the U.S. is but one of 154 countries which belong to the International Telecommunication Union (ITU), and that each country will have just one vote on any matter which requires a decision at the WARC. Given that many radio services will be seeking new and expanded allocations in the high-frequency (HF) band...services such as Amateur, Broadcasting, and Maritime Mobile...the competition for votes will be fierce.

McCoy concluded his editorial comments by calling on the Amateur service to rid itself of those individuals who would place our access to the radio frequency spectrum in jeopardy, and by encouraging Amateurs everywhere to conduct their on-the-air activities in a matter which reflects credit on the Amateur service.

Technical bases for WARC prepared by the ITU'S special preparatory meeting

On October 23, 1978 the ITU convened a Special Preparatory Meeting (SPM) of the International Radio Consultative Committee (CCIR: the technical arm of the ITU) for the purpose of preparing the technical bases for WARC-79. The SPM, which lasted for a period of four weeks, was tasked with preparing a comprehensive and self-contained report which would

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consist of all technical information thought to be of importance to the work of WARC-79. Since this technical report will now form the basis for proposals to be submitted to WARC by various administrations, material contained therein is of vital importance to all radio services seeking continued access to the radio-frequency spectrum resource.

Numerous documents pertaining to the Amateur and the Amateur-Satellite services (the ITU considers the "Amateur" service to consist of two services) were presented for consideration by the SPM. Despite the fact that these documents were considered by at least five separate committees, and were, in some cases, merged with other documents, the final report prepared by the SPM contains a large number of entries which are of importance to the Amateur and Amateur-Satellite services.

Some of the more significant conclusions to be found in the SPM's report are given below:

1. There is no longer a requirement that the Amateur bands be harmonically related (since harmonic radiation from Amateur transmitters was a problem in earlier years, the allocation of harmonically-related bands insured that harmonics from Amateur transmitters fell in Amateur bands).

2. Access to bands distributed throughout the spectrum is desirable to enable the Amateur to become experenced with those problems which are peculiar to the different parts of the spectrum.

3. It is desirable that the bands allocated to the Amateur service be sufficiently wide so as to permit experiments with wideband techniques.

4. The Amateur service can share frequency bands with the Radiolocation (Radar) service (as is now the case, for example, in the 220-225 MHz band). Such sharing does not require the Radiolocation service to provide protection to the Amateur service; useful exploitation of shared Amateur-Radiolocation allocations is possible by the Amateur service.

5. The communication capability of the Amateur service would be significantly advanced by a better distribution of the frequencies available to it below 30 MHz. A suitable family of frequencies with narrower spacing between successive bands than is at present the case would have some technical advantages.

6. Frequencies in the MS band are useful to allow investigation into, and use of, propagation peculiar to this band, particularly during a sunspot minimum when the MUF is below 3 MHz.

7. Exclusive allocations, where possible, would help to meet particular needs of the Amateur service.

8. It is technically feasible to use existing worldwide Amateur service frequencies in the Earth-to-space direction in the Amateur-Satellite service under the same limitations that now exist for their use in the Amateur service. In addition, it is technically permissible to utilize in the space-to-Earth direction those frequencies which are allocated exclusively to the Amateur service on a worldwide basis.

Certain deficiencies in Amateur service preparations for the WARC were also identified, including the lack of documentation on the use of bands above 40 GHz. by the Amateur and Amateur-Satellite services, and on the possibilities for frequency sharing between the Amateur service and other services in the bands below 30 MHz. Regardless, the final report of the SPM should serve the Amateur and Amateur-Satellite services well at the WARC.

Finally, it should be noted that the efforts of SPM representatives from the International Amateur Radio union (the IARU; these representatives included personnel from the ARRL) were held to be "constructive," and were responsible, in part, for the positive attitude with which many SPM delegates viewed the Amateur and Amateur-Satellite services' contributions.

National Bureau of standards holds conference on RFI

In late 1978, the National Bureau of Standards (NBS) held a conference in the Washington, D.C., area, to review current problems in the field of radio-frequency interference (RFI; also known as eletromagnetic interference, or EMI). Specifically, the conference addressed how RFI affects the consumer, the manufacturer of electronic equipment, the radio operator, and the U.S. Government. Concern was also expressed for the biological effects radio-frequency (rf) radiation can have on human beings.

In comments prepared for the conference, Charles K.S. Miller, Section Chief for EMI and Radiation Hazard Metrology at the NBS in Boulder, Colorado, noted that the electromagnetic environment is not well defined at this time. Further, he observed that no one in Government or industry even has a "charter" to measure it. As a result, data are not available upon which to base judgements viv-a-vis the impact rf radiation has on society today.

It was also noted that today, there are 4500 AM stations and 4000 FM stations on the air in the U.S. These stations, together with about 1000 TV stations, 30 million CB stations, 300,000 Amateur stations, 35 million industrial r.f. sources, and countless rf sources used by police and fire departments, airports and harbors, and the Military Departments, produce an r.f. environment where interference between r.f. sources and other electronic devices is commonplace. In fact, this so-called "electromagnetic pollution" will probably become one of our most serious environmental problems in the 1980's.

No where is RFI more readily observed than on a television receiver which is susceptible to the r.f. signals from a nearby transmitter. Then too, problems have arisen with electronic braking systems used in trucks as well as with computers and other information-processing systems. For these and other reasons, several senators and congressmen have introduced legislation into the U.S. Congress which would give the Federal Communications Commission (FCC) the authority to set standards which would be intended to reduce the susceptibility of electronic devices to strong r.f. fields. The electronics industry, however, is concerned that Congress will enact such legislation before "industry-wide, voluntary regulations" can be developed by the industry.

In regard to environmental problems of another nautre, Paul Brodeur, author of the book "The Zapping of America," suggested that rather than devote all of our attention to interference between electronic devices, we should also be concerned with the effects electomagnetic radiation has on the human body. Brodeur noted that relatively little is known today about the effects of radiation (e.g., microwave radiation) on human beings, especially the long-term effects.

It is hoped that future RFI/EMI conferences such as the one recently sponsored by NBS will evolve into meeting places for decision makers who have the capabilities to accelerate research in the area of electromagnetic interference.

Your Editor extends his appreciation to Messers. Mort Blender (W4LPZ), Leonard Mendel (K5OVC), and Steve Thompson (N4TX) for their contributions to this month's column.

Power output is the difference between forward and reflected power. Here's a wattmeter that does subtraction for you and gives you a true power reading. And you can build it in one sitting.

A Power Meter That Says "Watts The Difference?"

BY WILLIAM VISSERS*, K4KI

The idea came like this. My nostalgia carried me back fifty years, when my first transmitter used a flashlight bulb in the feeder system, and maximum brilliance was maximum power output. And s.w.r. was something I'd never heard about. Wasn't there someway just to have one meter that would give a good indication of maximum power without any switching being required? A bit of thinking, and the light dawned.

Now isn't a s.w.r. meter nothing more than a device that measures forward voltage in one direction, and reflected voltage (even though it may be calibrated in s.w.r.) when switched in the other direction? And isn't true power P_o nothing more than forward power minus reflected power? The basic equation is $P_o = P_f - P_r$. Could there be an easy way to somehow get a s.w.r. meter or wattmeter to read this difference voltage without doing any manual switching? And as power is a function of the voltage squared, then this difference voltage would be a function of true power output. A bit of pencil sketching allowed me to come up with the basic idea shown in fig. 1. Now as there are many different kinds of s.w.r. and power meters on the market, it would be impossible to give a design change for each one. However, they all have diode output circuits that go to switching and meter circuits. And so this basic modification can be used with all meters, although it might be necessary to vary the current limiting resistances R1 and R2, depending upon the basic sensitivity of the meter system. So I'll just show the diode outputs and take it from there. In my own case I modified my Swan WM 1500 wattmeter, which has a 50 microammeter as it measuring element. And as this sensitivity is the typical of the majority of meters on the market, the modification described will cover just about any kind of s.w.r. or power meter you might have.

Looking at fig. 1 you see that it is nothing more than a simple differential circuit. Now for example in the extreme case s.w.r. equals infinity, and if the unit is properly calibrated, then the reverse voltage will be equal to the forward voltage, and the voltage developed across the microammeter will be zero. And also in this case the forward and reflected power will be equal, and the power output from the basic equation will be zero. And the meter will show this condition.

On the other hand, if we were loading into a perfectly matched load, we would have no reflected voltage present. And as there can be no reflected power, if there is no reflected voltage, our microammeter would then read forward voltage. And in this case the forward power would be true power.

And lastly, if we were connected to a load with a given s.w.r., the forward voltage would be higher than the reflected voltage, and this difference voltage would appear across the meter. And the true power reading would be a function of this difference voltage.

Well the idea seemed so simple and practical that the unit was probably the quickest breadboard I've built in years. Preliminary tests indicated that the basic design worked exactly as I had hoped that it would. A bit further experimentation showed the desireability of being able to read reflected power only, as this is directly related to s.w.r., and would thus increase the utility of the meter in my station. It then also serves as a convenient check if you wanted to make sure that your s.w.r. was 1:1 This is because when the reflected power is zero, then your s.w.r is 1:1. So a bit more thinking led to the final design circuit shown in fig. 2.

Design Features

My design thinking was based upon simplicity combined with the best voltage linearity in the diode circuits. Resistors R4 and R5 are nothing more than limiting resistors that save your diodes and/or meter in the event you had turned resistors R1 and R2 to zero resistance when you applied power from your rig before the unit was properly calibrated. To be on the safe side keep resistors R1 and R2 turned to maximum value of resistance when initally starting your calibration. Switch S is a small Radio Shack d.p.d.t. slide switch used to select either true power or reflected power. Resistors R6 and R7 are part of the differential circuit.

When the switch is in the true power position, resistors R6 and R7 act as a slight shunt across the microammeter. R3 is used to compensate for this effect when the switch is in the reflected power position.

Calibration

If you own or can borrow an already calibrated wattmeter and a dummy load the calibration is very easy. Just

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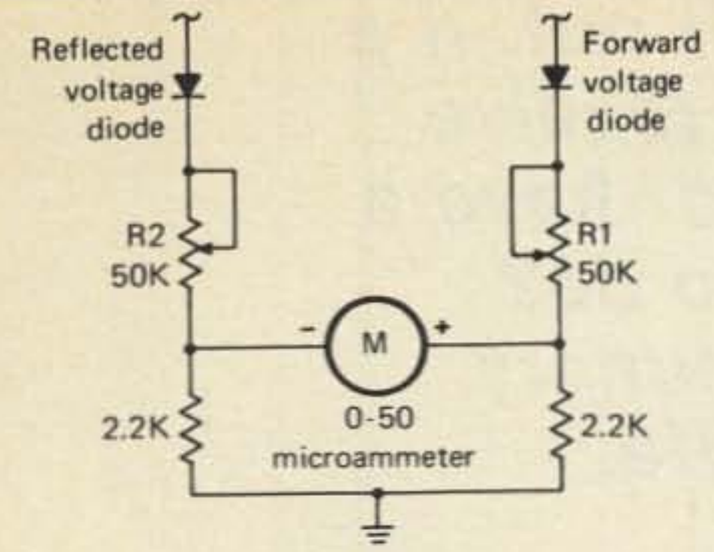

Fig. 1 - A differential circuit which served as the basis for K4KI's power meter

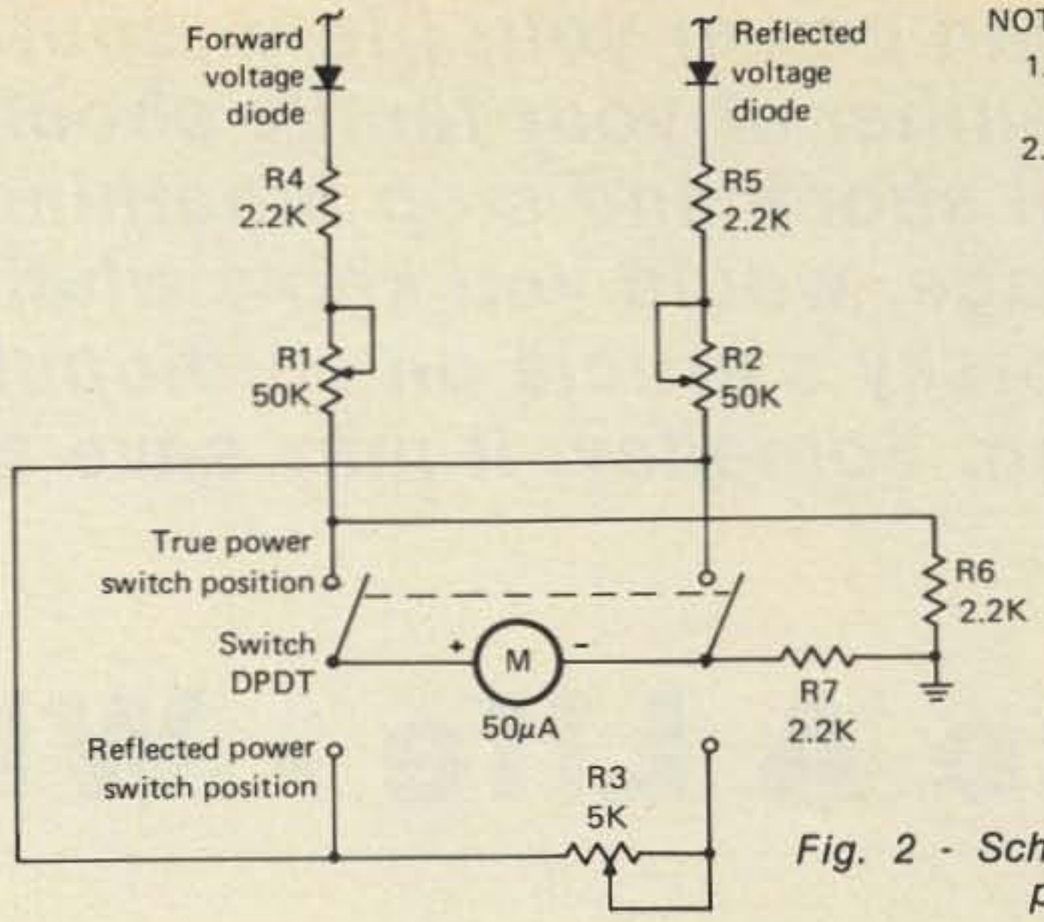

Fig. 2 - Schematic diagram of the power meter.

NOTES:

1. Variable resistors are trimpots or equivalent.
2. Fixed resistors are all ½ watt carbon, 5% tolerance.

put your calibrated wattmeter on series with the modified meter as shown in fig. 3. The calibration procedure is as follows.

(a) With the switch S thrown to the true power position, adjust your transmitter power output into a dummy load until the calibrated wattmeter reads the desired level of power at which you want your true power wattmeter to read full scale. In my own case this was 100 watts. Now adjust R1 until the microammeter reads full scale.

(b) Now reverse the input and output co-ax leads to the true power wattmeter. Reverse the microammeter leads on the true power wattmeter. Adjust your transmitter power output until you again read 100 watts on the calibrated wattmeter. Adjust R2 until the microammeter reads full scale.
Note: There is a small amount of interaction between the adjustment of R1 and R2 when doing the calibration steps of (a) and (b). It is necessary to repeat these steps a couple of times until you read full scale in both cases when the transmitter power output is 100 watts as read on the calibrated wattmeter. It's a real simple thing to do.

(c) Before proceeding with this step make sure that your microammeter is reconnected properly according to fig. 2. Do not further adjust R1 and R2. Connect the co-ax leads to the true power wattmeter as in step (b). Throw the switch S to the reflected power position. With the calibrated wattmeter reading 100 watts, adjust R3 so that the microammeter reads full scale. The meter is now calibrated. Once you have achieved full scale calibration as described, the same procedure can be followed for lower powers if desired to give you further scale calibration points on the microammeter. However my experience has shown me that you can use the relative scale graduations of your calibrated wattmeter, and you won't be very far off.

Even if you do not have access to an already calibrated wattmeter you can easily make a relative power calibration. Just adjust your transmitter for normal power output into your dummy load by watching your cathode current meter. Leave everything on the transmitter set, and just turn the carrier on and off as needed during steps (a) through (c). You can select about 70% of full scale on your true power meter to indicate normal power output. You now have a meter that will at a glance tell you what your relative power output will be compared to the value you selected originally as true power output.

Conclusion

The wattmeter just described has several distinct advantages when tuning up your rig. Because the meter indication is a function of the difference between forward power and reflected power, you will find that as you approach a matched condition, there will be a very marked increase in scale reading, as your forward power less the reflected power, or true power, indicates your output. There is no mistake when you approach this condition. Your meter just increases scale reading rapidly, which makes tuning control far more positive than when you try to mentally subtract reverse power from forward power, along with the switching which was previously necessary. Another very definite advantage is that if you are like me, you like to watch a single meter to indicate equipment performance, this meter does it. If for example you had your s.w.r. meter or wattmeter previously used reading forward power, and something happened, like a short in your co-ax antenna cable, you might never even notice it. The forward power would still be high, while at the same time your reflected power could also be high, and with the resulting high s.w.r. you could easily burn out a tube or damage your equipment. With the wattmeter just described, if such a fault happened, the true power would drop drastically, and you would have time to shut down your rig before something blew out. Another useful place where this kind of a meter can be used is in driving a linear amplifier from an exciter. The wattmeter when connected between these two units tells you continuously how much drive you are getting from your exciter.

If you want to build a wattmeter with extra ranges you can use a three gang selector switch with additional trimpots. Naturally different values of R1 and R2 will have to be used to cover the ranges you may want to design for. Undoubtedly many variations of this basic idea can be developed and built. I only hope that you will find it as useful as I did.

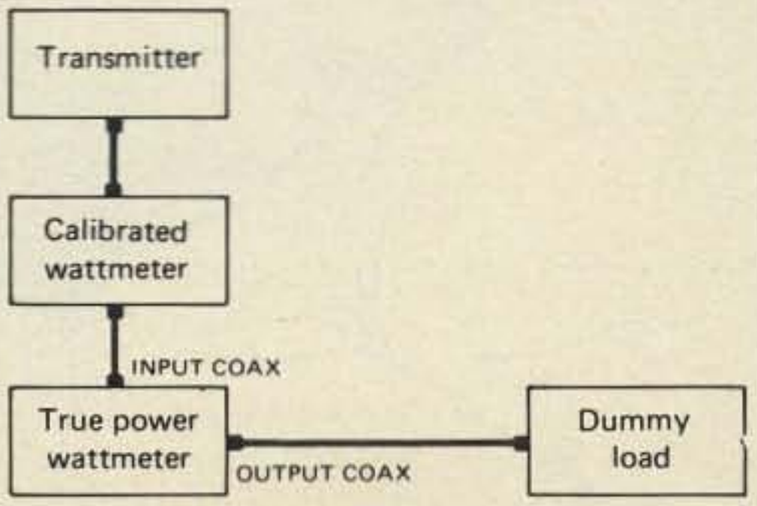

Fig. 3 - Installation scheme of the power meter.

Electricity can power your life or snuff it out. If a friend or member of your family should receive an electrical shock and stop breathing or have a heart-stoppage, would you know what to do? Read Dr. Gorsky's article on cardiopulmonary resuscitation. Someday, it may save a life.

Save A Life - With CPR

BY BENJAMIN H. "BUZZ" GORSKY, M.D.*, K8BG

CPR—cardiopulmonary resuscitation is a method for delaying death until definitive measures can be employed for victims of events which stop either the heart or the breathing apparatus. CPR by itself may be sufficient in some instances to save a life while in others it will merely serve to buy time. However, since only a very few minutes are available between certain life-threatening events and irreversible brain death, buying time can make all of the difference. Will you learn CPR from reading this article? No. CPR requires skills which can only be learned from instruction and practice (using a "doll" called *Resussi-Anne*). No matter where you live you should be able to find a CPR course in or near your community. For information you should contact your Heart Association, Red Cross, YMCA YWCA, or community college. This article will serve only as an introduction, but if you invest about a half-day's time in a course, you might be able to save a friend.

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When you try to fix a malfunctioning radio you must first do some troubleshooting and then solve the problem. In order to troubleshoot you need to have some idea of how the circuit in question functioned when it was working properly. CPR is the same way. When someone stops breathing or suffers a heart stoppage, you need to identify the source of the problem in order to apply the correct treatment. To do that you need to know some things about how the body usually functions. We'll begin there.

The body is composed of billions of cells. Groups of cells make up the various organs, each of which is responsible for a certain function. Each cell must be supplied with oxygen and nutrients and have the waste products resulting from its metabolism removed. The heart and circulatory system supply blood to each cell for those purposes. Blood coming to the cells is rich in oxygen and nutrients. Blood leaving an organ has given up some of its supplies and carries away carbon dioxide and other waste products. When blood returns to the heart from all of the body organs, it is pumped to the lungs where carbon dioxide is given up into the air and oxygen is taken from the air to enter the blood. Therefore the

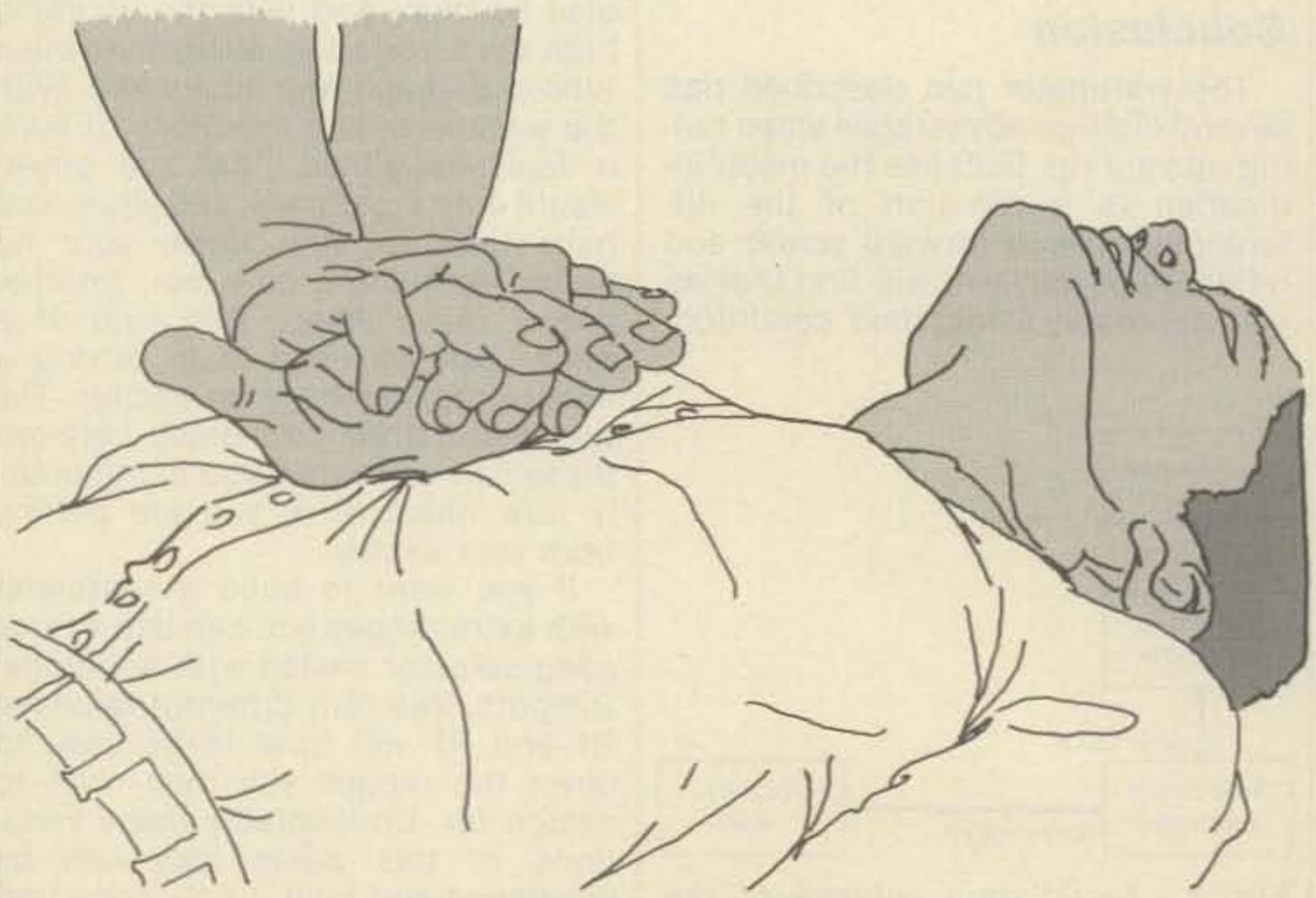


Fig. 1 - The position for administration of CPR.

heart and lungs, circulation and breathing, are of central importance to all of the cells of the body. Some cells will survive long periods without a blood or oxygen supply. For example, an arm or leg will withstand a few hours without any circulation with little difficulty. On the other hand, the cells of the brain are exquisitely sensitive to oxygen lack; they can survive only a few minutes without a supply of oxygen. After only three or four minutes of deprivation there is only a fifty percent chance for ultimate survival. So CPR is a technique for heart and lung resuscitation aimed at helping the brain to survive.

Normally, the heart generates its own rhythmic pattern of pumping which efficiently pumps blood through one set of vessels to the lungs and through another set to the other organs in the body. On the other hand, the muscles which cause breathing to occur do not act on their own; they require nerve impulses from the brain. Heart action may stop because of a heart attack or because of an external event such as electrocution which upsets the heart's own electrical activity. Breathing which is under control of the brain, which is so sensitive to lack of oxygen, will stop within seconds after the heart stops. However, breathing can also stop for other reasons including drug overdose, stroke, or any other process which seriously interferes with brain function.

The sequence for administering CPR includes "troubleshooting" the system as well as providing therapy for absent functions. The rescuer first gently shakes the victim and asks "Are you all right?" If someone has merely fallen, but is not unconscious this should elicit a response, and since it is dangerous to attempt to resuscitate an individual with normal cardiac and respiratory function, this step is necessary. If indeed the victim is unconscious, the rescuer turns the subject to a supine position. The rescuer kneels on one side of the victim beside the victim's neck. One hand is placed under the neck and another on the forehead and the head is tilted backward. For some unconscious victims who have had their breathing passage obstructed by the tongue falling back into the throat (an event incorrectly referred to as "swallowing the tongue") this head position will open the air passage and allow breathing to resume. After "opening the airway" the rescuer looks to see if the subject is breathing and listens for the passage of air. He also calls for help. (Do you know the correct telephone number for summoning emergency aid in your community? In many areas it is 911, in others the police, fire, or rescue squad may have a specific number for medical emergencies.) If no other person is available to obtain help, the rescuer stays with the victim and awaits another passerby. If the victim does begin breathing when the airway is opened, the rescuer continues to support the airway and monitor breathing until the victim can be transported to a hospital.

If breathing does not resume, the rescuer uses mouth-to-mouth breathing and gives four quick breaths to the victim to expand the lungs. He then feels for the pulsation of the carotid artery in the neck. That site is used both because it is handy while kneeling at the side of the neck and because it is usually an easier pulse to feel than the one at the wrist. If a pulse is felt, the rescuer gives one breath every five seconds and continues to monitor the pulse. In such cases where only breathing has stopped life can be easily maintained even for a long period by "rescue breathing."

However, if a pulse cannot be felt after the four quick breaths are given, then heart-pumping action must be supplied by the rescuer as well. The heart lies between the breastbone, called the sternum, and the spinal column. Since the breastbone is semi-mobile, pressure exerted there will compress the heart. If compressions are done correctly and rhythmically blood can be effectively pumped from the heart. The correct position must be located on the sternum and about 80 pounds of force must be applied to move the sternum about 1½ to 2 inches. It is important to locate just the right spot to apply pressure both to insure adequate compression of the heart and to avoid fractering ribs, lacerating the lung, or injuring the liver.

When only one rescuer is present that person must compress the heart fifteen times at a rate of about eighty compressions per minute, then give two quick breaths, then return to chest compression. When two rescuers are available one will compress the chest, at a rate of sixty per minute while the other rescuer gives a breath after every five compressions. When resuscitation must be performed for a long time the rescuers would usually swap positions from time to time to minimize fatigue. CPR is continued until facilities for more definitive therapy are available. In some communities the paramedics from a rescue squad will be able to perform more advanced procedures, while in other locations the victim will be transported to a hospital while CPR is continued. Since the brain cannot survive more than a few minutes without an adequate supply of oxygen containing blood, CPR is essential to sustain life until more advanced techniques can be applied to restore vital functions.

You can see from the description of the techniques that they are not tremendously difficult but that there are many details to remember and there are some specific skills which must be mastered. But wouldn't it be worth it if you saved a life? You can register with the American Heart Association to become certified as a "Heart Saver" by learning the techniques described here. If you also learn the techniques for opening an airway which is obstructed by a foreign object and the special methods for resuscitation of infants and children you can be certified as a "Basic rescuer." If you really get into the swing of things you might want to learn to be a "Basic Life Support Instructor" so that you can teach these life-saving techniques to others. To get started you'll have to invest about a half of a day so.

You can save a life. CQ

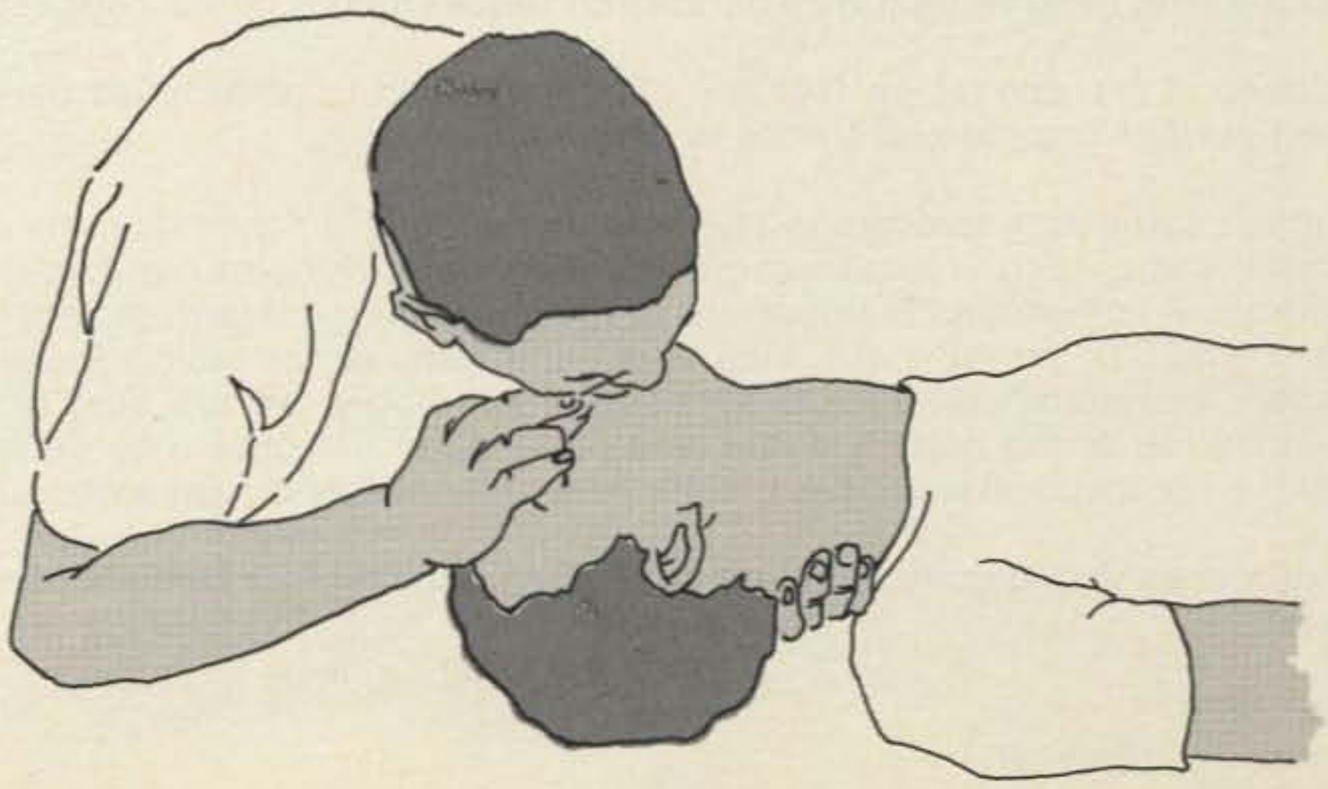


Fig. 2 - Mouth-to-mouth rescusitation.

Comments On Docket 20777

Suggestions For Rules Changes For Amateur Radioteletype (RTTY) Operation

The following letter and comments, written by George W. Henry, Jr., K9GWT, Secretary of HAL Communications Corp., were recently received at CQ. Both Mr. Henry and CQ welcome reader's reactions and comments. -K2VG

William J. Tricarico, Secretary
Federal Communications Commission
Washington, DC 20554

RE: Docket 20777

Dear Mr. Tricarico:

Attached is a discussion of Docket 20777 relating to authorization of the use of the ASCII teleprinter code in the amateur radio service. The opinions expressed in these notes are those of HAL Communications Corp., and reflect a number of comments we receive daily from our customers, active RTTY amateurs.

As is evident after reading Docket 20777, a number of options come to mind when the question of ASCII authorizations is opened. For example, in the spirit of deregulation one approach might be to simply eliminate all references to code type and data rates in the regulations. Obviously, this could lead to mass confusion for the user and manufacturer and make regulation by the commission impossible. Also, there is an incongruity between the use of high data rates and the need to minimize bandwidth requirements in the congested high frequency bands.

Enclosed is a proposal we feel will effect a working compromise between these conflicts and, at the same time, reflect current commercial trends in data transmission.

Although some standardization of codes and speeds is necessary, the experimental side of amateur radio cannot be ignored; some of the outstanding electronic innovations of our times have been made by technically active radio amateurs. It is particularly important in the data communications field to allow continued work on such problems as error correction on HF data links and bandwidth compression techniques, both of which could directly benefit amateur and commercial radio services. Accordingly, we are also proposing that specific provision be made for authorization of the use of modes and techniques not otherwise permitted. Such an "experimental authorization" should be granted on a per-case basis when adequately documented to the commission and be temporary in nature.

I hope the enclosed comments are helpful; please feel free to call upon us if we may be of further assistance in this matter.

Sincerely,
George W. Henry, Jr.
Secretary

FCC Docket 20777
Authorization of ASCII RTTY in Amateur Radio Service
Notice of Inquiry and further Notice of Proposed Rulemaking

I. Present Amateur RTTY Authorizations:
(FCC Rules & Regulations Part 97)
97.61 Authorized Frequencies and Emissions
97.65 Emission Limitations
97.69 Radio Teleprinter Transmissions
97.87 Station Identification

A. Summary of Present Rules:
1. 3.500 to 28.500 MHz = Type F1 emission in basically CW sub-bands
2. 50.1 MHz and higher = Types F1, A2, and F2 emissions in basically all but the CW sub-bands
3. Code = Single channel five-unit (start-stop), International Telegraphic Alphabet No. 2 (commonly called Baudot or sometimes Murray code).
4. Speeds = 60, 67, 75, or 100 wpm (45, 50, 56.25, or 75 baud); Tolerance = ± 5 wpm
5. Max. Freq. Shift = 900 Hz in F1 emission
6. Max. Audio Mod. Freq = 3000 Hz in A2 or F2 emission
7. Identification = Required of *transmitting* station at each end of transmission plus every 10 minutes of continuing transmission by either voice or Morse code (20 wpm maximum), whichever is compatible with sub-band allocations.

B. Some implications:
1. Bandwidth: FCC Rules & Regulations Parts 2.202(b) and 2.202(g) define RTTY bandwidth for type F1 emission as:
B_n (Hz) = 2.6(D) + 0.55(B) for 1.5<(2D/B)<5.5
or B_n (Hz) = 2.1(D) + 1.90(B) for 5.5<(2D/B)<20.
D = Half the difference between the maximum and minimum values of the instantaneous frequency in Hz.
B = Telegraph speed in bauds
if D = Half the frequency shift = 900/2, the maximum authorization,
and B = 75 baud, the maximum authorized (100 wpm)
2D/B = 12.0
and B_n = 1211.25 Hz, the maximum bandwidth implied by the authorization
Consider B = 300 baud, a common ASCII data rate
and D = 425/2 = 212.5 Hz (425 Hz frequency shift);
B_n = 717.5 Hz, much lower than the above maximum 5-unit example.

2. Identification: Section 97.87 requires Morse code or voice ID of ALL amateur transmissions. Although the amateur fraternity can continue to operate with this limitation, a more reasonable approach might also permit RTTY only ID's with standardized code and data rates.

3. Code Format and Rates: Section 97.69 very specifically sets an allowed code and four data rates to be used. The current trend on amateur rules is toward "deregulation." However, the FCC has also expressed concern with monitoring amateur activities implying that some code and rate standards would be preferred.

II. Some thoughts concerning ASCII:
A. Ionosphere propagation and present interference levels in the 3.5 to 28.5 MHz range put a realistic upper limit on data rates that can be reliably used with simple, non-error correcting data transmission schemes. It does not appear fruitful to press for data rates over 300 baud, particularly in view of the much wider bandwidth required for the next standard data rate, 600 baud. The 300 baud is much preferred over the next lower rate, 150 baud, because of the current heavy usage of this rate, as well as the convenience of faster data transfer.

B. Similarly, progressively higher data rates should be allowed in the VHF range from 28.5 to 225 MHz, remaining compatible with existing services and bandwidths already using these frequencies. From a user standpoint, these frequencies will probably be the most popular for hobby computer activities and higher data rates are very desireable. Because of the lower density of activity on these frequencies, data rates of up to 1200 baud should be possible, particularly if the F2 deviation is restricted to produce the same signal bandwidth required by present F3 NBFM activities.

C. In the 420 MHz band and higher, standard data rates up to at least 19,200 baud should be allowed and possibly no upper limit specified to encourage experimentation. However, operations at very high rates should be permitted only on a non-interference basis to present sub-band users.
D. In the interest of compatibility and to allow monitoring, the 7 unit ASCII code should be authorized; however, such things as parity and number of stop pulses should not be specified. The ASCII code should be sent in serial order of least significant bit, following current commercial practice. Also, use of sub-sets of the full ASCII code should not be precluded; a "caps-only" (no lower case letters characters) version of ASCII is quite commonly used by both electronic and electro-mechanical terminals.
E. Also, in interest of monitoring, the asynchronous mode should be standard, although experimental use of synchronous transmission should not be entirely precluded.
F. The Morse or voice ID requirement should be expanded to allow RTTY identification at specified rates and codes.

G. Although standardization of data transmission codes and rates is very desireable from the viewpoint of the user, manufacturer, or regulatory agency, the purely experimental interests of the amateur radio fraternity should not be precluded. Experimental work with synchronous transmission, higher data rates, and various error correction schemes are among the probable interests of the experimentally active radio amateur. Present amateur regulations either do not permit such activities, or restrict them to ultra-high frequencies where problems related to propagation of high user density cannot be successfully duplicated. A provision for experimental authorization of new techniques and modes should be included in Part 97 of the Rules and Regulations. Although such an authorization would obviously apply to far more than radio teleprinter techniques, the myriad of options discussed with regard to Docket 20777 indicates a strong need for some mechanism to support original work

III. Recommendations for changes to Part 97:

97.61 Authorized Frequencies and Emissions:

97.61(a):

1. 3500 to 3775 kHz : add new footnote
   7000 to 7150 kHz :
   14000 to 14200 kHz :
   21000 to 21250 kHz :
   28.0 to 28.5 Mhz :
2. 28.5 to 29.7 MHz : add new footnote
   50.1 to 54.0 MHz :
   144.1 to 148.0 MHz :
   220.0 to 225.0 MHz :
3. 420.0 MHz and above: add new footnote 16

97.61(b) Limitations:
[add the followings footnotes:]

(14) Type F1 radio teleprinter transmissions permitted at baud rates up to (and including) 300 baud.

(15) Type F1, A2, or F2 radio teleprinter transmissions permitted at baud rates up to (and including) 1200 baud with the restriction that the total signal bandwidth of F2 emissions should not exceed that of an F3 voice signal authorized in the chosen band segment.

(16) Type F1, A2, or F2 radio teleprinter transmission may be used at any baud rate so long as the resulting bandwidth is compatible with the other modes in prevailing use in the chosen band segment and undue interference is not caused to other users of the frequency range.

97.69 [Modify wording as follows]:

97.69(a) A single channel five- or eight-unit (start-stop) teleprinter code shall be used which shall correspond to the International Telegraphic Alphabet No. 2 with respect to all letters and numerals (including the slant or fraction bar) (five-unit code), or to the American National Standard Code for Information Interchange (hereafter called "ASCII"). In general, these codes shall conform as nearly as possible to the teleprinter codes in common commercial usage in the United States. The use of the eighth "parity" unit of the ASCII code is left to the user's discretion. Exceptions to these rules regarding code used or use of synchronous instead of asynchronous may be granted on an individual basis with an experimental authorization, detailed in sub-part 97.92.

97.69(b) The normal transmitting speed of the radio teleprinter signal keying equipment shall be adjusted as closely as possible to one of the standard teleprinter speeds or data rates, namely for five-unit code, 60 (45 bauds), or 67 (50 bauds), 75 (56.25 bauds), 100 (75 bauds), or 132 (100 bauds) words per minute or, for eight-unit code, 110, 150, 300, 600, 1200, 2400, 4800, 9600, or 19,200 bauds. The tolerance for speed (or rate) control shall ± 5 wpm or ± 5 %, whichever is least. Exceptions to these rules regarding speed (or rate) may be granted on an individual basis with an experimental authorization, detailed in subpart 97.92. the limitations of subparts 97-61 (a) and (b) regarding maximum data rate for various frequencies apply to both 5- and 8-unit codes.

97.69(c) [add to present note restricting maximum shift to 900 Hz]:
Additionally, when ASCII code is used at 300 baud on frequencies below 28.500 MHz, the maximum frequency shift of type F1 emmission shall be no more than 500 Hz.

97.69(d) [Add to present note restricting maximum audio modulating frequency]:
In addition, when type F2 emmission (5 kHz deviation) is also used, the total bandwidth of the F2 emission shall not exceed that of the co-channel voice signals.

97.87(g) [Add to the present text requiring Morse or voice identification]:
In the special case of radio teleprinter emissions, the identification of the transmitting station may also be made strictly by teleprinter if:

1. The code is either 5-unit or 8-unit "standard" codes defined in section 97.69(a).
2. The code is "start-stop" in nature (asynchronous).
3. The identification is sent at one of the standard rates authorized in 97.61(b) and 97.69(b).

97.92 [Add new section]

97.92 Experimental Authorization

In order to encourage experimentation and allow use of newly developed communications techniques, the FCC may, at its discretion, grant experimental authorizations for amateur operations utilizing modes or techniques not formally defined in these regulations. To obtain such an authorization the applicant must do the following:

1. Hold a valid amateur radio license of Technician or higher class;
2. Technically describe the proposed special transmission desired including such diagrams and bandwidth as may be pertinent;
3. Provide a statement as to why the proposed transmission is to be

preferred over "standard" communications modes currently authorized in Part 97 of these regulations.

The commission may grant such experimental authorizations for periods of up to one year on length and may be renewed if the applicant can show continuing need for the authorization. The commission may, at any time cancel such authorizations, as it sees fit.

After the authorization is received, the holder may then operate in the manner described by his original application for the period of the authorization subject to the following restrictions:

1. An exact log of dates, times, frequencies, and stations communicated with during those times that the special transmission form is used.
2. Transmission authorized by experimental authorizations may only be conducted on a non-interference basis with other users or adjacent frequencies.
3. Only the modes or procedures described in the application and subsequent experimental authorization may be utilized. Modifications beyond the scope of the original authorization or materially differing from the original authorization require new application and authorization.
4. Regardless of the mode or modes of communications used in the experimental transmissions, identification of at least the transmitting station's call sign shall be made in accordance with section 97.87 of this part.
5. If the experimental transmission is required for a period greater than a year after issuance, the authorization may be renewed if, in the commission's opinion, the renewal request sufficiently justifies continued experimentation in the designated manner.

The purpose of tne experimental authorization is to provide a mechanism to encourage experimentation in communications techniques beyond those specifically authorized in Part 97. It is the intent that such authorizations be temporary in nature and that if the experimental application proves usable for amateur communications, the rules covering "standard" transmissions should be revised to include the new technique rather than continued renewal of experimental authorizations. ■

a monthly feature by

ADRIAN WEISS, K8EEG

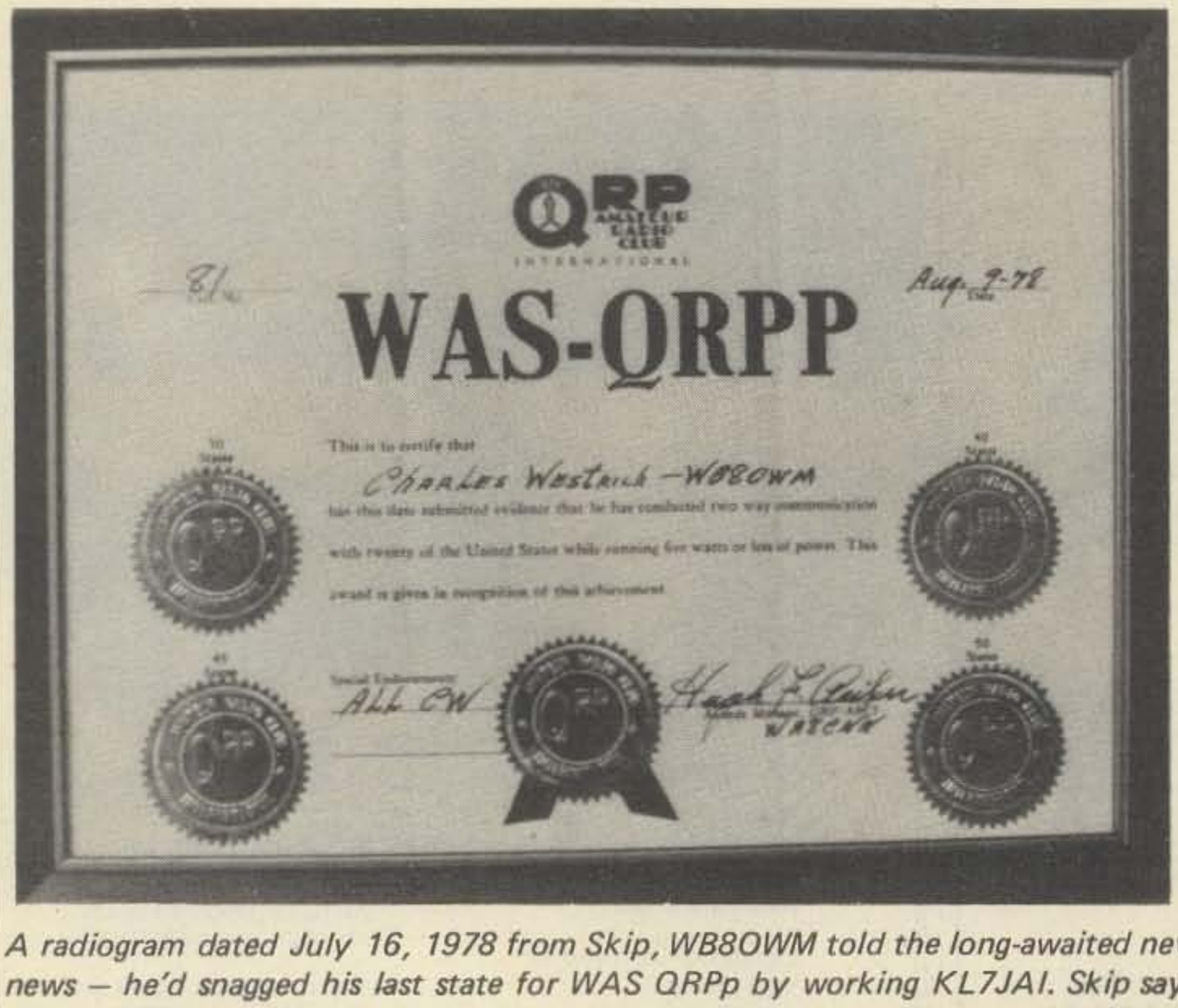
QRP

The art of very low power operating

QRPp Operating Reports & News

It's been a while since we've turned this space over to our readers and given them the opportunity to share their experiences and views with the gang. This is partly due to my eight-month sojourn in Europe which proved to be the realization of something I never even dreamed of ever doing. I suppose I ought to at least fill you all in on what I was up to over there. As it turned out, I remained in London from January to June. As I noted in an earlier column, London was fantastic from many angles. Museums abounded. I didn't scratch the surface. One of the pieces that impressed me was the now-famous Ware bedstead built to the specifications of Lord Ware back in the 1590's or so. The bed measures eleven feet square, has a full canopy, bookshelves as the head board, carvings all over the place, and indeed, a truly remarkable bed. Given English weather—always damp and cold—the Ware bed seemed to represent the most imaginative and practical response to living in England. Lusty old chap too! The English countryside is like a miniature painting—all the fields laid out so neat and orderly, and hemmed in with fences of stone or hedges. Winding, eight foot country lanes lined with twelve foot hedges provided a very interesting place to ridge my motorcycle, since visibility was usually about 50 ft. at the most! Castles and cathedrals were everywhere and quite impressive, but what I was really impressed with were the small, out-of-the-way churches built 700-1000 years ago! English pubs are an ancient tradition likewise and specialize in the heavy malt beer known as Guinness "stout." Yuck. No such thing as a pub named "Joe's Bar" in England. Classy names for every pub—"The Lion," "The Boar's Head," "The King George." "The Old Swan" housed "Matilda's Folk Club" which featured an open stage for musicians from all over the world. Very interesting listening to the folk songs in many different languages. And then, the early music scene in London was fantastic! There are four to seven pre-1750 concerts per week featuring music by ancient composers only fanatics like myself have heard about. At any rate, I picked up a Spanish guitar the second day in England, and spent most of my time at the London Music Club learning to operate it. Found a nearly-new Honda CJ360T cycle in April and bought it cheap. Took me a couple days to learn to operate it, but then I was living a dream that I've had for a long time. Only trouble was that it rained five of seven days. Met a lot of very interesting people from all over the world who passed thru the club and made some good friends. But by June, the rain had me climbing the walls, what with my shiny yellow cycle parked outside and the world waiting for me! So I took a good friend I'd met at the club and who spoke fluent French to France. Good thing she was along, because I didn't know a single word of French. It is quite a shock to land in a foreign

*83 Suburban Estates, Vermillion, SD 57069



A radiogram dated July 16, 1978 from Skip, WB8OWM told the long-awaited news news — he'd snagged his last state for WAS QRPp by working KL7JAI. Skip says: "My QRPp signal finally found its way to KL7 land . . . never thought I'd see a KL7 in my log! Would suggest to any fellow QRPp'r to get a KL7 and KH6 tucked into the log before going after the other states. Gotta run now and start keyin' up for that QRPp DXCC stuff. . . "So we proudly present a photo of WB8OWM's award for all to behold. Skip is an outstanding example of the type of stick-to-it attitude that a QRPp'r has to have if he is to succeed. He has been hounding KH6 and KL7 for quite a while now after working the other 48, and could have given up a long time ago. I suppose a lot of guys would have given up, but not Skip. So, I can finally offer my congratulations to you Skip on a good job, and sincere thanks for keeping us all posted on your progress with periodic notes.

country, get waved through customs, head out looking at the signs for directions, and not having the slightest idea of what the signs were saying! Wow! Un-nerving. Thank God for French Canadian painists! Then the "easy ride" began by running south from Calais along the coast and inspecting Nazi fortifications which were everywhere. It is one thing to read about the amphitheater sized blockhouses which housed 20 inch guns, but it is coldly sobering to walk thru them. Cut inland from Boulogne, and, as we rode into the dusk on a cold damp evening, way out on the horizon there appeared a huge dark bluish mass that was the cathedral at Amiens. I said to myself "naw, can't be that yet, Amiens is 12 miles away." It was, and what a hulk of granite stone. Mindboggling. So too with the cathedral at Chartes with its utterly incredibly 176 original stained-glass windows. French villages of brick and tile, streets so neat that you could eat off them. Ancient buildings and chapels everywhere. Prehistoric ruins. Warm, friendly people who would stick it out until they figured what I was trying to say in my broken French. All the hotel rooms with dainty, flowered wall-paper. Meals of two-foot long long loaves of fresh French bread, cheese, sardines, plastic containers of the local wine. The snowcapped Alps three miles north of Vence where I stayed, the Mediteranean Sea six miles south. The Col de Vence at 3700 ft. just eight miles north of the sea. Little villages hung on cliffs 1800 ft. above the valley floor. Stunning coastline all the way to Italy. The beach at Nice with beautiful azure colored water—and beautiful bronze bathers. Then a quick three day trip acorss the south of France to Barcelona, Spain, in search of a dream guitar at three shops a friend had told me about.

Didn't have any money, but had to go anyhow. Believe it or not, they took Master charge! So I haggled myself into trading my old guitar for the best instrument I've ever heard or played. Haggling without knowing a word of Spanish is a real challenge, but I did manage to get them to change store-policy on "no trade-ins" despite the language barrier! Looking back, I wonder if it all really happened. Then I remember how many times in how many different places I'd stand gazing at incredible sights of all kinds and hit myself up the side of the head—I *really* see this!—saying, "this is real man, this isn't a picture in National Geographic! Remember it!" And I find myself walking along the campus here and an image crops up in my mind—maybe of the finely carved intricate floral patterns snaking their way up a column of stone 138 ft. high at Amiens, or the gargoyles at Notre Dame, or some other detail, and I know all this really did happen. It was fantastic. I rode a cycle through a world that I never dreamt of touching, and it was incredible! I could fill a book with stories, but I hope this little note suffices to fill all you readers in and maybe make up for letters that laid unanswered for half-a-year while I was away!

Now, let's turn to our readers and hear them out. de. . .WD5JDJ, Mike Kilgore, 3511-23, Lubbok, TX 79410: "I am a newcomer to amateur radio, having just received my Novice ticket in March of 1978. I got an HW-8 on the air first of August and I love QRPp! I incorporated some of your modifications from the "Super-Modified HW-8 Contest Machine" articles. I'm very pleased with the rig, but since I changed the 15 meter coil as per your directions, I hear the CB operator two blocks away all across the 15 meter band because of his 1500 watt overmodulated rig! He overloads my receiver so badly that he has cost me several contacts. His signal is so clear that at first I thought he was "bootlegging" on 15 meters. Is there anyway to eliminate this problem, short of eliminating him? (ED: I'm afraid not Mike. A signal that powerful in all likelihood will overload most receivers.) I wrote the FCC about the problem and got a letter back saying that they were understaffed and couldn't be everywhere! Now that I'm finished complaining, I'll say that I read your column first each month and that Ron W8ILC, who worked 100 countries with one watt, is my idol (ED: W8ILC is at about 240 countries with one watt, with over 200 QSL's!). Well, 73 and keep up the good work!."
de. . .VE5JQ, John Dudley M.D., University Hospital, Saskatoon, Sask, Canada: "This is just a note to tell you that I appreciated your 'basic information' on QRPp operating in the July issue of *CQ*. I have been inactive for ten years, being occupied with my medical training, and am presently becoming interested in operating again. My initial thoughts were to go out and buy a nice transceiver and linear amplifier and erect a large tower with a rotational antenna. However, this thought seemed rather unexciting after a while as I perused the radio amateur equipment catalogues. It just seemed all too easy, and so, after reading a few of your columns the idea of QRPp operating took hold. I'm now awaiting the arrival of an Argonaut transceiver and I am building a vertical antenna and look forward to operating this station I wonder if you could mention in a column more information on QRPp organizations and QRPp contests. I wonder if there are QRPp sections in any of the major DX contests as well. Thanks for the interest you have stirred in me with regard to QRPp. (ED: You're welcome John. In next month's column, I'll give a complete rundown on the type of information that you request. Good luck with the Argo and vertical!.)"
de. . .W9MIK, G.A. Schuman, 1922 Belmont Ave., Chicago, ILL 60657: "I need your help on T1 for the 420XC transceiver described in the past issues of *CQ*. ON p. 50 of the October, 1978 issue, it indicates that T1 consists of 9 turn trifilar pair around a 2401 core. On page 51, the table lists 12 turns of #24 on a 2401 core. This is the same as the 20 meter L2. Which is correct? (ED: the diagram on p. 50 is correct for T1. The p. 51 entry is an error.) One more question—on p. 36 of the May issue, you indicate that L1 & L2 for the 15 watt amplifier are wound with #21 enamel. Can you use #20 or #18? (ED: yes you can. The wire size is chosen primarily for current-handling capability. Since high r.f. current is flowing through L1 & L2, any resistance will cause thermal loss in that current. So, the lowest resistance wire that will fit on the toroid core is the best, since it will exhibit the least resistance and hence lowest loss.)
(ED: in the next column, we will add some further clarifications and notes on the 420XC transceiver.)
de. . .WD9ENH, Paul Eskew, Rt #2 Box #3, DuQuoin, IL 62832: "Just thought I'd drop you a line and let you know that you've gained another QRPp fan. I had my doubts about working anything with 2-3 watts when I swapped my old faithful Knight RX-100 receiver for an HW-8, so I planned only on using the receiver section of the HW-8. The transmitter was a 30 watt crystal controlled rig for 40 meters and QSO's were hard to come by, especially at night. Then, one day, I decided to try the HW-8 transmitter also. I heard WD4MEG loud and clear with little QRM, so I called him and he came back with a 569! After many such contacts, I was hooked! I tried 15 meters and worked coast-to-coast with flattering reports, but no DX, not even a KP4!

Then came a General Class ticket and a two element quad and things started ticking! My first DX QSO was SM5AYY with a 449, and in four months time I have 45 countries and WAC under my belt with the HW-8! I'm just 18 years old so I've got plenty of time to make DXCC. I've snagged such choice areas as C31, HKØ, ZP5, VP2M-D, and UA9-Ø, many of these in formidable pile-ups. I've found that when trying to break a pile-ups, a quick "de QRPp" on the

other guy's final transmission if effective. Although some consider that bad practice, it does work! (ask KC31NM and 4U1UN HI!) Well, I'll say so-long for now and keep your fine QRPp articles coming. Best 73's. P.S. Also will get into the '78 CQ WW CW Contest, but don't laugh at my score!"

de. . .WA1UHA/AD1C, Jim Reisert, 17 Mansfield Drive, Chelmsford, MA 01824: "Like you, I am also a low power enthusiast. I am only 14 years old, and I have a completely homebrew station. The transmitter runs 2 watts output to a vertical with 2dB of feedline-loss. I have worked 11 countries and 30 states, which is quite an accomplishment since the only band I work is 40 meters! (ED: good job!) I frequently read your column in *CQ* and I enjoy what I read. I haven't seen too many of your articles lately, so I was wondering what happened to you. Have you been on the air too much? Now, the point of this letter. A while back, it was mentioned in *CQ* that your QRPp magazine *The Milliwatt* may cease publication. Is it still being published, or is it too late? (ED: *The Milliwatt* ceased publication in June, 1975, after a run of 33 issues. 26 of these issues are still in stock, and can be purchased at 6 for $4.00.) Also, I am always trying something new, so if you can use construction articles let me know (Ed: sure thing Jim—try us!) Good luck and good DX'ing. 73's."

de. . .WB5OAU/6, Jack Brewer, 1240 Mesa Oaks Ln, Lompoc, CA 93436: "Been missing your column in *CQ*, and hope that this finds you back in the states and enjoying stateside QRPp again. I'm operating portable-six with an HW-8 to a 40-20 meter dipole fed with the same feedline, up 35 ft. and supported by two pieces of Eucalyptus tree spliced together with a length of PVC tubing. Cheap but effective. Many QSO's have been made on 20 meters, including numerous JA's, KH6's, and I've worked ZS2 in Port Elizabeth with a 559 as my best DX. I have a QRO station at home and find that I have much more fun with the 'lil HW-8. I have a request to make—if there are any runs of *The Milliwatt* left, reserve a set for me! Also a suggestion. Could you publish a design for a transmatch using "roll your own" coils and possible 365pf broadcast band type variable capacitors? I've read umpteen articles on transmatch construction, but all seem to demand use of obscure toroid cores, roller inductors, and other "mail off for" components. I am like many others—I can't stand waiting for components through the mail and I want to build it NOW! Welcome home, and I'll be waiting to hear from you. Oh yes, I have a 300mw. "tuna-tin" rig and made a number of 6-land contacts on 40 meters with it."

Well gang, that's it for this month. Next month we'll continue with other letters from readers and go on with information about QRPp operations, contests, awards, organizations, parts sources, and similar grab-bag information. In the meantime, I hope you all are enjoying the benefits of the improving sunspot cycle situation and working a lot more DX than before. I'll be interested in receiving reports and letters from many of you so that I can pass them on in future columns! This is important to a good column. What I would like to do in the future is to frequently run the regular QRPp column consisting of letters, operating reports, questions/answers, news, and the like, plus a feature article which discusses some piece of equiment and gives construction details. So, if the gang can start sending in reports, photos, operating hints, project descriptions and the like on a regular basis, we can provide the two types of QRPp articles in most future issues. But it's up to you fellas to provide the material! What say?

73, Ade K8EEG/W0SP

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Bird Mod 43	80
General Radio 650A	150
Measurements Mod 80	195
Nems Clark 1400	495
Ballantine 300H	175
PACO Scope Mod-S-50	75
Singer FM-10C	3495
Simpson 260 V.O.M.	49.50

Allied

AX-190 Receiver	$159

Ameco

PV-50	$ 9
CN-50	29
CN-144	39
TX-62	79
621 VFO	45

B&W Waters

Nuvertor 2+6 Conv.	$ 75
6100 SSB Xmitter	395
670 SSB Adaptor	39
Co-Dax Keyer	95

Central Electronics

100V Transmitter	325
MM-2 Scope	69
20-A SSB Adaptor	79

Clegg

22'er FM	$129
66'er 6M Xcvr	115
99'er 6M Xcvr	59
Interceptor BRCUR	275
Ant Pre Amp	22
All Bander	69
HT-146	125
2 Vess	259
FM-27-B Xcvr	325

Collins

75 A4 Receiver	$395
75S3B Receiver	695
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KWM-2 Xcvr	595
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PM-2 AC Supply	95
516 F2 AC Supply	139
312B5 Console	425
361D2 Mount	29

Drake

2A Receiver	$149
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GTX-200 2M FM	149

Globe/Galaxy

VHF 6+2 Transm	$ 39
Chief Transmitter	39
Galaxy III Xcvr	159
Galaxy V Xcvr	189
Galaxy V Mk II	239
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GT-500A Xcvr	329
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FM-210 2M FM	95

Gonset

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Com IV 2M	129
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G-50 Xcvr	149

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HT-32 Transmitter	179
HT-32B Transmitter	269
SX-99 Receiver	79
SX-115 Receiver	349
HT-37 Transmitter	159
HT-40 Transmitter	49
SX-99 Receiver	99
SX-117 Receiver	189
SR-150 Xcvr	259
SR-160 Xcvr	159
SX-146 Receiver	175
HT-44 Transmitter	159
SX-111 Receiver	149
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S-36 UHF Receiver	125

Hammarlund

HQ-110 A VHF Receiver	$189
HQ-110C Receiver	119
HQ-110AC Receiver	149
HQ-145X Receiver	169
HQ-170C Receiver	159
HQ-180 Receiver	379
HQ-215 Receiver	259
SP-600 Receiver	179
HX-50 Transmitter	169

Heathkit

SB-300 Receiver	$199
SB-301 Receiver	229
HR-10-B Receiver	69
SB-303 Receiver	269
SB-220 Linear Amp	449
SB-102 Trivcvr	379
DX-60B Transmitter	69
HW-32 Transmitter	85
HW-100 Transceiver	249
SB-100 Transceiver	299
SB-401 Transmitter	249
SB-101 Transceiver	349
SB-650 Digital Freq. Display	149
HW-30 Twoer	29
Also Sixer	29
H-10 Monitor	69
VHF-1 Seneca	79
HW-12 Transmitter	75
HP-23 AC Supply	49
HP-23B AC Supply	59
HW-202 2M FM Xcvr	159
SB-620 Spectrum Analyz	120
SB-102 Xcvr	369
SB-610 Scope	95
HA-20 6m Linear	125
SB-634 Ccnsole	175
SB-604 Spkr	29.50
SB-644 VFO	129.50
SB-230 Linear	359
SB-104 Transceiver	625

ICOM

IC-21 2M FM Xcvr	$299
IC-230 Demo	369
IC-22A 2M FM Xcvr	185
IC-30A 432 MCFM	269

Johnson

1-KW Matchbox/SWR	$195
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Ranger II Transmitter	139
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Invader 2000 Xmitt	495

Kenwood

T-599 Transmitter	$289
R-599 Receiver	289
TS-520 Tranc	429
QR-666	259
QR-666 Receiver	239
TV 502 Transvertor	179

Knight

T-60 Transmitter	$ 39
r-100 Receiver	59
TR-108 Trancur 2M	79

Lafayette

HA-800 Receiver	$ 89
HP-350 Receiver	149
HE-45 Transceiver	49

Midland

509 H.T.	$149

Millen

92200 Transmatch	$149
90651-A Grid Dipper	95

National

NC-270 Receiver	$119
NC-300 Receiver	129
NCX-5 Transceiver	279
NCX-5MKII Transcvr	299
NC-303 Receiver	199
AC-500 AC Supply	69
NCX-500 Transceiver	199
NCX-3 Transceiver	169
NC-190 Receiver	149
NC-105 Receiver	69

Regency

HR-2B 2M FM	$169
HR-220 FM 220 MC	185
AR-2 2M Amplifier	85
HR-25 2M FM	225
HR-6 Meter FM	189

SBE

SB-34 Transceiver	$249
SB-33 Transceiver	189
SB-144 2M FM	175
SBZ-LP Linear	179

Standard

SRC-146 HT	$149
826 M Trnscvr	195
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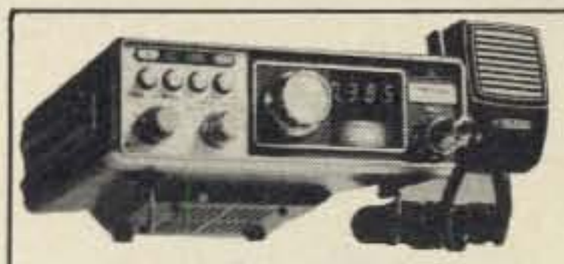

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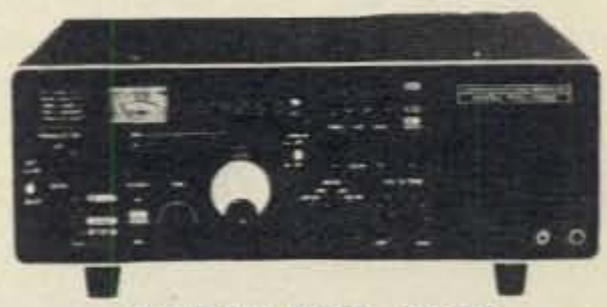

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Novice

"How to" for the newcomer to Amateur radio

QSL Cards - Part III of III

This month's column completes this three-part article about QSL cards. Each part contains useful information but I hope you will read all three parts to improve your overall knowledge about QSL cards, since they are a distinctive facet of amateur radio.

Addressing Cards. Callbooks. The report form is usually printed on the reverse side of the QSL along with adequate space for adressing the card to the amateur worked during the on-the-air contact. It is important to purchase (or gain access to) up-to-date amateur radio callbooks as soon as you start operating. A pair of callbooks are issued during the first week in December for use during the coming calendar year. One covers the callsigns, names, and addresses of foreign (DX) amateurs and the other provides the same information about American (domestic) amateurs. Supplement subscriptions are separately available to update domestic and foreign callbooks three times (March, June, and September) during the year. You can separately purchase either the domestic or foreign callbook, or you can get both of them. Similarly, you can separately buy either domestic or foreign callbook supplements, or your can get both of them, if you have the basic (December issue) callbooks to which these supplements apply. Neither callbooks nor supplements are cheap (about $30.00) and it is advisable to make a joint purchase of them, if possible. If you are in a local amateur radio club, your fellow members may concur that callbooks are an excellent club investment and agree to buy them. If there is no club in your area to purchase and store a set of callbooks, check with your local public library to find out if they will retain a set of callbooks and supplements for use on a no-loan basis if you purchase these books and donate them to the library each year. If this approach is successful (and it should be), conduct a small scale drive to get local amateurs to help finance this project. Very few amateurs can afford to purchase the callbooks and supplements needed to have up-to-date information on hand year after year. These callbooks contain a lot of helpful information in addition to the callsigns, names, mailing addresses, and licesne classes of amateurs. A few of the many useful features included in each callbook are domestic and international postage rates, callsign prefix-to-country and country-to-callsign prefix lists, world callsign/zone map, list of amateur radio equipment distributors, list of QSL managers, list of domestic and foreign QSL bureaus, and other lists of essential operating information such as Q-signals, Callbooks are worth the cost and it is advisable to get a set from time to time, even if your financial situation is tight. If you can't afford a set of new callbooks, buy used ones that are not more than a few years old.

Domestic Cards. Most Americans mail QSL cards directly to other American amateurs using the address data shown in the Domestic Radio Amateur's Callbook. Obviously, the information appearing in a callbook reflects the data available months ago when the callbook was being prepared for printing. Naturally, some callbook information is no longer correct by the time a callbook is printed and distributed. Nevertheless, callbooks and their supplements provide the facts known to exist when they are being prepared. It has been my observation that callbook information is normally about three months in arrear. You can minimize your use of out-of-date incorrect addresses by checking in the supplements for possible changes instead of simply using the address listed in the callbook. Each callbook supplement just lists changes that are known to have occurred since the previous callbook or supplement was printed. Consequently, you should retain each supplement issued without throwing one away. If you purchase a callbook and buy a set of the associated supplements, you have the basic (December issue) callbook and three quarterly supplements that year, and all four items are needed to have a complete set of the current information. I find it is helpful to staple the newer supplement to the front of the older ones to keep associated information in one place. The relatively stiff front and back covers on these supplements enable them to be stapled together well enough to hold up in frequent use.

Those of us who operate the Novice bands run into a lot of trouble if we completely depend on getting addresses from existing callbooks and supplements. This is normal since many of the Novice contacted are newly licensed and their address information can't possibly be in the printed callbook or its supplements. I usually look thru the supplements (newest one first) and callbook while I am talking to an amateur to determine whether or not her/his address is listed. If I find the address, I tell the other amateur I intend to send my card to the listed address. This gives them a chance to tell me if their address has changed. If the existing printed callbook data does not include the address of the amateur I am working on the air, I request that it be included in his/her next transmission. If you are a new operator, it is unlikely that you would be able to maintain a contact on

*2814 Empire Ave., Burbank, CA 91520

Here is Fred Weiss (WN5ZAH) of Tulsa, Oklahoma. Fred is a 24 year old apprentice plumber who was first licensed as a Novice in 1969. He runs a Heath HW-101 Transceiver on 80, 40, and 15 meters.

the air while you are hunting an address, but you will soon develop this capability if you try to do it a few times. Until you reach the necessary degree of proficiency, it is best to simply have someone do your searching or just ask the other amateur to send his address if he knows he is not yet listed. In any case, it is best to complete the card by the end of the contact so that you won't have to stop to get your "bookkeeping" caught up to date. Get your station log and card completed so that you are ready to go on to the next contact when the previous contact is finished.

Foreign Amateurs. There is some direct exchange of cards between amateurs in different countries but most DX cards (incoming and outgoing) are routed through bureaus. Bureau operations are detailed later in this article, but direct QSL exchange is covered prior to the bureau explanation. It is time consuming and expensive to individually address and mail cards to each foreign (DX) amateur contacted on the air. However, I fully understand how thrilled new amateurs are when they first contact DX amateurs and how impatient they can be to receive the DX cards. Since QSL bureau operation is seldom understood by a new amateur, it is normal for a Novice to send his card directly to the DX amateur using the name and address listed in the latest DX supplement or callbook. Direct exchange of QSL cards between two amateurs is much faster than exchanging such cards via QSL bureaus and new amateurs usually mail cards directly to DX amateurs. However, this system requires one to look up the name and address of each DX contact and to write them on the card or envelope being mailed. One also must attach the correct postage to each item being mailed and this gets to be a major expense as one becomes increasingly active on the better DX Novice bands of 10 and 15 meters. Since we can send mail to Canadian and Mexican amateurs at our regular postage rates, most American amateurs mail these cards directly.

Postage Reimbursements to DX Amateurs. It is very common for a new American amateur to want to send money to help a DX amateur pay part of the cost involved in mailing a DX QSL to an American Novice. It is almost always true that the Novice will be much more anxious to receive the DX QSL, than the DX amateur is anxious to get the Novice's card. However, it is not wise to send American money to foreign amateurs since some countries take legal action against any of their citizens found to possess foreign (to them) currency.

International Reply Coupons. Amateurs often use International Reply Coupons (IRCs) as a medium of exchange and they are accepted in almost every country on Earth. The IRC can be purchased in American post offices at 42 cents each at the present time. Each callbook contains a list showing how many IRCs are required to exchange specific classes and types of mail between foreign countries and America. If you decide to supply IRCs to stimulate prompt reception of cards from DX amateurs, it is advisable to send the correct number of coupons to cover the specific mailing cost in each case. Amateurs have told me that IRC use has not helped them get DX cards in some cases. I seldom send an IRC, but I have good results when I have sent IRCs to DX amateurs.

Foreign Postage. Some organizations supply current foreign stamps at reasonable cost and I have had extremely good results using this system to pay postage costs required to send the DX card from the foreign amateur to myself. In this system, one requests a set of stamps issued by the country in which the contacted DX amateur lives. The appropriate value in foreign stamps (for airmail or other delivery, as stipulated) is received in a wax envelope. You just attach these foreign stamps to an envelope, address the envelope to yourself, and enclose this SASE with the card you send to the foreign amateur. When the DX amateur receives your SASE, he can easily fill out a card for you, seal it in the SASE you provided, and drop in the post box for delivery to you. This foreign postage service is advertised in amateur radio publications and it is effective.

QSL Bureaus And What They Do. There are many bureaus providing a variety of services. Some just handle cards between amateurs in a country. Others just handle cards being exchanged between amateurs in different countries. There are special bureaus that just handle cards associated with a specific type of operation, such as satellite communications. Bureau services, costs, and requirements are unique and data sheets should be requested directly from any bureau you may intend to use.

Why Amateurs Use Bureaus. If you are new to amateur radio, you may wonder why anyone would want to route cards through a bureau, instead of mailing them directly to other amateurs. Despite the fact that it is much faster to exchange cards directly, just a small percentage (2 out of my last 936, as an example) are received by direct mail. This percentage is probably higher when Novices work DX amateurs because the type of DX operator who has the patience to slow down to work Novices probably realizes just how impatient Novices are to receive their first few DX cards. Nevertheless, even Novices quickly get use to the fact that most foreign amateurs will send their cards via the QSL bureau system. One of the standard parts of a DX contact is the foreign amateur's statement that he will QSL via buro. Nothing is more aggravating to new amateurs than having to wait, and wait, and then wait some more for DX cards to be received via the bureau. Despite their apparent slowness, QSL bureaus are used more extensively every year because they save amateurs time, effort, and money. Even if you can afford to directly mail a card to each DX amateur contacted, it takes a lot of time and effort to locate the name and mailing address of each one. Additionally, callbooks are expensive and the type size used is small enough to be difficult to read. There is no reason to write the name and address on any card being delivered via a bureau. Also, as one becomes more proficient and active as an operator, the time, effort, and money needed to mail cards directly reach the point where they are prohibitive. If nothing else, direct mailing would reduce your operating time since you would have to stop operating from time to time to get your outgoing cards ready to be mailed. Our QSL bureau system provides the only realistic way to exchange millions of cards each year at minimum cost and with the least possible loss of operating time. Fortunately, you will learn that bureau operation is very dependable. Those DX cards will take 6 months to two years (on the average) to arrive, but they *will* be received. Remember, if your DX contact mailed all his cards directly, he may not have had time to be on the air to contact you!

ARRL Outgoing DX QSL Bureau. One of the newer outgoing DX QSL bureaus is the one that is operated by the American Radio Relay League, 225 Main Street, Newington, Connecticut 06111. This bureau just handles cards going from ARRL members to foreign amateurs in more than 100 countries. I am a charter life member of ARRL and few people are better acquainted than myself with the extremely wide range of services the league provides. However, even if ARRL had nothing else to offer, I would still advise every active HF (3-30 MHz) operator to join

the league to take advantage of their excellent outgoing DX QSL service. ARRL members just arrange their outgoing DX cards in prefix (DX country) sequence, provide a self-addressed and stamped envelope (SASE), enclose one dollar (check or money order), and include the mailing label cut from the mailing label of the latest *QST* magazine (to prove league membership). Everything is securely packaged (preferably in a small cardboard box) and the package is mailed to the Membership Overseas QSL Service, using the ARRL address shown at the start of this paragraph. There is no restriction about how many cards can be sent at one time, but members are not allowed to use this service more than twelve times per year. As is true with most bureaus, received cards are sorted to make packages of cards which are shipped to their foreign destinations about once per month. I have used this service since it first started operating in late 1976 and I have found it to be highly satisfactory.

ARRL Incoming DX QSL Bureau. The league also operates an excellent bureau which handles cards coming to American and Canadian amateurs from foreign/DX amateurs. Unlike the ARRL outgoing DX QSL bureau, which is quite new, the ARRL incoming DX QSL bureau has been in operation more than 40 years. A major difference between the ARRL incoming and outgoing DX QSL bureaus is that one does not have to be a league member to receive cards via the incoming bureau. I worked about 20 hours a week for more than three years in the California branch of the league's incoming DX QSL bureau. I learned first hand that it is a highly effective organization. I now know that every American and Canadian amateur who does any operating in the 80 through 10 meter bands should send at least two self-addressed and stamped envelopes (SASEs) to their ARRL incoming DX QSL bureau. Bureau addresses are listed in the front matter of each callbook, prior to each callsign area listing in the callbook, and in alternate issues of *QST*. The overwhelming majority of DX cards are received through this bureau, which means that you will not receive most of your DX cards if you do not send SASEs to your local branch of this bureau. If you know any amateur who is (or has been) active on the high frequencies (3-30 MHz.), please advise him/her to send a couple of SASEs to the local address of the ARRL incoming DX QSL bureau. There are probably a few million DX cards on hand right now that can't be forwarded due to no SASEs being on file from the amateurs who should get these cards. It is advisable for every Novice and Technician to send SASEs to the bureau as soon as they start operating. This is particularly important if the 10 and/or 15 meter Novice bands are used. Since DX cards continue to be received for a couple of years, it is advisable to leave envelopes on file with both your old and new callsigns, if you change callsigns when you upgrade. Since it is very likely that a different bureau sorter handles cards received for each of your callsigns, you should provide a separate set of SASEs for each callsign you hold or have recently held. It is not expensive to provide extra sets of SASEs in this situation and the extra envelopes can make the bureau worker's job easier, as well as assuring that you will receive all cards sent to you, regardless of which callsign you were using. I have a class aid about the ARRL incoming and outgoing DX QSL bureaus function. Anyone who wants a single copy of this free aid is welcome to have one; just enclose the usual 10 by 12 inch self-addressed envelope with double first class postage (28 cents, at the moment) attached. Remember to include a note saying what you want. I get several requests every day for copies of class aids and not everyone remembers to include a note to let me know what is wanted.

How Bureaus Handle Cards. When you know the long related chain of actions involved in getting DX cards via the bureau systems, it is easier to live with the relatively slow receipt of DX cards. Most of the active foreign/DX amateurs fill in a card as they work each contact. About every month, they arrange their cards in callsign prefix (country) sequence for the contacts they have made. In some cases, the DX operator then mails envelopes or packages of cards to the appropriate bureaus, using the addresses listed in the callbooks. In most cases, the sequentially sorted cards are mailed to the DX amateur's organization (similar to our ARRL) that handles such cards being sent from that country. Such bureaus sort received cards and assemble packages that are mailed to the appropriate bureaus in other countries. It seems reasonable to assume that it would take about three months between the time you work a foreign amateur and the time his card has been shipped to your incoming bureau. Most bureaus ship cards one time each month and these packages of cards are usually sent the least expensive way, which means they travel by ship, truck, and train, instead of by airplane. Some foreign bureaus do not send packages of cards directly to the individual branches of the ARRL incoming DX QSL bureau; instead, they ship a single unsorted package to ARRL headquarters. In these cases, the received cards must be sorted, packaged, and shipped to the individual branches scattered throughout Canada and the United States. It is reasonable to assume that 3 to 6 months can pass between the time they are received at the ARRL incoming DX QSL bureau serving your area. When cards are finally received at your incoming bureau, they are initially sorted according to the callsign suffix and/or prefix of recipients and (in most cases) cards are then packaged and shipped to the individual (usually a suffix sorter) who inserts received DX cards into the corresponding SASEs supplied by intelligent local amateurs. It is reasonable to assume that 3 to 4 months pass between the time your local incoming bureau receives cards and the time your sorter has put your cards in your SASE. Most sorters try to mail envelopes of cards to individual amateurs about once per month, if DX cards have been received and if the amateur has at least one SASE on file in his bureau. The net result of all these time consuming steps is that it is normal to receive cards through the bureau system for contacts made 9 to 14 months ago. I have seen cards coming into the bureau for contacts made two to three years back. I just received a card last week for a contact made 33 months ago; this is unusual, but it is not as rare as one might think it is. All of us require a lot of patience when we exchange cards via the bureau system, but it gets the job done in commendable fashion, if we all follow the rules. Frankly, our incoming DX QSL bureau could do a fantastic job for us if we could just get every Canadian and American amateur to send a couple of SASEs to their local bureau address. If you have a friend or acquaintance who does not provide SASEs, do everyone a favor and put a couple of SASEs in the bureau for him/her. It must be hard for a new amateur to comprehend the magnitude of work involved in getting DX cards to their intended and anxious recipient amateurs. I assure you from my personal experience that it requires a lot of effort by many dedicated amateurs all over the world to get these cards delivered. More than five million incoming DX cards are now handled each year by just our ARRL incoming DX QSL bureau. It is important to know that the ARRL incoming DX QSL bureau does not handle cards being exchanged from one Canadian or American amateur to another Canadian or American amateur. I often received a package of cards from some American amateur who had contacted several California amateurs and had forwarded his cards to the Califor-

nia bureau for distribution to his California contacts. I always returned such cards to the sender and included a note to advise that only DX cards are handled by this bureau. Do not send your cards to the ARRL incoming DX QSL bureau for distribution to American or Canadian amateurs.

Other Bureau Data. As previously stated in this article, there are several other bureaus in addition to the ARRL incoming and outgoing DX QSL bureaus. Some of these other bureaus offer specialized services that are not available from the league. I advise you to request a data sheet from any bureau you may want to use and it is advisable to include the usual SASE to get a prompt reply. There are differences between the ways various bureaus operate. Even individual branches of the ARRL incoming DX QSL bureau have slight differences between them. Some bureaus require envelopes of some particular size that fits their sorting pins and shipping containers; such envelopes are sometimes made available by the bureau at low cost.

Most incoming QSL bureaus have very similar requirements. The bureau address should be neatly printed on each of your envelopes as the return address, with the envelope positioned horizontally. Do not use your own address as the return address because your envelope may end up in some dead letter office if you move and your mail is not forwarded after a while. If you make the mistake of using the same address as both the normal mailing address and the return address, neither is good when one becomes incorrect. Leave room above the bureau return address and carefully print your callsign (one callsign only) in large lettering in this space, making it possible for your sorter to locate your SASE without having to remove it from the sorting bin. If you are dealing with a bureau which provides envelopes, I advise you to send the correct number of self-addressed gummed labels with your envelope request. Print or type your complete name and address on each label and use self-adhering (no wetting required) labels if you can get them.

Include your first and last name in your address because your amateur radio station is not likely to be as well known to your postman as local TV and radio broadcast stations. It helps speed mail deliveries when the postal zip number is included as part of your address, although I must admit that I do not understand why we are required to use a complete address in addition to the Zip number. It appears that the addressee's name and new 9-digit postal Zip number should suffice to get mailed delivered. Obviously, apartment, trailer space, and similar address differences would also be required with the name and 9-digit zip number, but why write the rest of the address when it is represented in the zip number?!

When sending SASEs to a bureau, attach single first class postage to each envelope, which is 15 cents at the time this article is being written. It is not good to attach more postage than is needed to send one ounce of first class mail. If you attach more than single first class postage to an SASE, it may be a longer than usual delay before you receive DX cards, since your sorter will probably wait until enough DX cards have been received to properly use the full amount of postage you attached to your SASE. If you are extremely active and work a lot of DX, it is best to simply insert a few 13 cent stamps (first class postage, per each additional ounce, after the first ounce) in one of the SASEs you send to your bureau and put a highly visible note on the back flap of the envelope to let your sorter know that extra stamps are enclosed. It is not wise to loosely enclose extra postage in the envelope used to send SASEs to your bureau; it is too easy for loose stamps to be overlooked in the rush of handling incoming bureau mail. Received cards vary a lot in size and weight but careful observation of more than two million received cards convinced me that 5 to 6 cards usually weigh a total of one ounce.

QSL Managers.

Some of the most active DX amateurs have another amateur handle their cards because the volume is so great that operating time would be reduced and many less stations would have a chance to contact the DX amateur without such help. An amateur operating from some rare DX location that is seldom heard on the amateur bands is almost certain to need a good QSL manager to handle the resultant flood of incoming and outgoing cards. Naturally, there is a little delay as the QSL manager waits to receive a copy of the station log from the DX operator being assisted. Fortunately for American Novices, many of these QSL managers are fellow Americans, which makes it easier and faster to get cards for DX contacts with the amateurs they aid. If you work a rare DX station, check the callbook listing of QSL managers. If you do not find a QSL manager listed for the DX amateur you contacted, just send your card however you normally send cards to DX stations. If you find that a foreign amateur is the QSL manager for your rare DX contact, you can attach the appropriate number of IRCs to your card and send it however you normally send cards to DX stations. However, if the name and address of the foreign amateur serving as the QSL manager is available to you from a callbook, it is better to enclose IRCs with your card and a self-addressed envelope in another envelope addressed directly to the QSL manager. This system enables the QSL manager to easily locate your contact in the log he received from the rare DX station; he can then fill in the report on the DX card, slip it into your self-addressed envelope, and mail it to you by exchanging the IRCs you sent for his country's postage stamps. It is standard practice to just let received IRCs pile up for a while before exchanging them for postage. If your search through the callbook listing of QSL managers discloses that the QSL manager who handles cards for the rare DX station you worked is an American, you are in luck. If this is the situation, just enclose the usual SASE with the card you send to the American QSL manager. As previously described, he will locate the contact from the information on your card, fill in the DX card, and mail the DX card to you in your SASE. It is not unusual to find that the QSL manager's address turns out to be the regular home address of an amateur who temporarily operated from a rare DX location. In this situation, it is common for the amateur to wait until he/she returns home before any cards are sent to conform the contacts made from the rare DX location.

There is no doubt that QSL managers make it possible for rare DX locations practical experience in this line, you can contact a local amateur listed as a QSL manager in a current callbook. Your efforts will benefit the amateur radio fraternity and you will learn many things that will enable you to enjoy amateur radio to a greater extent. If you find that you sincerely enjoy providing this type of service, it is easy to make the arrangements to directly serve as the QSL manager for one or more active DX stations.

Summary.

This series of articles is intended to provide a simple but complete explanation to let new amateurs know how to select, use, and exchange QSL cards. As is always done in one of the

multi-part Novice articles I write, each month's Novice column contains information which can be read and used by itself. However, the reader gets more benefit by carefully reading the entire related series of Novice columns. I get requests for copies of Novice columns printed in previous issues of *CQ* but I cannot provide them because I do not have them. However, past issues of *CQ* are available and they can be ordered using the address shown on the masthead (front matter) of this magazine.

I hope you have learned the importance of using a good card and how to properly fill in the report form. Order an adequate supply (500 to 1000) of good cards as soon as you learn your callsign. Most of us first see our callsign printed on address labels attached to advertisements received from companies selling amateur radio equipment, accessories, publications, and services. Get cards and start using them to confirm contacts as soon as you start operating. Simply stated, you must send cards to receive them in reasonable numbers. If you use cards from the beginning of your amateur operating activity, you will more easily get states and countries confirmed than others who operate as much as you do and with equal success, but who do not send cards. One of the oddities of amateur radio is that almost every operator insists he/she send far more cards than he/she receives. Some amateurs consider the sending of a QSL to be part of every contact. It is my personal practice to send a card to each amateur contacted for the first time, but I must admit that it gets expensive during Novice Roundups and other accelerated operating activities.

I am far from a senior citizen but I have seen the cost of mailing a QSL card to a fellow American amateur increase from one cent to its present level of 10 cents each. Despite the high cost of mailing cards to other American amateurs, many of us continue sending cards because we know QSL cards play an important role in amateur radio. If you simply cannot afford to send a card to each amateur you work, it is certainly acceptable to just send a card in response to each one received and/or requested during the on-the-air contact. If you mark your station log to show that a card has been sent and/or received to confirm each contact, you will know card status at a glance. I write the letter O in my log to indicate a card went out and I write the I in my log to indicate a card came in. The letter I (in) is written inside the letter O (out) with both positioned at the contact being confirmed. A minor advantage associated with just responding to received cards is that you don't have to hunt for the other amateur's name and address; you simply copy them off the received card. Last but not least, please realize that no QSL cards would be exchanged if every amateur waited to receive a card before sending one, and we would miss this interesting part of amateur radio.

References. A few recent QSL articles are referenced below to help you further expand your knowledge about QSL cards. I hope you will carefully read as many as possible of the following:

CQ
April 1976 Build Your Own QSL Card Display Rack

Ham Radio
December 1968 Time-to-Reply Statistics for DX QSL's

Ham Radio Horizons
February 1978 How to Design QSL Cards
February 1978 Collecting QSLs

QST
October 1976 DX QSLs, QSLs, QSLs (outgoing bureau)
October 1976 The Flip Side (incoming bureau)
August & September 1978 How to Receive More QSLs

Novices are urged to submit good black-and-white pictures of themselves at their operating positions. If your photograph is printed in a future Novice column, you will receive a one year subscription (or renewal) to *CQ*. A brief description of operating activities and some personal background information are needed with your picture.

Some of the stations I've recently worked on the Novice bands are:

WB1GVU Victor @ Stratford, Ct., KA6DGJ Bill @ Arleta, Calif., KA2BSP Pete @ Brooklyn, N.Y., WB7UEB Ken @ Southbend, Wash., WB3LGQ Dick @ Proctor, Penn., WD8NZE Jerry @ Martin, Michigan, WD4SDM Bob @ Kernersville, N.C., KA9AHR Kay @ Kankakee, Illinois, WD5DMX Marvin @ Artesia, N.H., WD0CZM Mike @ Elbow Lake, Minn.

73, Bill - W6DDB

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Part III — Digging In

BY KARL T. THURBER, JR.*, W8FX/4

We've discussed the reasons for buying a kit in the first place, and have suggested some ways to select the best kit for your needs. Now let's talk about putting it together. Here are some construction tips you can follow:

1. *Find a good place to build your kit.* This should be done before the kit arrives. If you've never assembled one before, now is the time to set up your workbench and acquire your tools while you're waiting for it to arrive. You're ahead if you can pick a quiet place that is far from the regular household bustle. It should be a spot where you don't have to "fold up" after each session. If you have a regular workbench, fine. If not, a card table is good, since you can slide it out of the way after each session. A comfortable chair or stool will be appreciated after a few hours at the job—the chair should be one that allows a good reach over the work area yet allows you to be relaxed while building. Make sure you're near a.c. outlets for your soldering iron, test equipment, and work light. A portable or clip-on *flexible* desk or bench lamp of 50 to 100 watts is good, and will allow the light to be directed at a particular area. A small point, but try to work over a plain tile or wooden floor, as it is well-nigh impossible to find tiny components and hardware that you may drop into a two-inch pile carpet!

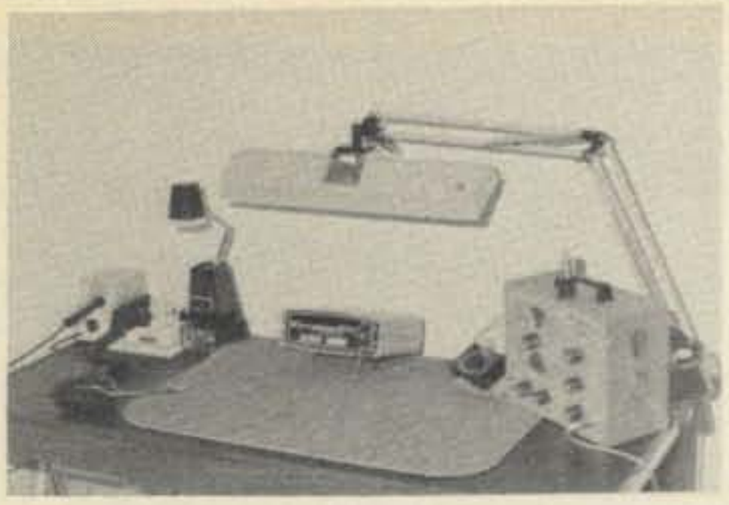
2. *Check out the kit when it arrives.* You should open the kit carefully (preserving the packing material should it be necessary to send it in for repair). After becoming familiar with the contents, read the manual thoroughly. It will usually give you important information such as how the kit is packaged, and show you the major construction sequence. It will identify any components that must be treated with special care. The manual will also tell you if any extra equipment will be needed to align and test the kit, such as a v.o.m., signal generator, oscilloscope, etc. Skimming the manual will also show how the finished kit will look—what the major sub-assemblies are and how they go together. In other words, treat yourself to the "big picture" at the outset.

Now too, is a good time to "bite the bullet" on your decision to go the kit route. If you decide that you've tackled too big a job, *now's* the time to send it back for a refund—not after half-completing the kit. Most manufacturers will refund your purchase price *provided* you send the kit back just as it came to you, complete and with all packing materials returned. A few manufacturers will assemble the kit for you, the charge depending on its difficulty. If you have a kit that's too difficult for you to build, check with the manufacturer *before* returning it for a refund or factory assembly.

3. *Familiarize yourself with the contents.* It's a lot easier to work with something you're familiar with. So, now's a good time to go to the parts list and inventory the components. While this is a time-consuming task with large kits, it *can* be a time-saver. If the kit is incomplete, you can write immediately requesting the "shorted" parts be replaced while you're building the kit, rather than waiting till you discover at the "eleventh hour" that a critical component is missing. Going over the list will also help you recognize various parts, which is especially important if you've never built an electronic kit before. While doing this, you might want to identify and group components to save time later. Sort out resistors, capacitors, transistors, IC's (integrated circuits), and hardware. You can put small parts in ashtrays, Dixie cups, saucers, muffin pans, or whatever else is convenient. Try not to handle transistors and IC's too much, particularly if they're covered with aluminum foil. This usually indicates that they're easily damaged by static electricity. Best to leave them alone until you're ready to install them. One thing you'll want to learn—or at least, to understand—is the color coding used for identifying resistors and capacitors. Some kit manuals give you the color-band markings in the instructions, and some don't. If you're not sure, refer to the complete color-code chart shown in fig. 1. It's a fact that some folks have trouble distinguishing between certain colors. If you have this problem, take the time to measure each resistor using the ohms function on a v.o.m.

Be particularly careful to give any kit you buy from an unknown company a good once-over before digging in. Make sure that all the parts are there and that the chassis, cabinet and circuit boards "match-up"—that the kit is indeed *buildable.* P.c. boards are a special trouble spot. Check all plated-through holes for continuity, and look to see that there are no breaks in the circuit foil which might give you trouble. If no IC sockets are provided, run down to Radio Shack and buy some. You'll be glad you used them if you later have to replace a bad IC! It's unfortunate, but a few fly-by-nighters have come up with kits that were literally "thrown-together" and which couldn't *really* be built from the parts and instructions furnished. I'd suggest asking for a refund if you should get one like that, rather than trying to patch it up.

*233 Newcastle Lane, Montgomery AL 36117



Close-up view of the workbench used for light repair jobs and kit-building at W8FX. Note the signal generator and the digital voltmeter—both were wired from kits.

4. *Follow instructions!* By this we mean, *exactly*. Most kit manuals have been carefully designed to show you precisely what to do and when to do it. They usually include detailed diagrams that show the optimum arrangement of components and wires. These diagrams should be followed faithfully to avoid such problems as hum, instability, feedback, and other hard-to-trace symptoms. Experienced builders are more likely to deviate from the instructions than novices, since they may feel that they can do a better job working directly from the schematic, with only an occasional glance at the assembly manuals. In most cases, what results is a lot of mistakes. You'll find that it's almost impossible to work *both* from the schematic *and* the instructions. Try also to observe the component and wire lead lengths that the instructions specify.

5. *Wire with care.* It's hard to make your wiring look *exactly* like a professional factory job—you just don't have the tools. But you can *closely approach* factory wiring if you try. Follow wiring layouts carefully so you don't end up with a hodge-podge of crossed wires. Some instruction manuals go into great detail and have photos showing how leads should be placed, or "dressed." Others leave it up to you. If you don't know what good wiring looks like, open up some commercially wired equipment and take a look. This may be your transceiver, receiver, an accessory, or even your TV set. Note that most "point-to-point" wiring is generally "squared-off," each component seems to have its place, most components are layed out parallel to the chassis or circuit boards, and parts aren't stacked one on top of another. Cables are laced and logically grouped, and the shortest leads possible are used between wiring points. Printed circuit boards are "clean" looking, with most components mounted on the *non-foil* side of the board. You'll find that the key to good wiring lies in patience, forethought, common sense, and a good way with a soldering iron. This leads us into the most important aspect of building *successful* kits: good soldering techniques.

6. *Do the best soldering job you possibly can.* There's no question that the biggest problem in building kits is in *soldering*. Most of the kits returned to the factory for repair don't have anything wrong with them except bad solder connections. Good soldering is an art and a craft, and while we won't go into intimate detail here, it's worthwhile to highlight some of the points that make for good soldering techniques.

Some of the major problems in soldering stem from the fact that many neophyte constructors just don't know what a good solder joint looks like. A properly soldered connection is silvery-bright and shiny, and doesn't have any ridges or sharp points showing. It should appear to have smoothly flowed over the connection, much like molten lava. And of course, its strong and doesn't present a grainy or flaky appearance. Nor does it resemble a shapeless blob! Many of the better kit assembly manuals go into extensive detail as to what good soldering is all about. It's worthwhile to read the "how to solder" section before digging in!

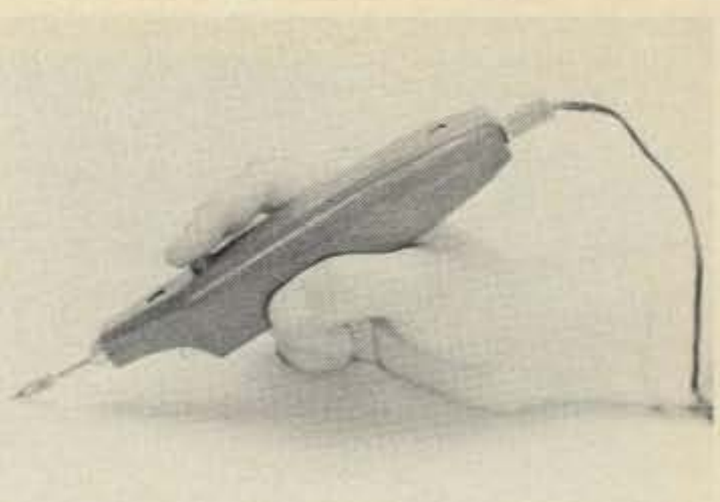
Some errors beginners make in their first soldering attempts include using too much heat on p.c. circuit boards (thereby damaging the foil); using too little heat or applying the soldering iron tip to the solder rather than the joint itself; and moving the connection before it has a chance to set. Other errors are using too much solder (resulting in "solder bridges" between connections) and working with pitted or dirty equipment. Recognizing the major hang-up people have in starting to build a kit—not knowing how to solder—Heathkit has brought out a programmed instruction course on soldering. The course, which costs under $10, includes a circuit board and some parts to allow the beginner to test his skills. If you're afraid to get your feet wet on a regular kit, the programmed course is a good way to develop confidence in your ability to successfully build a kit. Even if you don't purchase such a training device, spend a little time practicing your soldering.

Soldering is a simple process and is really very easy once you get a "feel" for it. Keep the following in mind when you solder:

1. The soldering iron should be completely warmed up and "ready to go" before you try to solder anything. The tip should be clean—wipe it off with a rag if it isn't.
2. The tip should be tinned, which means that a very thin layer of solder is applied to it to facilitate the soldering process. Over a period of time, the tip will become pitted—when it does, it can be reshaped with a file or sandpaper and retinned.
3. The wire and terminal you're trying to solder should be mechanically solid. You can't depend on solder for mechanical strength.
4. When you apply the soldering iron to a connection, apply the tip to *both* the joint and the solder at the same time. Allow the connection to be heated enough so that the solder melts quickly and spreads almost immediately to every part of the connection. You should keep the soldering iron against the connection long enough to "cook out" any flux residue, but no so long that the solder appears to burn up.
5. Leave the connection alone long enough for the solder to harden. Resist any temptation to cool the joint by blowing on it!
6. Visually check the connection. If the joint cools with a rough or grainy appearance, it's a "cold" connection, caused either by insufficient heat, a wire moving, or foreign matter (such as oxides) getting into the connection. *The cure*: reheat the joint and apply a little more solder.

7. "Heat-sink" any delicate components, such as transistors, diodes, and IC's to prevent their being damaged by excessive heat when soldering. You can do this by holding the component near the body with the tip of a pair of needle-nose pliers, or by attaching a small aligator clip to it.

Let's talk for a moment about the *solder itself*. Many kit manufacturers furnish a hank of solder with their kits. If they do, use it! Chances are the solder furnished is "60/40," which means that the mixture of tin and lead is set at a *60-40 ratio,* the tin being the first figure. This is about the optimum



Rechargeable cordless soldering irons are becoming quite popular these days, having largely overcome problems in retaining their charges long enough to work on a kit or other construction project. The Radio Shack unit pictured here heats in five to ten seconds and makes up to 100 connections on a single charge.

Make a wiring mistake on a fragile p.c. board? This mini vacuum pump makes it easy to desolder and correct mistakes without making a mess. (Photo courtesy Radio Shack)

mix, liquifying at about 361 degrees F —a fairly low temperature as far as solder goes. The 60/40 type of solder is the easiest kind to work with, and it's fairly strong, too. Gauge or diameter isn't too important as long as you don't try to use heavy electrical solder; 16 to 20 gauge is best for most kit projects.

What *is* important, though, is that the solder you use have a *rosin flux* core. The flux is normally built right into the solder, and when it flows over the connection and is heated, it removes harmful oxides from the metal surfaces and helps the soldering process to occur. Any oxides are suspended in the flux and come to the *surface* of the connection, and remain there. Years ago, a separate flux was applied each time a connection was soldered. Now, convenience has taken over, and the flux is imbedded in the core of the solder *itself*. It's *automatically* applied when the solder is heated. The one important axiom to remember about solder and soldering fluxes is this: Never use anything but rosin flux on electronic equipment—*always use rosin core solder.* Never, **NEVER**, use acid-core solder or paste fluxes in anything you build. Why? Acid fluxes are highly corrosive. If you should use it, the acid flux gradually begins to eat away at the leads of the components. After a period of time, oxidation builds up around the leads, acting as an insulator. The equipment simply will not work then and to repair it means that the kit has to be completely rebuilt. Also, acid-core solder can damage p.c. boards. For these reasons, kits with acid core solder may not be repaired *at all* if you send them back to the factory for repair. In fact, Heath's warranty states that "...Our warranty does not cover and we are not responsible for damage caused by the use of corrosive solder..." So, when you buy solder, make sure it is designed for radio purposes. Much of the solder sold in hardware and discount stores is heavy, acid-core solder. It doesn't have a place in your tool box.

8. *Be a Plodder!* In building kits, the speed demon is usually rewarded by a kit that *won't work* the first time around. It really pays to work carefully, methodically, and patiently. For example, take care to double-check that you've selected the right component *before* you solder it in place. This is especially important with delicate diodes, transistors, and IC's. Be sure to note whether the instructions just ask you to install the transistor or IC *socket,* or the *device* itself. Usually, you're best to wait until construction is complete before installing delicate plug-in components such as these—they can easily be "zapped" by stray electricity or the heat from your soldering iron. Are you to merely "connect" a terminal, or *solder* it? Check off *each step* in the instructions as you complete it, and look over the results as you check it off. Be your own inspector! And, needless to say, don't try to build a complete amateur transceiver in two sittings. Pace yourself; don't work too long at one time. Careless often expensive mistakes are easy to make when you're tired, so know when to quit.

9. *Check and re-check your work.* This goes hand-in-hand with following directions. Of course, recheck the circuit when asked to do so by the manual —*never* skim over this step. Even if the assembly book doesn't provide for periodic checks, inspect your own work after each session. Some of the things you might look for are solder "bridges" between adjacent components, the *wrong* parts in the *right* places, loose "pigtails" or bits of wire, "cold" solder connections, wires connected to the *wrong points* on switches and terminal strips, and *omitted* wiring and components. Pay close attention to printed circuitry—it's almost impossible to build a large board without making *some* kind of error, even if it's nothing more than a single solder bridge or cold joint.

It's a good time to point out that it's hard to repair a mistake on a p.c. board without damaging the board and its components. If you do find a mistake on a board, devote your efforts to *correcting it* before moving on to complete the board. The board is delicate: the base material can be charred or

A precision rechargeable high-speed drill is useful in cleaning up holes in p.c. boards and in repair work, too. A unit such as the Radio Shack drill shown above can also be used for jewelry working, models and other hobby purposes. The drill speed is rated at 28,500 r.p.m.

melted, and the metal foil can be pulled up from the base and broken if you're not careful. If you must replace a resistor, IC, or other component, be sure to use as little heat as possible in removing the old part. This is because excessive heat can damage adjacent components and the board itself. Sometimes, you can't "save" the old component, so plan on buying a new one and chalking up the small loss to experience.

10. *Give the kit a final "Q-C Check."* Even if not called for in the instructions, give your kit one final "quality check" before plugging it in and turning it on. Doing this may save considerable frustration and unnecessary expense should there be an error in the wiring. *Now* is a good time to cross-check the kit against the *schematic* diagrams. Don't skip over any resistance checks called for in the manual, as they are designed to turn up major wiring errors that could cause the kit to malfunction or result in damage to components when power is applied.

11. *Adjust and align it.* Usually, this is called for after making an initial "smoke check." Of course, if the kit doesn't work properly, there's little point in trying to make adjustments until the problem is solved. But, assuming the kit works, proceed with the alignment, calibration or other adjustments required by the manual. *Don't skip around* at this point—it's best to follow the procedures *exactly* as described. They are usually carefully worked out and must be performed in a certain sequence if the kit's specifications are to be met.

The inset summarizes these ten construction tips. Follow them, and you're on the way to building a successful kit—even on your first try. ▣

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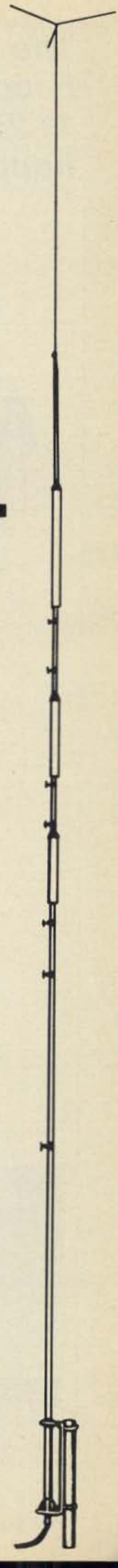

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The annual New York City runners' marathon has become the most popular of its kind in the world. 11,298 participants and 128 radio amateurs made it a happening to be remembered!

Amateur Radio Helps Run The New York City Marathon

BY STEPHEN MENDELSOHN*, WA2DHF

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Spectators at New York City's Central Park numbered over 100,000 as they watched Bill Rogers win the New York City Marathon.

October 22, 1978 will be found in the running record books as the date of the largest organized Marathon in the history of road running. At exactly 10:31 a.m. Mr. Alan Steinfeld, KL7HIR, fired the cannon that officially started 11,289 men and women running on the 26 mile, 385 yard course through all five boroughs of New York City. The organizers of the event, the New York Road Runners Club, had once again asked the Tri-State Amateur Repeater Council to provide communications. In two previous runnings the NYRRC had found that amateur radio could provide end to end coverage for the race. End to end coverage did not mean only course coverge, but end to end of the entire event. This year the event started on Saturday, with a symbolic delivery on the marathon torch, and ended Sunday at the finish line with over 8,000 runners completing the long course. For amateur radio it was a sustained 48 hours of operation with officials of the Amateur Athletic Union looking on in awe.

But back to the gray dawn of the beginning. The Marathon in New York City is quickly becoming the race for runners to try. It has 5 bridges and

over 2.5 million spectators to cheer the runner on. It has a volunteer force bigger than many cities, over 4,000. As has been the case in the past years I received a call from Mr. Fred Lebow, president of NYRRC, which started with "Do you have a free minute or two?" This was in March, as planning meetings were to start with the officials of New York City that week. The Tri-State Amateur Repeater Council had voted, with great insight, to agree to participate in the race again this year. With this shaping up as the greatest marathon in history it would be a good vehicle to use to put amateurs in the public eye again. A quick word about TSARC. This Council represents over 50 repeaters in the New York, New Jersey, and southern Connecticut area. Our directorships are broken into areas by telephone company area code. Thus the director for the "north" New York area, and the director for the Connecticut area are asked to provide manpower for the north end of the marathon course. The New Jersey area directors are asked to provide finish line coverage, and the director from Long Island is asked to provide manning for the east end of the course. The New York City area director is asked to provide manpower for the starting line area network, and the first 5 miles of the course. Simple, yes? Well maybe it is until you realize that we are talking about the logistics of the race itself.

This year it was requested that we use a completely different system of spotting. This was to be the year of the National Womans Marathon held at New York. It would be a race providing the women the ability to set new national records. But they would be back in the pack with the men. Could amateurs spot the women in the pack, as well as the men leaders? The Road Runners also asked if we were able to give all of their senior officials individual communications at the starting line area. It would prove to be quite a task. Then came a "by the way." The AAU was going to have an official torch brought into the city along the race course on Saturday. Could TSARC provide communications for the 5 vehicles, and have someone at the finish line also? This now made it a two day event. The days and the many meetings sped by. Paul Vydareny WB2VUK, and Will Smith K2CFX, beat the northern bushes. Pete Glenn, WB2YGT and Gary Kantor, WA2BAU, went on the stump like candidates in New Jersey visiting many radio clubs. George Gluck, WA2WKV, and Duke Harrison, K2MZ, were heard on many Long Island repeaters taking lists. Jerry Abrams, WB2ZEX, and Bill Higgins, WA2RXQ, found that the Staten Island community, and the Brooklyn amateur community had not forgotten about the race, and were volunteering by two's and three's daily. Things were starting to roll. A new strategy was developed this year. The men, always the leaders, would have dark blue letters on a light backround. The women would have red letters on a light blue backround, leading to high visibility. The Saturday group was to be formed from all areas to test the course repeaters. For the starting line area WR2ADP, Staten Island, would be used, with further course communications being held on 146.52 simplex, and contact with the finish line on WR2ACD, New York City. At 10:30 a.m. the group consisting of Jerry, WB2SPE, Bob, WA2KHR, Rich, N2KO, Jerry WB2ZEX, and I climbed into the cars, and trucks, and established a convoy communications group on 52. As we reached the starting line Bill, WB2ZKX, arrived at the finish line in the Damrosch Theater area of Lincoln Center, home of the Metropolitan opera. At 12:30 we started. One by one runners would run for 2 miles carrying the torch of the marathon through the city alerting startled viewers that the "big marathon" would be held the next day. Everything went very well, except for one torch which, when lit, had a bit too much wick, and looked like an oil well fire. Who has the hot dogs and roasting sticks? Everything was set for the big effort.

Sunday I woke up at 4:30 a.m. as 75 city buses arrived at Lincoln Center, I took the first bus out to Staten Island, and with N2AER at Lincoln Center, and Alan, N2KW at the Road Runners office. Away we went. Sunday dawned and the sun shone warmly. Nice day for a race right? Wrong! Anything above 55 or 60 degrees leads to lots of heat exhaustion. It would rise to 67 before the day would end, resulting in many medical emergencies. But at 6:30 a.m. the order of the day was to establish a link for the various officials to make decisions on. Questions such as late runners, runners without bus passes, and medical problems would arrive with the hordes. The Staten Island group, led by Bill, WA2RXQ, arrived at 7 a.m. and away we went. Amateurs volunteer to communicate, right? Well communications had some strange interpretations that day. One of the boys communicated to traffic as a traffic cop. Another stayed at the front gate of Fort Wadsworth, the starting area, and commuinicated to runners with language difficulties. English, French,German, and Greek were all heard on 52 at times. Runners arrived and prepared. The buses would make 154 trips to bring all of the runners to the starting line. By 7:30 a.m. the net control stations started to arrive at the finish line. Dave, WA2EXP, and Pam, WB2TWU, started to handle traffic from mobiles on the way to the mile posts. Gary, WA2BAU, checked into the starting line net via Jerry, WB2ZEX who was listening to both 52 and WR2ADP. 10:30 a.m. arrived like a train rushing downhill. 11,289 people lined up with 15 helicopters overhead for air conditioning. Amateurs to their posts on bridges, in tunnels, and put up mile markers. At 10:00 a.m. the course coordinator went up the course to troubleshoot any last minute problems. Jerry, WB2SPE, went with him saying, "I guess that you won't hear from me until the finish line." That would prove to be like asking Howard Cosell to say a few words.

As the activity around the starting line peaked, amateurs headed for the vehicles that would make their way along the course. Press trucks, lead cars, special buses all were to have amateurs aboard. At 10:15 Mike, K2OUD, announced that medical traffic would be handled on WR2AFE. By the end of the race you would have thought that he was giving away two meter walkie-talkies he had so many takers.

Council President Dave, WA2EXP and Steve, WA2DHF in the command trailer.

10:31 WWV time. Alan fires the cannon. 11,000 race at the lead car. The driver gets plenty scared and we bolt ahead. The race was on! The network was in place. 129 amateurs would work to pass information on the first 5 women that passed them. I was in the lead car, and would pass to the net control at the finish line the first place men, and their times as they passed the mile markers. The start line crew would go home and rest, vowing never again. Like lemmings heading for the sea the throng surged forward. Stan, K2SJO, reported that it looked like an amoeba spreading out a pseudopod.

Up Fourth Avenue in Brooklyn. The numbers started flying. Leader numbers, first women numbers, and requests from Howie, N2WX, in the press tent at the finish line for repeats. Through Brooklyn and into Queens. Suddenly the half Marathon was there as I spotted Milt, WB2DYO, and Wally, N2WS, laughing at the slow moving cars, and the faster runners. The press trucks couldn't make the bridge, so the leaders just ran around them. Through Queens to the foot of the 59th street bridge. A voice yells "smile Steve" and George, WA2WKV, snaps a picture. On the bridge Alan, WB2BNA, calmly hands me a cup of orange juice as we drive by, and asks what's new.

Down onto Manhattan's First Avenue. In one 10 block stretch the police would later estimate over 1 million people were seeing the race. And listening to WA2JTJ, and WA2GUG's mobile installation. Past two miles of a human wall. By now Bill Rogers, always one to spot amateurs, was again in the lead and waving "hi" to the operator. Pam, WB2TWU, and Dave, WA2EXP, sounded like a number machine. By the time the pack came down from the 59th Street bridge Mike, K2OUD, was starting to get heavy volumes of medical traffic. Downed runners, broken bones, huge blisters, and ambulance dispatch were all being handled by Mike from the Medical Emergency Comm. Vehicle, or MERV, at the finish line. Volunteer ambulance corps and EMT groups scattered along the course were sent to aid the injured.

The net control stations take a break at the end of the race. From left to right: Dave, WA2EXP; behind Dave is Gary, WA2BAU; Jerry, WB2ZEX; Steve, WA2DHF; Lee, WB2CUW; Pam, WB2TWU.

And the Race went on. Up for the Madison Avenue bridge was Paul, WB2VUK, and his camera. Could it be that we were really 20 miles into the race already? Down the bridge and onto 135th Street. It should be noted that the ever silent Jerry, WB2SPE, with the course coordinator, would break in from time to time with information that the race director should have, such as the fact that a mistake had changed the course. This caused a rather heated exchange with the police officials resulting in the course being changed back to it's original line. A mistake here would have invalidated the entire race! Back into Manhattan and down 5th Avenue. All amateurs here were asked to wear suits by the residents. It's the 2,000 dollar a month rent district. Into Central Park the race went. The finish line network started to perk. Timing and scoring officials were kept up to date on the progress by amateur radio. At the last two miles, the vehicles went ahead and parked allowing the press to get pictures of the finisher, Bill Rogers. The race was over, but now Mike, Pam, and Dave had lots of traffic from people needing medical help. Bill finished at 2 hours, 10 minutes 11.6 seconds, Not a record. The big surprise would come when Greta Weitz from Norway came over the finish line and set a new womens' record. The race now was really over. But on and on came the medical traffic. Mike would handle over 50 dispatches as well as several hundred at the finish line itself. A really fine performance. Credit for the fine performance by all was given over both the CBS and ABC radio networks, and the CBS television network even managed to get a word or two in about us.

For all of the 128 amateurs involved it would be summed up by the letter of thanks from the race director. He said that it was the "most organized race in history, and amateur radio once again showed that it was the critical link. My congratulations on a fine showing." CQ

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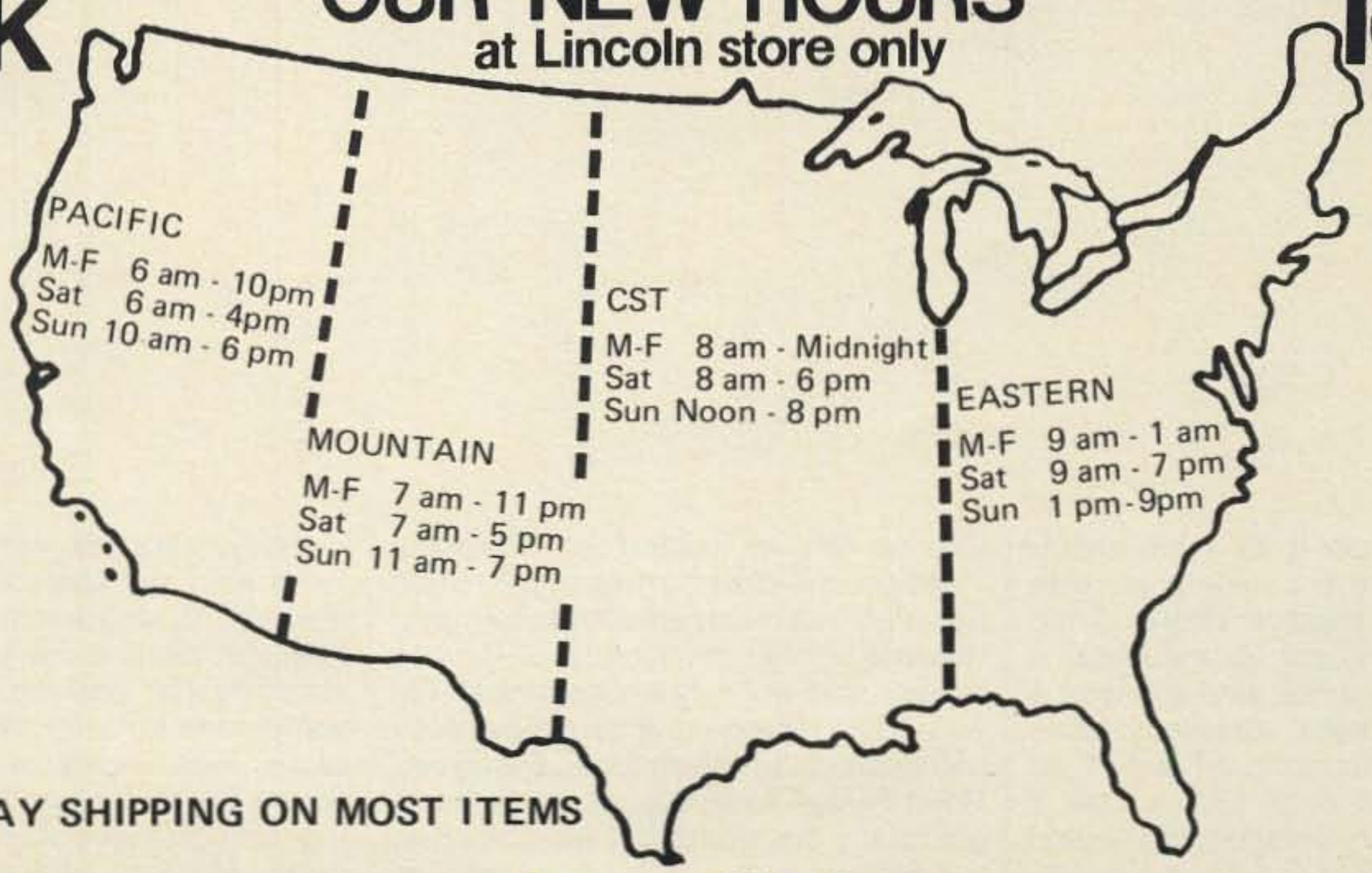

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Two meter f.m. can be real fun — especially if you work the repeaters while travelling cross-country. Read about W7NG's six thousand mile journey.

Across The U.S.A. With Two Meters

BY DON WALTER*, W7NG

I don't know how it all came about, but sometime late last summer my wife and I got it in our heads to take a driving trip across the country. So we bought a used Ford commercial van, and over a period of five weeks, installed insulation, paneling, carpeting an airbed, an AM-FM cassette deck *and* a new 2 meter rig (we also installed, or should I say incurred, a $3000 debt in the process). On the cold rainy afternoon of October 6th, we headed out of Seattle.

When one plans a trip of 12-15,000 miles across much unfamiliar territory, there is a high probability of getting royally lost on a few occasions. We wasted no time on that count, because somewhere between the Evergreen Point Bridge and I-90, we managed to get totally disoriented! It was then that we realized one of the main justifications for having burdened our BankAmericard by the $315 price of that rig. This was the first of countless times that two meters would get us back on course.

Everywhere we went amateurs offered help and assistance in a variety of ways. An amateur in Bozeman, Montana, let us put our van in the local auto dealer parking lot where he works; one in Cody, Wyoming, told us of a nice homecookin' restaurant where we stuffed ourselves after driving through miles of snow and slush. A good Mexican dinner was had in Boulder, Colorado, thanks to the advice and directions from a local amateur. Good traffic directions via 2 meters saved us from disaster (after dark and no map) while trying to locate

*1431 Minor Ave., Seattle WA 98101

my brother's house in Lincoln, Nebraska. While in Ohio, I ran into Herb, W8OE, a veteran traffic handler, who took 21 messages from me. I later found, in checking with friends after our return to Seattle, that every one of those radiograms were delivered in two days.

Several amateurs, bless their souls, directed us to the New Meadows Inn in West Bath, Maine. You see, I have never had live Maine lobster before, and decided that this was certainly the best time and place to try it. So I tried the local repeater for some advice and I got steered, through a fairly hard rain and thick fog (just like home), by a consensus of the local fellows, to the New Meadows Inn. There we partook of what turned out to be the most enchanting meal we were to have on the whole journey. And only $6.95 for a complete live lobster dinner! It has fast become my favorite delicacy -sometimes it pays to be a W1...

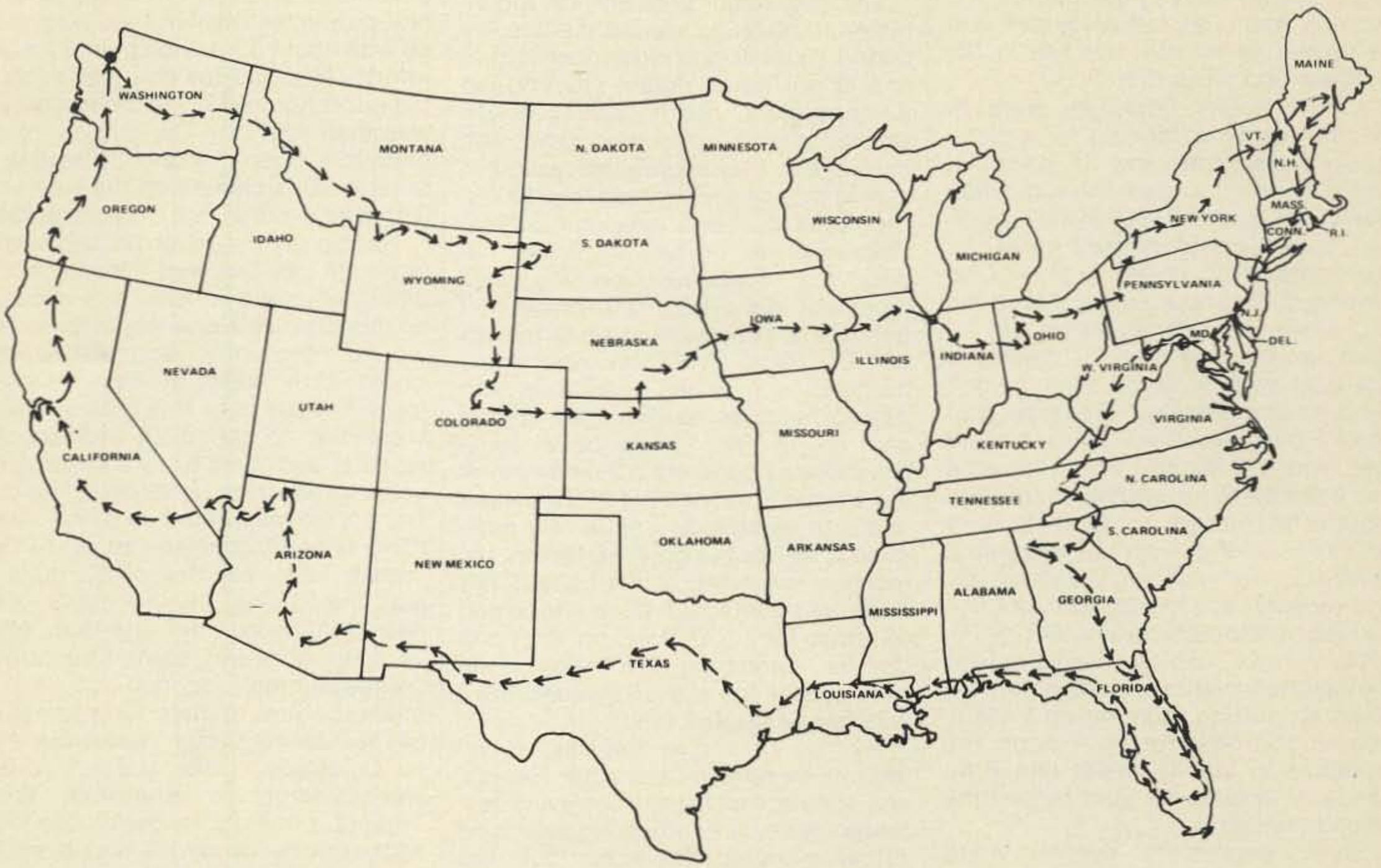
After that dinner we drove on down the coast, looking for a suitable, hassle-free (and, hopefully, at no cost) place to park the van for the night. A guy on the Portland, Main repeater directed us to a parking lot, "right on the ocean - you'll love it." We drove over a small knoll, "OK, the lot and the ocean are just at the end of the block -do you see it?" Do I see it? What I saw is a small shelf of asphalt (enough for maybe six cars, maximum) sloping gently down into a choppy, windswept surf. "Are you sure it's at high tide?" "I'm pretty sure" Hmmmm.... After about an hour of deliberation and/or listening to the waves pound onto the asphalt, we drove back to that shopping center parking lot we passed in town and bedded down for the night.

Traffic directions and restaurant recommendations continued to be very helpful in our travels. In New Orleans, we lucked out and got hold of WB5RNT. Harv expertly guided us through a maze of streets otherwise known as downtown New Orleans and we ended up in a $3 overnight parking area - 2 blocks from the French Quarter - and its Saturday night! Even my wife was moved to utter one of her rare compliments about amateur radio!

"The Town and Country Diner in Bordentown, New Jersey is one you'll want to try," said WA1YCG. Abe Gordon, a lawyer, and his wife Marilyn, of Fairfield, Connecticut, beside recommending eating spots, also invited us to stay overnight. We had an enjoyable visit with them, including a stop at the Athena Diner in Fairfield. I guess Abe is really into diners.

Earlier that day I finally (after 18 years of amateur radio) played a visit to the ARRL in Newington. I saw that the administrative building had been expanded and things are almost settled down. The radio museum, however, was still temporarily in storage, which validated a variation of Murphy, "When you visit a place but once in 18 years, something is bound to be closed." Oh well, at least I wasn't passing through on Sunday. I stopped in the QSL bureau and saw that they are quite busy - as are most folks in the building which, by the way, strikes me as being much smaller than it appears in QST photos. The W1AW "shack," that classic red brick building familiar to readers of *QST* sits underneath several towers topped with neat-looking beams. Impressive - not so much as some of our better known local antenna farms, but not bad.

When I travel, I like to get to know something about the places I'm visiting and that means (to me at least) getting to meet and know some of the



W7NG's cross-country route.

people that live there. The 2 meter rig tured out to be perfect for meeting new folks with whom you already share some aspects of a common interest - amateur radio. We were often invited for an eyeball QSO and in many instances invited overnight! In addition to staying with WA1YCG and his wife in Connecticut, we were invited one evening to the home of Jim and Mary Stewart, WA2EOM and WB2FVI of Grand Island, New York, who told us about winter 1977 in the Buffalo area. 18 feet deep snowdrifts are hard to imagine on a rainy November evening but, just 10 months prior, that's what sat in the front yard of the home we were visiting. Jim, an electrician, had to get up very early in the morning, so our visit was brief, but enjoyable, and he invited us to park our van in his driveway and sleep there.

A few weeks later, we were in Mobile, Alabama, looking for a place (again hassle-free and, if possible, just plain free!) to park the van, when Manley Ellis, WD4HSD, invited us to park it in the seldom-used lot of the apartment he occupies. On-the-air, he gave us quick and accurate directions and when we arrived, came out to meet us. Walking straight down the sidewalk with a white stick in one hand, I heard him say, "Well now, that wasn't bad directions from a blind man, was it?" Manley, who told us he has been blind for several years, well before he moved to Mobile, is a retired pensioner who got interested in amateur radio about 1½ years ago and recently passed his General. He had just gotton on the air with a TR-7200A which enabled him to reduce the natural isolation of lost vision. He plans on putting together an h.f. station in the near future. I hope the amateurs in Mobile assist him if he needs it because he sure helped me when I needed it.

Short, impromptu eyeball visits played an enjoyable role on this trip. Near Montpelier, Vermont, we eyeballed with Press, K1BCS, along the side of the road. Later that night we were invited up to Pinkham Notch Recreation Area by Al, K1OIQ, the weatherman on nearby Mt. Washington in New Hampshire.* After much needed hot showers, we ragchewed in our van with Al and Larry, W1HJF, who happened by later that evening. The following morning we ran into Al again, this time in nearby Gorham, New Hampshire.

One benefit of meeting a wide cross-section of amateurs around the country is that several of them are into special aspects of the hobby to which I have not previously been exposed, other than through what I'd read in amateur magazines. Dick, W6SLZ of Bakersfield, California is one such amateur. Dick is into SSTV and until he invited me over for an eyeball QSO, I had never seen a slow scan station. He had taped several SSTV QSO's and I'm now now impressed with the medium. Another $600 in parts and equipment and I, too, could do it. Sounds familiar, huh?

Most of the folks I got to meet were surprised at my age. "With a call like W7NG, I thought you were an old buzzard." is now an oft heard phrase.

The only major problem, for a contester, in traveling around the country during October and November is that one is not home during CQWW and Sweepstakes. Both Sweepstakes weekends saw us purring down the freeways, so no scores this year, but luck is mostly and my side for CQWW. On phone weekend, I was in Canfield, Ohio, and had no luck on Friday finding any contesters on the area repeaters. Saturday night, however, I got into a conversation on 2 meters will Bill Skipp, WB8UGG, who asked me to come over and operate on Sunday so he could see what his station can do in the hands of a semi-experienced contester. Sunday morning I turned on his TR-4 to 15 meters and was astounded - either his miniquad at 30 feet is a great performer, his location excellent, or the band is hot because I contacted 48 countries and 20 zones by 7 p.m. WAC on 15 in one day is something I've never done before! Not too big of a score, but I was happy (so was Bill)!

By the time c.w. weekend rolled around, we were in Clearwater, Florida, and once again I tried to see if any contesters were on 2 comparing setups on Friday morning. Not much luck, but then N400, Ink, pooped in and I found he was driving about 70 miles north to operate at W4WS near Weeki Wachee, Florida. "Do they need any more ops?", I asked hopefully. "I don't know, but quite possible. Can you stick around for an hour and I'll call you back when I get there?" Can I stick around? - sure! Two 807's (no solid state beer yet) later, Harold, W4ZCB, co-conspirator in the sudden emergence of W4WS to big time, called me and invited me up for the weekend. He arranged for Jim Roux, W4YA, to give me a ride up (and back on Sunday night). So off we went!

W4WS is situated in a new two bedroom, one floor house on a five acre tract in a still sparsely populated area. Three S-lines (for 80-40-20), two home brew amps and an Alpha 374 crowd into the living room; the 10 meter S-line and the 160 meter station in the front bedroom, and the 15 meter S-line in the back bedroom. Alpha 77D's give slight boosts on 10 and 15. Outside are single band beams (6 on 10, 4 on 15, 4 on 20), each atop separate 120 foot towers and 3 elements on 40 at 150 feet. Sloping dipoles from a few of the towers are for 80 and 160. Inside are some crackerjack ops including Vic Dubois, N4TO/K4SHB, Tim Cotton, N4UM/K4DBZ, Paul Ferris, N4WC/K2UME, Dale Stretier, W4QM/W4DQS, and of course, Bob James, W4WS. There was fun (some great multipliers) and frustration (lousy band conditions, even in Florida, and Murphy) during the weekend and we ended up with about 3.1 million points for our efforts. Not bad for only the second big effort from W4WS (phone weekend was their first go). The guys were an enjoyable bunch to operate with and several of us celebrated the weekend with a nice dinner in a local restaurant.

Having done almost no two meter work prior to October, I found that it didn't take long to learn alot about it on this trip. Quite a variety of repeaters around the country - ones with timers, ones with autopatches, remote repeaters and ones that entertain you. I listened to the main Indianapolis repeater and heard a guy autopatching some information tapes on it. "I didn't know a repeater could do that," said I. "This is nothing; when you get to Columbus, Ohio, ask one of the guys to play their tapes." A few hours later, near Columbus, I did just that. What we heard were some humerous "repeaterisms" topped off by a hilarious three minute long imitation of Prez Jimmy Carter "welcomin' y'all to Columbuz, Ohia, U.S.A." A few weeks later, in Bluefield, West Virginia, I heard a fellow on the local repeater offer to all his sound advice on financial management: "I puts all my bills into a hat and draw them out and pay them in order till I'm out of money. Now, the ones that don't get paid - if they complain, well, I just don't put their bills in the hat next payday." Well, that's one way to do it.

After we arrived in Miami, Florida, we heard two Spanish language repeaters used by Cuban W4s. Sounds like 15 meters at home with the beam pointed south. You can hear all kinds of accents and languages on 15 or 20 meters in an hour at home, but it's very different to hear them one at a time on 2 over a ten week period of driving across the country, operating mobile in every call area. Meeting many of the faces behind those calls, voices, and accents adds a dimension to the journey that really can't be described.

*See "45 Years of Hamming Atop Mt. Washington" by Al Oxton, K1OIQ, July, 1977 QST, p. 21.

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a monthly feature by
JOHN A. ATTAWAY, K4IIF

DX

News of communications around the world

We are pleased to report that amateur radio is alive and well in Iceland and Finland.

This is hardly news to those who work TF- and OH- stations on a regular basis, but in late October and early November ye DX Editor was privileged to visit both these northern lands, meeting amateurs and even making a few QSO's. Quote Red-Eyed Louie, "an eyeball QSO is worth 100 QSL's."

As our stay in Iceland totalled 4 days and included the weekend of the *CQ* Worldwide Phone Contest in October, we had arranged to operate under the reciprocal licensing agreement concluded last year between TF-land and the U.S. Some of you probably worked us during the contest as K4IIF/TF. We had thought it would be /TF3, but we were clearly told to use /TF which counts as TF0 for WPX.

For arranging the license we extend out most heartfelt thanks to Kristinn "Kiddi" Andersen, TF3KX, Secretary of the Icelandic Radioamateur Association, who handled the paper work for us. If you contemplate a summer vacation in Iceland, where the temperatures are invigorating and the scenery among the most spectacular on earth, write Kiddi about 3 months in advance about a license as the arrangements are time-consuming and it is necessary to work through the Icelandic Radioamateur Association.

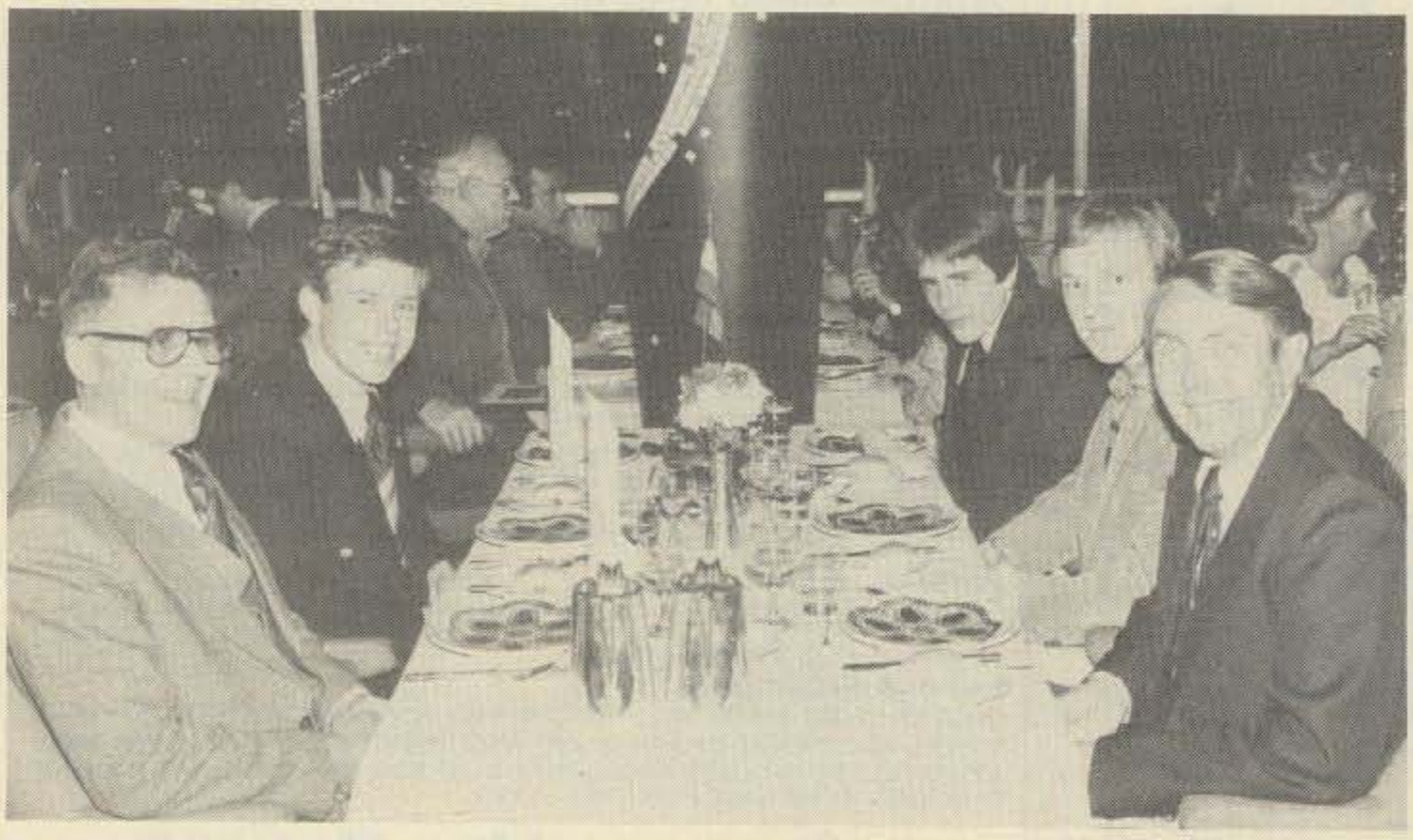
Before I left Florida, Kiddi had written that the club would help with equipment but I assumed that setting up and erecting an antenna would be my job. Therefore, you can understand my surprise when I checked into my top floor room at the Hotel Saga in the wee hours of the morning to find the Drake R4B and T4XB belong to Association President, Axel, TF3AX, hooked up on the desk and an RG8U feedline leading to a 40-10 meter vertical mounted on the roof. A note said "The transmitter is already tuned out on 14200 KHz. and you can just begin a *CQ* at once." Still standing, we flipped the switch and answered the *CQ* of Victor, UL7LA, who gave is a 5/8. We were called immediately by Dave, WL7ACY, who gave us 5/7 in Alaska. Thirty seconds after entering the room we had made 2 good DX contacts and hadn't even reached a chair. Axel, old friend, we will never forget your generosity in loaning us the equipment, and Saemundur, TF3UA, and TF3KX for taking time away from the University to help set it up. In fairness to the TF-gang, they can't do this much for all their visitors, but that Icelandic radio amateur hospitality will be there for any of you privileged to visit their most interesting country.

We would also like to express our appreciation to the TF-group for the special dinner arranged for me, and for the effort they made to put Iceland on the air during the 1978 contest. Several TF stations were active enabling many to log their Zone 40 multipliers. Especially active were TF3JB, operated by TF3JB and TF3CW, who made an excellent score in the multi-operator, single transmitter class; TF3AC, who went all out on 10 meters and TF3YH and TF3US who were in many pileups.

Moving on to Ocean Henry land, we were met at the Helsinki airport on a cold, frosty night by Ville, OH2MM; Miika, OH2BAD and Leifi, OH2SB who grabbed the suitcases and sped to the Hotel Intercontintental while ordinary travelers were still waiting for the bus. On the second night a DX banquet was arranged at the hotel which also included Armas, OH2NB; Jorma, OH2KI/OH3XZ and Jorma's XYL Annikki. We were interested to learn that OH2NB is the same Armas Valste who represented Finland in the Olympic Games in the pre-World War II years and was 11 times a national champion in track and field events. He was Head Coach of the Finnish Athletic Union from 1935-60, General Secretary from 1960-68 and was President of Findland's Radio Amateur League from 1968-71.

It was a great pleasure meeting the world-famous OH DX and Contest Team who have compiled such a great record in the *CQ* contests over the past decade. Unfortunately we missed Martti, OH2BH, who was still in the Madeira Islands recuperating from a

*P.O. Box 205, Winter Haven, FL 33880



Dinner at the Hotel Saga in Reykjavik, Iceland. On the left side of the table are Axel, TF3AX, President of the Icelandic Radioamateur Association and Kiddi, TF3KX, Secretary of the Association. On the right are John, K4IIF/TF, Siggi, TF3CW and Saemundur, TF3UA. TF3KX and TF3UA are students at the University of Iceland which is just across the highway for the Hotel Saga. (Photo by Gudjon, TF3AC)

great single operator effort during the phone test.

Many thanks to Ville for the use of the OH2MM station for skeds with Frank, W1WY, and to theology student, Miika, OH2BAD, for his kindness in showing us around the famous Temppeliaukio "Stone" Church in downtown Helsinki and acquainting us with Findland's railroad system.

4U1UN

Discussions with European DXers in November, 1978 reavealed that the new country created at the United Nations building in New York can only be worked with great difficulty in Europe. An appeal was made for assistance to this station so that a stronger signal can be radiated across the pond.

Desecheo - The Country

One of the most exciting DX highlights of 1978 was the addition of Desecheo Island to the amateur radio countries list. The acceptance of Desecheo was brought about largely through the efforts of the DX Club of Puerto Rico, particularly its President, David Novoa, KP4AM, who patiently assembled the necessary information for the A.R.R.L. offices. For those of you interested in the where, why and how of this new country in the Caribbean, the following synopsis, provided by KP4AM and the DX Club of Puerto Rico, tells the story:

"The island of Desecheo lies in the Mona Passage between the Dominican Republic and the Commonwealth of Puerto Rico at latitude 18°23′ north and longitude 67°29′ west, and occupies an area of approximately 1.46 square kilometers. It is uninhabited with a desert type vegetation and has no source of drinking water.

"Desecheo was discovered on Nov. 20, 1493 by Christopher Columbus and named Isla de Zicheo. Until April 14, 1940 Desecheo was a part of the Territory of Puerto Rico, but on that date with World War II threatening the western hemisphere it was conveyed by Congress to the U.S. military for use as a bombing and gunnery range. In 1965, jurisdiction over the island was transferred by the General Services Administration to the Department of Health, Education and Welfare for use as a scientific site for monkey experiments by the National Institutes of Health. In 1976, the administration of Desecheo was again transferred, this time to the Department of the Interior for use as a National Wildlife Refuge under the Administration of the Fish and Wildlife Service. The Commonwealth of Puerto Rico has no claim, jurisdiction or administrative control over Desecheo Island. It is a separate entity owned by the federal government, as differentiated from Puerto Rico which is a Commonwealth under the 1952 constitution. Thus, Desecheo qualifies as a new DXCC country under the rule applying to separate government or administration.

In 1976, the DX club of Puerto Rico formally requested recognition of the status of Desecheo as a new country from the A.R.R.L. The League finally gave its approval in late 1978 and a large scale 24 hour/day operation from the island is planned by KP4AM and a group of DX and contest operators from both Puerto Rico and the U.S. Their plans call for a 7-day operation to include both c.w. and s.s.b. using all bands. Three stations will be operated simultaneously using the callsign KP4AM/Desecheo. It is reported that the Northern California DX Foundation

CQ DX Honor Roll

The CQ DX Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more countries for the mode indicated. The top SSTV DXers are also listed. The ARRL DXCC Country List, LESS DELETED COUNTRIES, is used as the country standard. Total number of countries currently on the DXCC list as of this listing is 319. Honor Roll listing is automatic when submitting application or endorsement for 275 or more countries. To remain on the CQ DX Honor Roll, annual updates are required. Honor Roll updates may be submitted any time, in any number. Updates indicating "no change" will be accepted to meet the annual requirement.

C.W.

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K6EC 315	N4PN 309	W2GT 305	DL3RK 295	DJ7CX 280
ON4QX 315	W8KPL 309	N6AV 303	N6CW 292	W4OEL 275
W6ID 314	K6JG 306	W4BQY 301	WA8DXA 290	

S.S.B.

WA2RAU 319	F9RM 312	YV1KZ 309	HP1JC 299	W4MWT 285
W2TP 318	K4MQG 312	F2MO 308	K6XP 299	W8ILC 285
K2FL 317	W3AZD 312	W4DPS 308	N4MM 297	WA4WTG 285
XE1AE 317	I0ZV 311	ZL3NS 308	F9MS 295	N6AW 284
I0AMU 316	OE2EGL 311	OZ3SK 307	N6AV 295	I3LLD 283
K6YRA 316	VE3GMT 311	SM5SB 307	K8PYD 294	JH1VRQ 282
I8KDB 315	W6EUF 311	W6YMV 307	N2SS 294	K3EH 282
VE3MJ 315	W9QLD 311	XE1KS 307	DK6KG 293	OK1MP 281
W3NKM 315	DJ9ZB 310	VE2WY 306	JH1EIG 293	W7JYX 281
W6EL 315	K6EC 310	W0SD 303	K4LSP 292	K8LJG 280
W9DWQ 315	K9MM 310	ZL1AGO 303	K9RF 291	VE7HP 280
W9JT 315	SM5CKS 310	DK2BL 302	VE7CE 290	WB2RLK 280
G3FKM 314	W4UG 310	W0SFU 302	W6FET 290	9H4G 279
VE3MR 314	ZS6LW 310	WB6DXU 302	DJ7CX 288	JA6GDG 277
W4EEE 314	K6JG 309	EA4LH 301	OE3WWB 288	DJ2AA 276
W9KRU 314	K6WR 309	I5WT 300	W7OM 286	K9PPY 276
I8YRK 313	WA2EOQ 309	W9SS 300	YS1O 286	VE3FJE 276

SSTV

W8YEK 108	G3IAD 101

One of the first steps toward a successful DXpedition is selecting the proper site. Here, left to right, are HI8WPC, HI8JAG and HI8MFP eyeballing the proposed location for their HI1RCD operation from Beata Island. HI1 is a rare prefix for CQ's WPX award. The RSC indicates Radio Club Dominicana. (Photo via HI8MFP)

John K4IIF and Miika, OH2BAD with the tower and beams of OH2MM in the background. (Photo by OH2MM)

John, K4IIF and Miika, OH2BAD, operating Ville's ICOM-701 station which ran up such a great score from OH2MM during the 1978 CQ Worldwide Phone Contest. Miika was first licensed 20 years ago at age 12, the youngest amateur to be licensed in Finland. For you YL's out there, he is still single!!! (Photo by OH2MM)

Victor Melnikov, UV3EX, was first licensed as UW9CE in 1961. He has confirmed Zone 19 for many DXers around the world. (Photo courtesy W2LZX)

will sponsor the DXpedition, including the transportation costs, gasoline for the generators and printing and handling the QSL cards. Wilson Electronics has already sent two System 2 tribanders and New-Tronics has contributed two Hustler multiband verticals. Herb Johnson, W6QHI, has promised four Atlas transceivers, two 210X's and two 350XL's. Hopefully, by the time you read this you will have worked the DX Club of Puerto Rico gang from exciting Desecheo Island."

Desecheo - The Controversy

Since *Desecheo - The Country* was written, amateur radio has a new controversy as well as a new country.

After A.R.R.L. approved new country status, but before the DX Club of Puerto Rico could clear the final hurdles for its DXpedition, a separate operation was launched from Desecheo by Bob Denniston, W0DX, and John Ackley, KV4KV. Mr. Denniston will be r e m e m -
bered by most readers as a former president of the A.R.R.L.

The DX Club of Puerto Rico has advised the *CQ* DX Department that to their knowledge W0DX and KV4KV did not have permission for a legal landing on Desecheo. KP4AM, who is a practicing attorney in Puerto Rico, indicated to us that approval of the Wildlife Officer who administers Desecheo must be obtained in advance of any landing, and that the DX Club of Puerto Rico was the only amateur group who had contacted the Wildlife Officer to seek a permit.

To insure fairness to all concerned, the DX Department wrote Mr. Denniston at both his Tortola, B.V.I. and Newton, Iowa addresses asking for his views in the matter. Although we enclosed self-addressed, stamped envelopes, six weeks have passed without a reply from him. We are still hoping for an answer as we feel that W0DX would want our readers to have the total picture.

Meanwhile we also contacted the League and received a prompt reply from Don Search, W3AZD, as follows:

"Desecheo has been made a DXCC country. It will go on the DXCC list sometime after the first authorized operation has been made and certified by A.R.R.L.

"I realize that W0DX and KV4KV claim operation from there. No documentation or authorization to substantiate their claim has been received, as of this date.

"I know KP4AM and KP4DSD have been working on this a long time. I understand they are still making plans to go when they get authorization." Hopefully more information will be available in future columns.

At press time we have been advised by the ARRL that they have received a letter from the Fish and Wildlife Service of the Department of Interior. This letter states that the Service is "having problems of illegal entry on Desecheo National Wildlife refuge by ham radio operators", and that "no entry permits have been issued for the purpose of broadcasting from Desheo". The letter was strongly negative regarding the possibility of future operations from Desecheo.

The WAZ Program

CQ's WAZ Manager, Leo Haijsman, W4KA, was in southeast asia for the past month and was able to check only a few sets of cards for this month's report. He hopes to be current with WAZ authorizations by the deadline for the next issue.

Single Band WAZ
20 Meter Phone

176...WA4JTI
177...K9MD

All Band
S.S.B.

1539...WA4JTI

C.W. Phone Mixed

4383...YU2AAV
4385...W8KUZ
4385...K2IJ
4386...WA8LWK
4387...ZS5LB

The complete rules for all WAZ awards are found in the May, 1976 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to the WAZ Manager, W4KA, 1044 South East 43rd. St., Cape Coral, FL 33904. Applicants forwarding cards to W4KA should include sufficient postage for their safe return. Please note that effective Jan. 1, 1979, the fee for *CQ*'s DX certificates was raised to $2.00

Need Zone 23 For WAZ

Most DXers in North and South America find zone 23 to be most difficult hurdle for either all-band or single-band WAZ. Those in the race for the new 5-band WAZ award will find it equally difficult. Not everyone is aware that there is an alternative to a JT, Mongolia QSL for zone 23, namely Tannu-Tuva, a part of Soviet east asia with a population of near 200,000 and an area of 66,100 square miles which lies along the northwestern border of Mongolia. Tana-Tuva became part of the U.S.S.R. in 1921 and its official name today is the Tuva Autonomous Soviet Socialist Repubic.

Fortunately for those of us in the DX game, a station in Tuva is easily distinguished from other UA0 stations

by the Y immediately following the numeral. For example, two of the most active UA0 stations in zone 23, Tuva has been UA0 and UA0YAE. If you're looking for zone 23, listen for the *Y*.

North Jersey Need List

Last fall, the North Jersey DX Association polled its members to determine which countries were in greatest demand. The results were as follows:

1. Okino-Torishima
2. Saudi Arabia - Iraq Neutral Zone
3. South Sandwich Island
4. Spratly Island
5. Bouvet Island
6. China
7. Burma
8. Kamaran Island
9. Bhutan
10. Khmer Republic (Cambodia)
11. San Felix Island
12. Heard Island
13. Laccadive Islands
14. Mayotte
15. Mellish Reef
16. Crozet Island
17. Glorioso Island
18. Mt. Athos
19. Central African Republic
20. Andaman & Nicobar Islands
21. Annobon Island

By this time the requirements of the North Jersey gang may have changed as a result of such developments as the addition of Desecheo Island to the list and possible activity from Bouvet Island.

And Further West

Early returns from a poll by the West Coast DX Bulletin show the following to be the 10 most desired countries:

1. 3Y, Bouvet
2. BY, China
3. 8Z, Neutral Zone
4. VS9K, Kamaran
5. XZ, Burma
6. ZA, Albania
7. 1S, Spratly Island
8. VK0, Heard Island
9. VU, Laccadives
10. Abu Ail

Again, these are early returns and the complete poll may shuffle the order somewhat. A very conspicuous feature of both polls is the total absence of Clipperton which dominated all polls for many years. This shows the great job done by the great Clipperton DXpedition in 1978.

WPX Endorsement For North America

For many years the toughest of WPX continental endorsements was North America which requires 126 prefixes. However, the bicentennial calls of 1976 improved the odds considerably, and the recent addition of N calls and 2 X 1 calls to the U.S. list has reduced the difficulty even further. Check your logs, you may find you are over the top for the WPX North America endorsement and didn't even know it.

New Certificate Fees

As announced in the October, 1978 issue, the fee for all *CQ* DX certificates was raised from $1.00 to $2.00, effective Jan. 1, 1979.

Rolf Rasp, PY1RO, visiting Southeastern DX Club members, left to right, Paul, N4YD, Bill, N4NX, and Dave, WA4SSU after his successful DXpedition to St. Peter and Paul Rocks. (Photo via K4SMX)

Kurt Stegert, DK4HD, of Hamburg, Germany. DK4HD is an enthusiastic participant in CQ's WPX Program.

Victor, UV0EX, uses this neat homebrew transceiver, designed by UW3DI, to drive a 200 watt linear. Victor is in Zone 19, USSR Region 153, Sakhalin Island. (Photo via W2LZX)

The WPX Program

Mixed

688...SM3EVR
689...FM7AV
690...YU2CDX
691...W0SR
692...SL6DO
693...SM6CQV
694...OK3JW
695...AB4Z
696...AF5M

S.S.B.

1097...PA0RRS
1098...N5RR
1099...VK8BG
1100...FM7AV
1101...W0SR
1102...W8QGP
1103...G4CHP
1104...WA6PKN
1105...DK9QD
1106...SM6CQV

C.W.

1741...N5RR
1742...PI1PT
1743...VO1KO
1744...JA4DZ
1745...FM7AV
1746...W0SR
1747...N2ADI

WPX Award of Excellence:

I0JX, WA1JMP

WPNX

129...VK2NOG
130...WD8RNQ

Endorsements

Mixed:....400 FM7AV, SL6DO, AB4Z, AF5M. 450 JR1TNE, JH3XCU, KL7AF, SM6CQV. 600 W0SR. 650 K2UFM. 700 SM3EVR. 800 HI8LC, W0IUB. 850 JA1BN, OK1IQ, W6ANB. 900 JH1VRQ. 950 I3ANE. 1000 OK3-JW.

SSB:....300 N5RR, FM7AV, WA6PKN. 350 PA0RRS, VK8BG, SM6CQV. 400 W8QGP, WD8CRY, DK9QD, N5RR. 500 YU2CDX, W0SR, G4CHP, K2UFM. 700 YV1KZ. 750 JH1VRQ. 850 WB9EBO. 1050 K5UR, 9H4G. 1300 I8YRK.

CW:....300 N5RR, VO1KO, FM7AV, W0SR, N2ADI. 400 N6FX, N5RR. 450 K7CPC, OK1DKW, W6YMH. 500 PI1PT, DK4HD, G4CHP, N4YB, W3OGY. 550 JA4DZ, 650 PI1PT. 700 OK1IQ. 1000 OK3JW. 1300 W2NC.

10 meters . . K2UFM.
15 meters . . VK8BG, OK1IQ.
20 meters . . PI1PT, DK4HD, OK1IQ, YU5FAM, K7CPC, OK3JW, N5RR.
40 meters . . I3ANE.
80 meters . . OK3JW.
Africa: 9H4G, OK3JW.
Asia: VK8BG, JH3XCU, DK4HD, PI1PT, WA2AUB.
Europe: PA0RRS, VO1KO, PI1PT, JH3XCU.
No. Amer.: 9H4G, OK1IQ, PI1PT, I3ANE.
Oceania: 9H4G, JH3XCU.

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage if air-mail desired) to "CQ WPX Awards", 5014 Mindora Dr., Torrance, Calif. 90505. U.S.A..

CQ DX Awards Program
S.S.B.

623...JA6GDG
624...K9UAA
625...AA4NC
626...XE1HR
627...XE1DDP
628...WA2SRM
629...WA6TOO
630...WB2RLJ
631...WA4OIB
632...VE7IX

C.W.

329...JA6GDG
330...WB5OGQ

S.S.B. Endorsements

310...XE1AE/317
310...I8KDB/315
310...VE3MJ/315
310...W3NKM/315
310...W6EL/315
310...VE3MR/314
310...W9KRU/314
310...I8YRK/313
310...E2EGL/311
310...VE3GMT/311
310...K9MM/310
300...YV1KZ/309
300...XE1KS/307
300...VE2WY/306
275...K4LSP/292
275...W7OM/286
275...WA4WTG/285
275...JA6GDG/275
250...W2CC/269
150...XE1DDP/177
150...WA6TOO/150

C.W. Endorsements

310...W6PT/318
300...N4PN/309
275...K9MM/299
275...W4OEL/275
150...W7DAZ/152

Complete rules and application forms for the CQ DX Awards program can be obtained by sending a business size, No. 10, envelope, self-addressed and stamped to: "CQ DX Awards", 5632 47th Avenue SW, Seattle, Washington 98136 U.S.A..

QSL Information

A computerized QSL Manager Directory is available from Gary Yarus, WB0MSZ, 921 North Clay Ave., St. Louis, MO 63122 for $1.00 plus 41¢ postage. Send an s.a.s.e. to Gary for complete information.

QSLs for each of the following stations may be obtained by directing a self-addressed, stamped envelope to Mary Ann Crider, WA3HUP, R.D. 2, Box 5A, York Haven, PA 17370: CE0AE, CN8CW, CN8AK, CT1BY, CT1KD, CT1OF, JA1, KP4KK, M1B, OY5J, TA2SC, ZP5YW, VE3BWK/4U, VE3BWK/4X, 3A2CP, and 7X2BK.

A2CBT - Via DJ0FX
A2CDW - To VK7UX
A35BD - c/o ZL1BD
A4XFC - Via G4AWJ
A4XGB - To G4CTQ
A6XB - c/o KH6JLN
A6XF, A6XR & A6XT - Via G4CHP
A9XEC - To K4CG
AP2UR - c/o W8QFR
C31FO-Via F3BW
C31KC - To DK1RV
C31NO - c/o PA0GIN
C31QN, C31QO, C31QQ & C31 QR - Via PE0MOT
C5AAR & C5ABK - To G3LQP
CN8CS - c/o WB0MSZ
CP1AT - Via W0GK
CT6UA - To W3HNK
CY2YM/2 - c/o VE2YM, P.O. Box 35, Dorion, Quebec, Canada
D68AF - Via K5YY
DU1MEL - To K9MD
EA6EU - c/o WD5BIF
EA8CR - Via W3HNK
EA9EY & EA9UI - To WA6QDR
EL1I - c/o VE1RY
EL2AE - Via WB3CQM
EP2ER - To K3AW
EP2GT - c/o K1DBA
EP2NY - Via K7KNM
FG7AS/FS7 - To Jean Sahai, Box 44, Pointe-a-Pietre, Guadeloupe
FG7TD - c/o W5RU
FK8CR - Via W7OK
GD5BTU - To W3LPL
GJ5CLS - c/o WD6CZR
GU5CIA - Via N6MA, 3800 J Street, Oxnard, CA 93030
H44CD - To W4BAA
HH2CQ (CQ WW C.W. DX Test, Nov., 1978) - c/o George Werner, 1045 Le Brun Drive, Jacksonville, FL 32205.
HK0COP - c/o W9UCW, Barry Boothe, RFD-1, Bell Road, Minooka, IL 60447
HZ1AB - Via Leo Fry, K8PYD, 5740 North Meadows, Columbus, OH 43229
HZ1BS/8Z4 - To DJ9ZB
ID9VXC - c/o I3ON
JT1AN - Via JH1LBR
JT1BF - To UW0NE
KG4DS - c/o WB4DKQ
KG4KG - Via YASME Foundation, Box 2025, Castro Valley, CA 94546
KG6DX - To W1OO
KJ6ZK - c/o W6WA
KM6BI - Via W5RU
KX6DX - To W6VG
KZ5SIT - c/o K2KGF
N0TG/KP1, W0RJU/KP1 and W0ZH/KP1 - Via Randy Rowe, N0TG, 3237 Connecticut Drive, St. Charles, MO 63301
OG4AB - To OH4AB
OX3AB - c/o OZ3PE
PJ9JR & PJ9KK - Via N4MM
PY0RO - To W1DA
S8ABC - c/o WD5BOU
ST2AE - Via DJ9KR
ST0YY - To K5YY
SU1AL - c/o WA2DDE
TA1DKF - Via WB3KUK
TC2AB - To W7OX
TF3FG - c/o W3HNK
TF3YH - Via WA8AEE
TG8DX - To W3HNK
TI2APG - c/o W7OK
TI9KT - Via TI2CF
TJ1AD - To WB4WHE
VK2BTC - c/o K1SC
VK9ZM - Via VK4ABW
VK9ZR - To VK2BJL
VP1DX & VP1EF - c/o WB4INC
VP1JEC - Via W4BSO
VP1RX - To W4SME
VP2MBA & VP2MBC (1978) - c/o Chuck & Roberta Clayton, W7EP, and WA7KMC, 5270 York Hill Drive, Hood River, OR 97031
VP2MT - Via WB8LDH
VP2MUZ - To W8UVZ
VP2VDH - Via N6CW (K6SDR)
VP2VDQ - c/o N6ZZ (W6DQX)
VP2VER - To N6CW (K6SDR)
VP5CNL - c/o W8CNL
VP5WS - Via W4SME
VR6TC - To W6HS, 10861 Langdon Drive, Mission Hills, CA 91345
VU2AZZ - c/o WA6OET
YN1H & YN1Z - Via WA4ZXC
YS1ESH & YS1GMV - To W3HNK
W6QL/6Y5 - c/o YASME Foundation, Box 2025, Castro Valley, CA 94546
XT2AT - Via Mr. Egon Wegner, P.O. Box 140, Ouagadougou, Voltaic Republic
ZL3HI/C - To Gary Medford, N2CW, 207 West Fifth St., Ship Bottom, NJ 08008
3B8YY - c/o K5YY
3B8ZZ & 3B9ZZ - Via W2GHK
3Y1VC - To LA5NM, Mathias Bjerrang, Box 210, 9401 Harstad, Norway
4N2EC - c/o YU1JAS
4U1UN - Via U.N. Radio Station, Box 20, New York, NY 10017
4L0RK - To UW0AF
4M3AGT - c/o YV3AJ
4X4GD & 4Z4MB - Via K2UVV
5U7AG - To K1VSK
6Y5AH - c/o W1BPM
7P8BH - To WB9ZKK, P.O. Box 1671, Kankakee, IL 60901
9J2JN - Via WB2IZN
9K2FX - To W4KA

73, John, K4IIF

a monthly feature by

A. EDWARD HOPPER, W2GT

Awards

News of certificate and award collecting

Special Honor Roll
All Counties

#203 John Stephen Swaim, W5LXG 11-1717-78
#204 Manuel B. Greco, K2LFG 11-21-78
#205 Barry Kutner, W2UP/WB3LYB 11-25-78

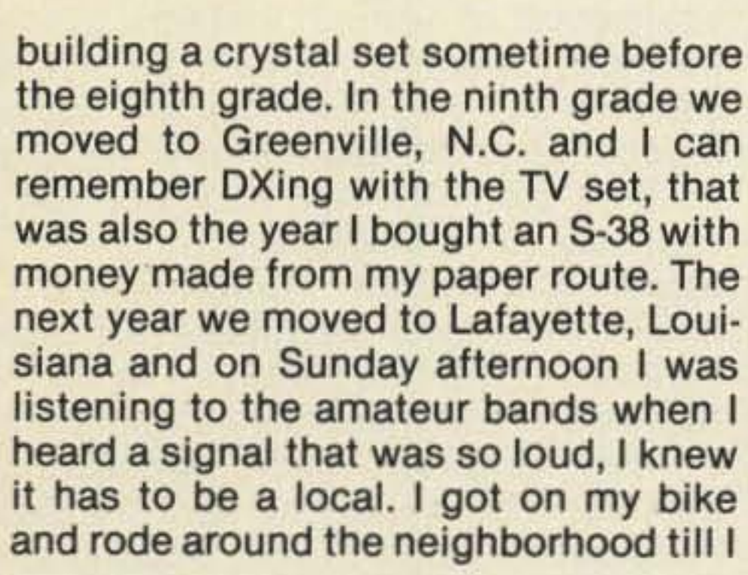
The March, "Story of The Month" as told by Eric is:

Eric S. Johnson, WA9ZRP.
All Counties #195 9-29-78

"I was born in 1939 in Murphy, North Carolina and before first grade I had lived in N.C., Virginia, and South Carolina. I don't remember exactly when I got interested in radio, but do remember being an avid broadcast band listener at an early age and building a crystal set sometime before the eighth grade. In the ninth grade we moved to Greenville, N.C. and I can remember DXing with the TV set, that was also the year I bought an S-38 with money made from my paper route. The next year we moved to Lafayette, Louisiana and on Sunday afternoon I was listening to the amateur bands when I heard a signal that was so loud, I knew it has to be a local. I got on my bike and rode around the neighborhood till I spotted a house with a wire antenna and a lead going to a "shack" in the backyard. There I found two high school juniors and a Ham shack. They encouraged me and through the help of an adult education electronics class, I became WN5AZW in the spring of 1956. About six months later I up graded to K5AZW.

"Operations in those days were with an NC-98 an a Johnson Adventurer, the latter some times modulated with a pair of 2E26's, and a 40 meter doublet.

*P.O. Box 73, Rochelle Park, N.J. 07662



Eric Johnson, WA9ZRP (Taken a couple of years ago before he shaved off the beard).

I.N.O.R.C. Award (Italian).

Towards the end of my senior year in high school I got a 2nd class radiotelephone license, and then about a month later the 1st class.

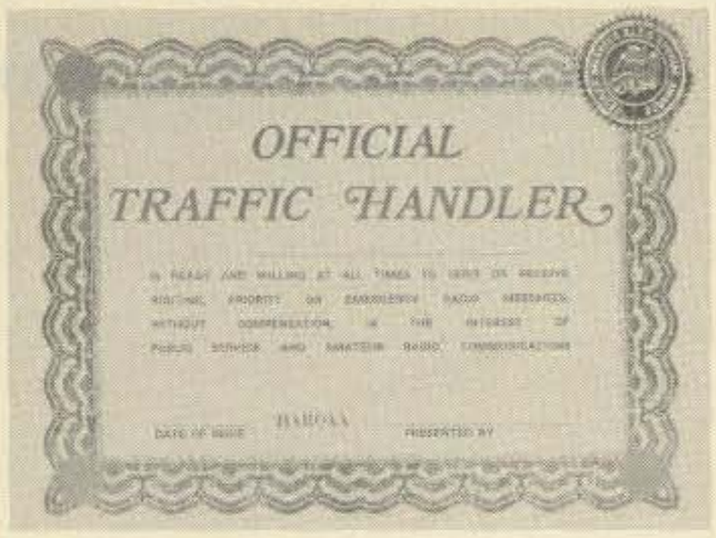
"I started college in the summer of 1957 and because the commercial license allowed me to work at night, I first worked at a local TV station and later as a night time engineer for a local radio station. Unfortunately, I wasn't much of a student as a Physics major, so after three semesters I became a History major, graduating with honors in 1960. During this time with college and work, hamming took a back seat and I actually let my license expire in the fall of 1960 while I was at graduate school at Northwestern University, now studying geography. The next eight years were spent in graduate school or teaching, but finally in the spring of 1968 I earned a PhD in geography from the University of Kansas.

However, my interest in radio never really left me and about 1966 I acquired another S-38 and then in 1968 an S-76. After getting the PhD in May of '68, I decided I had earned a little free time, and studied theory and code that summer (I was surprised how easily the code came back, especially considering I never felt I had been that good at it). In September of 1968 I again had a license, WA9ZRP (Can't seem to get away from the Zs). Initial operation was limited to c.w. and ten meter phone, by a Knight T-150 and an SX-110. About a year later that was up graded to an HT-46 and an SX-117 and it was in June of 1970 that I came across WA8SOF and K8KKX on 40 meters, both following WA9GAM mobile. I soon became hooked on County Hunting and that has been the majority of my operating since then. I

USA-CA HONOR ROLL

3000		1500		500	
W5LXG	223	K6TKV	387	W9FBC	1291
WA6CPP	224	W5LXG	388	W5LXG	1292
2500		WD6CQP	389	VE3BMR	1293
W5LXG	282	WA7UZU	390	WD6CQP	1294
K9GTQ	283	1000		WA7UZU	1295
2000		W6TKV	501	WB0AUZ	1296
WB0MIX	331	W5LXG	502	WD0EPE	1297
CT1RM	332	WD6CQP	503	WD4HDJ	1298
K6SLP	333	WA7UZU	504	PT7WA	1299
W5LXG	334	SM0AJU	505		
WA7UZU	335	WB0AUZ	506		
AC2J	336				

Luciano Sampaio de Suza, PT7WA
(ex-PY7VNY)



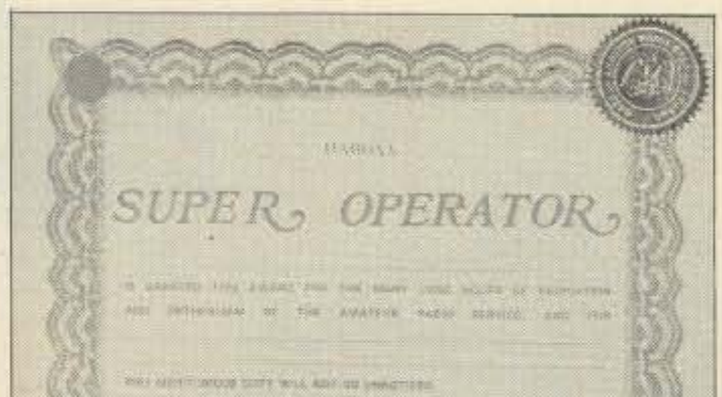
HAROAA Official Traffic Handler Award

did take time out in 1976 to work 200 stations in all 50 states during the Bi-Centennial contest, and that was with the FT-101-B.

"I have been here in the Bloomington-Normal area since 1968 where I am an assistant professor of geography at Illinois State University. My major teaching responsibilities include Conservation, Weather, The Geography of Latin America and the Geography of the Soviet Union. In addition to amateur radio, I am a gardner, figuring I supply about two thirds of the family's vegetables each year. And after an unscheduled three year stint as a bachelor, I have found cooking to be a pleasant hobby. Both my wife, Liz, and my oldest son, Johnny, have novice licenses, but try as I might, I can't get them active. Liz, I can under-stand, as a fourth grade teacher, she just collapses in the evenings, and there was such a time lag between the time the twelve year old passed his test and the arrival of the license, his interests had drifted elsewhere. Completing the family are Sharon, ten and Drew, four.

"Needless to say, I have enjoyed County Hunting and am most appreciative of all the mobiles who helped me achieve All Counties. I plan to try for a second time, but I might try to get DXCC, especially with conditions improving.

Of all the county contacts I have had, the one I remember the most was my last county in Kansas. It was July 4, 1974 and many County Hunters were heading towards the convention in Kansas City. I had gotten on the air (20 meters) early and about 8:30 AM worked W0NKE, he was heading toward Kansas City and would be in my last county in about a half hour. Shortly after talking to Terry, the band went dead, a complete blackout. Shortly after 9:00 AM I heard a few weak signals, and then W0NKE on the county line of Osage and Coffey, we exchanged signal reports and the band went dead again for another fifteen minutes. Yes, County Hunting has been much fun, Thanks to all."



HAROAA Super Operator Award

Awards Issued.

John Swaim (note Swaim), W5LXG waited until he had them *all* before sending for USA-CA-500 endorsed all SSB, all 14, all mobiles, all c.w. USA-CA-1000 through 2500 endorsed all SSB, all 14, all mobiles, and USA-CA-3000 and all counties endorsed Mixed.

Manuel Greco, K2LFG picked up all counties, Mixed.

Barry Kutner, W2UP/WB2LYB also picked up all counties, Mixed.

HAROAA Super Certificate Hunter Award

Paul Schuett, WA6CPP (WA7PEI & KQ6ITU) acquired USA-CA-3000 endorsed all SSB and raised his endorsement of his USA-CA-2000 to include all mobiles.

Tom Ross, K9GTQ, obtained USA-CA-2500 endorsed all SSB, all mobiles.

Jim Roberts, WB0MIX claimed USA-CA-2500.

Adilio La-Salette, CT1RM was issued USA-CA-2000 endorsed all SSB.

Larry Moore, K6SLP added to his collection, USA-CA-2000 endorsed all A-3.

Val Hanney, WA7UZU applied for USA-CA-500 through USA-CA-2000.

Larry Taylor, AC2J (ex-WB2PMO) qualified for USA-CA-2000 endorsed all SSB.

Fred Roberts, W6TKV (ex-K2AMN) collected USA-CA-1000 and 1500 endorsed all SSB.

Don Krusen, WD6CQP gained USA-CA-500, 1000 and 1500 endorsed all SSB., all 14 MHz, all mobiles.

Leif Lundin, SM0AJU won USA-CA-1000

LeRoy Duncan, WB0AUZ had me send him USA-CA-500 and 1000 endorsed all SSB, all 14, alll mobiles.

Douglas Freytag, WD4HDJ made USA-CA-500 endorsed all SSB.

USA-CA-500 Certificates endorsed Mixed were sent to:

Maurice Mead, W9FBC.
Dave Raycroft, VE3BMR.
Steve Scott, WD0EPE.
Luciano Sampaio de Souza, PT7WA (ex-PY7VNY). This was #4 Award to Brazil and #1 to PT/PY7.

Awards.

HAROAA Awards: As promised, here is data on some more of their Awards. They are available to all licensed amateurs and amateur stations. Each application should be accompanied by two (U.S.) Dollars, $2.00. Payment may be made by cash, check, IRCs, or U.S.A. stamps. DX applications please use IRCs. Please do not send QSL cards. A list showing full details of the contacts (log information) should be certified by one other amateur or radio club officer. Photocopies of QSL cards or original log will also be permitted. At your request, special endorsements will be added, such as: c.w., SSB, all YL, QRP, RTTY, SSTV, One Band, etc.. If you so desire, you may request separate awards, for each endorsement. Contacts may be made over any period of years. Contacts made through repeaters cannot be used. Satellites permitted. All correspondence or applications should be sent to: HAROAA, P.O. Box 341, Hinckley, Ohio 44233, U.S.A.

Super Certificate Hunter Award: HAROAA Award designed for the serious certificate hunter. To earn this award you must have a minimum of ten amateur radio operating awards. Simply list the awards that have been issued to you. Special endorsements are 10, 25, 50, 75, 100, 100 plus.

Special-Non Operating HAROAA Awards:

A1. **Official Traffic Handler Award:** Indicates you are ready and willing at all times to send or receive routing, priority or emergency radio messages, without compensation, in the interest of Public Service and Amateur Radio Communications.

A2. **HAROAA Super Operator Award:** Issued for any service rendered via, or in the interest of amateur radio; such as weather observer, public service, emergency, helping a new ham, providing communica-

tions for a community function, etc. Briefly describe event or service.

I.N.O.R.C. Award: The Italian Navy "Oldo Rhythmers" Club Award is an attractive diploma in seven colors. It bears the four coats of arms of the Italian Medieval Seafaring Republics (Genoa Venice, Pisa and Amalfi) and in addition to some impressive decorations and badges, it shows the Italian Armoured Cruiser "Carlo Alberto" (1896), the first Warship rigged with a Radio Station with her primordial multiwire antenna employed by Marconi for his early tests at sea. The Award is available to amateurs, SWLs and Club Stations for QSOs or "heard" basis with INORC member stations. Italian stations need 10, Europeans need 7 all others need 4 OSOs. All modes and bands are valid, also mixed bands, modes are valid. One INORC station cannot be contacted more than once per day. Send log extracts with full data of QSOs and 3 USA Dollars or 30 IRCs to get the Award via air mail.

INORC Stations to contact are:

I1: BQE, BWI, DKF, DNX, EZA, JFT, JNL, MQ, PIM, YEH, YRL, ZB, ZEU.
I2: BLZ, BVS, CSJ, DMK, GHD, HTO, VTW, VZD, XJO.
I3: BLF, NEN, RBY, SIB, TRK, VXO, WFU.
I4: AND, RZJ.
I5: EGE, GKO, PIW, TBH.
I6: LWK, PQO, VDB.
I7: PHH, ZCZ.
I8: AOH, BSC, CXU, IC8CQF, SCV, WWV.
I9: AGA, AQ, DHR, DYP, FQF, GXE, JSK, KMU, LAW, NMW, PBR, PLM, RHK, VPP, XGE, XNM.
IS0: IGV, XBL.
I0: FFO, JGC, JGL, HBX, OAL, PAB, SNA, ZMI, ZRM.
VK2BAN.

Send applications and fee to: Nicholas Mastroviti, via Capitaneria 22, Augusta 96011, ITALY.

Notes.

Frankly, this is being written in early December, which makes me wish I had about 10 or 20 secretaries and many many stamps so that I could mail each and everyone of you a special Holiday Greeting.

Yes, I do issue the USA-CA Awards including those for all counties. MARAC at Route 1, Box 230M, DeSoto, Kansas 66018 issue a fine monthly Newsletter and MARAC C/O WA0YJL issue many fine Awards and one for the second time around for All counties. Dave, W6CCM will issue one for the third time around. Write and tell me—How was your month? 73, ED., W2GT.

a monthly feature by

GEORGE JACOBS, W3ASK

Propagation

The science of predicting radio conditions

The present sunspot cycle, Cycle 21, continues to increase at a rapid pace. Solar activity has already surpassed the peak of the previous cycle and there are indications that the present cycle may produce the highest level of sunspot activity since observations of the phenomena began more than 200 years ago.

The Swiss Federal Observatory at Zurich reports a monthly mean sunspot number of 97 for November, 1978. Daily levels varied from a low of 53 on November 23rd to a high of 129 on the 4th. This results in a 12-month running smoothed sunspot number, on which the solar cycle is based, of 81 centered on May, 1978. This amounts to an increase of 6 in the count since the previous month. The Swiss Observatory is forecasting a smoothed sunspot number of 136 for March, 1979. The peak of the previous sunspot cycle reached a level of only 111 during November, 1968.

Sunspot records have been kept regularly since 1750. In this more than 200 year period, the highest level of solar activity ever recorded took place during Cycle 19, which reached a peak of 201 in March, 1958. Soviet geophysicists announced late last year that they expect solar activity during the present cycle will exceed all levels registered previously, and that the peak may occur as early as mid-1979. Other scientists queried in this country and abroad agree that Cycle 21 will be an exceptionally high cycle, but are not yet prepared to forecast the magnitude of time of its peak.

Cycle 21 has already reached a sufficiently high level to assure exception DX propagation conditions on the shortwave bands for at least the next several years.

The National Bureau of Standards announced that effective December 1, 1978, WWV resumed its previous transmission on 20 MHz. This transmission has been reinstated because of improved propagation conditions on the 20 MHz frequency resulting from the rapid rise in solar activity. The 20 MHz frequency will continue to be used for WWV transmissions as long as propagation conditions warrant.

*11307 Clara St., Silver Spring, MD 20902

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for March 1979

	Expected Signal Quality			
Propagation Index	(4)	(3)	(2)	(1)
Above Normal: 1-2, 20, 27-28	A	A	B	C
High Normal: 17-18, 21-22, 25-26, 29	A	B	C	C-D
Low Normal: 3, 7-8, 11-12, 16, 19, 23-24, 30	B	C	D	D-E
Below Normal: 4, 6, 9-10, 13, 15, 31	C	D	D-E	E
Disturbed: 5, 14	C-E	D-E	E	E

Where expected signal quality is:

A—Excellent opening, exceptionally strong, steady signals greater than S9 + 30 dB.

B—Good opening, moderately strong signals varying between S9 and S9 + 30 dB, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.
2. With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for and day of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be excellent (A) on March 1-2, fair (C) on March 3rd, poor (D) on the 4th, and fair to not possible (D-E) on the 5th, etc. Subscribe to bi-weekly MAIL-A-PROP, P.O. Box 1714, Silver Spring, MD 20902.

March Conditions

It shoud be a toss-up between *10* and *15* meters for the best DX band during the daytime hours, with *20* meters not far behind. Exceptionally good DX is expected on all *three* bands from shortly after sunrise, and until sunset. From sundown to Midnight, DX honors will likely be shared between *20* and *40* meters, with openings towards the west and the south also possible on *15* meters. Some fairly good *80* meter DX conditions are also expected during this period. From Midnight to sunrise, best DX bands should be *40* and *80* meters, with quite a bit of DX also possible on *20* and *160* meters. All-in-all March should be a great month for worldwide DX conditions on all shortwave bands. For more detailed information, refer to the *DX Propagation Charts* which appeared in past month's column. This month's column contains *Short-Skip Propagation Charts* which are valid through March and April, as well as Propagation Charts centered on Alaska and Hawaii. The Short-Skip Charts contain band opening predictions for predominantly one-hop paths, ranging in distance between approximately 50 and 2300 miles.

For day-to-day changes in shortwave propagation conditions expected during March, see the *Last Minute Forecast,* which appears at the beginning of this column.

During March and continuing into April, relatively similar shortwave propagation conditions exist in the temperate regions of both the northern hemisphere (where it is spring) and in the southern hemisphere (where it is fall), as compared to the more extreme conditions that exist when it is summer in one hemisphere and winter in the other. This geographically widespread equalization in ionospheric conditions results from the equinox effect, as the sun crosses the equator on its apparent travels into northern skies. Similar conditions occur during September and early October, as the sun travels into southern skies. The equinox effect results in DX conditions *between* both continents being at their best. Exceptionally good inter-continental DX conditions are, therefore, expected this month on all amateur bands from *6* through *160* meters, at appropriate times. Typical of these openings are the paths between the United States and South America, Australasia and the central and southern regions of Africa and Asia, and Antarctica.

The best times to look for intercontinental openings are shortly *before* local sunrise and again shortly *after* local sunset on *40, 80* and *160* meters; for an hour or two *after* sunrise and again from an hour or two

before to an hour or so *after* local sunset sunset on *20* meters, and during the daylight hours on *10, 15* and *6* meters. During daytime openings, signals should peak from the east and the south before noon, from the south during the early afternoon, and from the south and the west later in the afternoon.

V.h.f. Ionospheric Openings

The combination of rapidly increasing solar activity and the equinoctial effect shoud produce exceptionally good F-2 layer DX conditions on the *6* meter band. Openings should be possible from the USA to almost all areas of the world during the month, particularly when conditions are HIGH NORMAL or better. Signals from the northeast to the southeast should peak by mid-morning. Noontime should be best for openings towards the Caribbean, Central America and the northern countries of South America. During the afternoon hours expect *6* meter skip to extend deeper into South America and to shift towards the west and northwest. Exceptionally strong signals will occur at times. Trans-continental openings on *6* meters can be expected from approximately noon through the late afternoon hours.

Trans-equatorial scatter propagtion (TE) usually improves considerably during the equinoctial period, and some *6* and possibly even *2* meter openings may be possible by way of this propagation mode during the month. TE openings must cross the magnetic equator at or near a right angle, and the best time for such openings is between 8 and 11 p.m., local time. Conditions favor openings between the southern tier states and the southern countries of South America, but some openings may be possible from northern states as well.

Auroral activity tends to peak during the equinoctial period, and there is a good chance for numerous v.h.f. ionospheric short-skip openings by means of auroral-scatter propagation. Check the *Last Minute Forecast* at the beginning of this column for those days that are expected to be BELOW NORMAL or DISTURBED, since these are the days on which v.h.f auroral openings are most likely to occur during March.

Short-skip openings due to sporadic-E propagation usually pick up a bit during March. An occasional *6* meter opening should be possible via this mode, over distances between approximately 1000 and 1300 miles. Sporadic-E type short-skip openings can occur during the hours of darkness as well as during daylight, but during daylight they may be masked by the more powerful F-2 layer openings.

Not much meteor activity expected during the month, although some v.h.f. meteor-scatter type openings may be possible for brief periods during minor meteor showers which are expected to peak on March 15-16 and March 25-26.

Propagation Handbook

The Shortwave Propagation Handbook by George Jacobs, W3ASK and Theodore J. Cohen, N4XX is now available. This book explains all facets of shortwave propagation in simple language, and it is full of do-it-yourself data for predicting propagation openings to all areas of the world on all shortwave bands, as well as day-to-day conditions. The book is a first of its kind for the radio amateur, shortwave listener, and all others who make use of the shortwave radio spectrum. It is published by Cowan Publishing Corp., the publishers of *CQ* Magazine. Copies can be obtained from your local bookshop for $7.50, or directly from the publisher for the same price, postpaid. A limited number of personalized signed copies are available directly from the authors for $7.50, postpaid. Orders from outside the USA should be remitted in US funds, including an additional dollar for postage. Personalized copies can be obtained from:

MAIL-A PROP
P.O. Box 1714
Silver Spring, MD 20902

Anniversary

This month's column marks the beginning of my 28th year as Propagation Editor for *CQ*. Special recognition is due the Editors and Publishers of *CQ* for recognizing the importance of propagation forecasts for radio amateurs, and for taking the lead in publishing this information on a regular basis, almost from the first issue of the magazine. There are a great number of interesting propagation events coming up in the years ahead on the shortwave bands and I expect to continue to report them here on the pages of CQ!

73, George, W3ASK

HOW TO USE THE SHORT-SKIP CHARTS

1. In the Short-Skip chart, the predicted times of openings can be found under the appropriate distance column of a particular Meter band (10 through 160 Meters) as shown in the left hand column of the Chart. For the Alaska and Hawaii Charts the predicted times of openings are found under the appropriate Meter band column (10 through 80 Meters) for a particular geographical region of the continental USA as shown in the left hand column of the Charts. An * indicates the best time to listen for 80 meter openings.

2. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. On the Short-Skip Chart, where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. The index indicates the number of *days* during the month on which the opening is expected to take place, as follows:

(4) Opening should occurr on more than 22 days
(3) " " " between 14 and 22 days
(2) " " " between 7 and 13 days
(1) " " " on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual *dates* on which an opening with a specific *propagation index* is likely to occur, and the signal quality that can be expected.

3. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M. etc. On the Short-Skip Chart appropriate *standard time* is used at the *path midpoint.* For example on a circuit between Maine and Florida, the time shown would be EST, on a circuit between N.Y. and Texas, the time at the midpoint would be CST, etc. Times shown in the Hawaii Chart are in HST. To convert to standard time in other USA time zones *add* 2 hours in the PST zone; 3 hours in the MST zone; 4 hours in the CST zone, and 5 hours in the EST zone. *Add* 10 hours to convert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 14 or 2 P.M. in Los Angeles; 17 or 5 P.M. in Washington, D.C.; and 22 GMT. Time shown in the Alaska Chart is given in GMT. To convert to *standard* time in other areas of the USA *subtract* 8 hours in the PST zone; 7 hours in the MST zone, 6 hours in the CST zone and 5 hours in the EST zone. For example, at 20 GMT it is 15 or 3 P.M. in N.Y.C.

4. The Short-Skip Chart is based upon a transmitted power of 75 watts c.w. or 300 watts p.e.p. on sideband; the Alaska and Hawaii Charts are based upon a transmitter power of 250 watts c.w. or 1 kw p.e.p. on sideband. A dipole antenna a quarter-wavelength above ground is assumed for 160 and 80 meters, a half-wave length above ground on 40 and 20 meters, and a wave-length above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level for each 10dB loss, it will lower by one level.

5. Propagation data contained in the Charts has been prepared from basic data published by the Institute for Telecommunication Science of the U.S. Dept o Commerce, Boulder, Colorado, 80302.

CQ Short-Skip Propagation Chart
March & April 1979
Band Openings Given in Local Standard Time
At Path Mid-Point
(24-Hour Time System)

Band Meters	*Distance From Transmitter (Miles)*			
	50-250 Miles	250-750 Miles	750-1300 Miles	1300-2300 Miles
10	*Nil*	09-13 (0-1)	07-09 (1) 09-12 (1-2) 12-13 (1-3) 13-16 (0-3) 16-18 (0-2) 18-20 (0-1)	07-08 (1) 08-09 (1-2) 09-12 (2-4) 12-16 (3-4) 16-18 (2-3) 18-20 (1-2) 20-21 (0-1)
15	*Nil*	07-09 (0-1) 09-15 (0-2) 15-19 (0-1)	07-08 (1) 08-09 (1-2) 09-15 (2-4) 15-18 (1-3) 18-19 (1-2) 19-23 (0-1)	07-08 (1) 08-09 (1-3) 09-15 (4) 15-18 (3-4) 18-19 (2-3) 19-21 (1-3) 21-23 (1-2) 23-01 (0-1)
20	11-13 (0-1) 13-16 (0-2) 16-19 (0-1)	08-09 (0-3) 09-11 (0-4) 11-13 (1-4) 13-16 (2-4) 16-18 (1-4) 18-19 (1-3) 19-22 (0-2) 22-08 (0-1)	06-07 (1-2) 07-08 (3) 08-09 (3-4) 09-18 (4) 18-19 (3-4) 19-22 (2-4) 22-00 (1-3) 00-02 (1-2) 02-06 (1)	06-07 (2) 07-08 (3) 08-10 (4) 10-15 (4-3) 15-22 (4) 22-23 (3-4) 23-00 (3) 00-02 (2) 02-04 (1-2) 04-06 (1)
40	06-07 (1-2) 07-09 (2-3) 09-18 (4) 18-20 (3-4) 20-22 (2-3) 22-00 (1-2) 00-06 (1)	06-07 (2-3) 07-09 (3-4) 09-11 (4-3) 11-13 (4-2) 13-15 (4-3) 15-20 (4) 20-22 (3-4) 22-00 (2-4) 00-03 (1-3) 03-06 (1-2)	06-07 (3-2) 07-08 (4-2) 08-09 (4-1) 09-13 (2-1) 13-15 (3-1) 15-17 (4-2) 17-19 (4-3) 19-00 (4) 00-03 (3-4) 03-06 (2-3)	06-08 (2-1) 08-15 (1-0) 15-16 (2-0) 16-17 (2-1) 17-19 (3-2) 19-03 (4) 03-04 (3-4) 04-06 (3)

80	07-11 (4) 11-18 (4-3) 18-22 (4) 22-00 (3-4) 00-07 (2-3)	07-08 (4-2) 08-11 (4-1) 11-16 (3-0) 16-18 (3-2) 18-20 (4-3) 20-00 (4) 00-05 (3-4) 05-07 (3)	07-08 (2-1) 08-11 (1-0) 11-16 (0) 16-18 (2-1) 18-20 (3-2) 20-03 (4) 03-05 (4-3) 05-07 (3-2)	07-08 (1-0) 08-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-2) 22-03 (4-3) 03-05 (3-2) 05-07 (2-1)
160	05-07 (4-2) 07-09 (3-1) 09-17 (2-0) 17-19 (3-1) 19-20 (4-2) 20-05 (4)	05-06 (2-1) 06-07 (2-0) 07-09 (1-0) 09-17 (0) 17-19 (1-0) 19-20 (2) 20-22 (4-3) 22-03(4) 03-05 (4-3)	05-06 (1) 06-19 (0) 19-20 (2-1) 20-22 (3-2) 22-03 (4-3) 03-05 (3-2)	05-06 (1-0) 06-19 (0) 19-20 (1-0) 20-22 (2) 22-03 (3-2) 03-05 (2-1)

HAWAII
March & April, 1979
Openings Given in Hawaiian Standard Time –

TO:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	08-09 (1) 09-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	06-07 (1) 07-08 (2) 08-11 (1) 11-13 (2) 13-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	12-14 (1) 14-16 (2) 16-18 (3) 18-21 (4) 21-00 (3) 00-04 (2) 04-06 (3) 06-07 (2) 07-08 (1)	18-20 (1) 20-22 (2) 22-01 (3) 01-02 (2) 02-03 (1) 21-22 (1)* 22-01 (2)* 01-02 (1)*
Central USA	08-09 (1) 09-11 (2) 11-15 (3) 15-17 (4) 17-19 (2) 19-20 (1)	06-07 (1) 07-08 (2) 08-09 (3) 09-14 (2) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	09-14 (1) 14-16 (2) 16-19 (3) 19-23 (4) 23-03 (3) 03-06 (2) 06-08 (3) 08-09 (2)	19-20 (1) 20-22 (2) 22-02 (3) 02-04 (4) 04-05 (2) 05-06 (1) 22-23 (1)* 23-02 (2)* 02-03 (3)* 03-04 (2)* 04-05 (1)*
Western USA	08-09 (1) 09-11 (2) 11-12 (3) 12-16 (4) 16-17 (3) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-11 (4) 11-15 (3) 15-18 (4) 18-20 (3) 20-21 (2) 21-23 (1)	15-17 (3) 17-21 (4) 21-00 (3) 00-02 (2) 02-04 (1) 04-06 (2) 06-08 (4) 08-10 (3) 10-15 (2)	18-19 (1) 19-21 (2) 21-22 (3) 22-04 (4) 04-05 (3) 05-06 (1) 21-22 (1)* 22-23 (2)* 23-04 (3)* 04-05 (2)* 05-06 (1)*

ALASKA
March & April, 1979
Openings Given In GMT –

TO:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	20-22 (1) 22-00 (2) 00-01 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-01 (2) 01-02 (1)	13-15 (1) 20-22 (1) 22-01 (2) 01-03 (3) 03-05 (2) 05-06 (1)	06-13 (1) 07-12 (1)*
Central USA	20-23 (1) 23-01 (2) 01-02 (1)	18-20 (1) 20-23 (2) 23-01 (3) 01-02 (2) 02-03 (1)	14-16 (1) 20-23 (1) 23-02 (2) 02-04 (3) 04-05 (2) 05-07 (1)	07-14 (1) 08-12 (1)*
Western USA	20-23 (1) 23-00 (2) 00-02 (3) 02-03 (2) 03-04 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-02 (4) 02-04 (3) 04-05 (2) 05-06 (1)	16-18 (1) 18-20 (3) 20-00 (2) 00-02 (3) 02-04 (4) 04-05 (3) 05-06 (2) 06-10 (1)	7-09 (1) 09-12 (2) 12-14 (1) 09-10 (1)* 10-12 (2)* 12-13 (1)*

See explanation in "How To Use Short-Skip Charts" in box at the beginning of this column.

* Indicates best time for 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a propagation index of (2), or higher.

Note: The Alaska and Hawaii Propagation Charts are intended for distances *greater* than 1300 miles. For shorter distances, use the preceding Short-Skip Propagation Chart.

a monthly feature by

FRANK ANZALONE, W1WY

Contest Calendar

News/views of on-the-air competition

The WPX Contest coming up at the end of this month, (SSB) and in May, (C.W.) should be a boon for you fellows with unusual calls and exotic prefixes. Now is the time to put them to good use as you will be in big demand for a new multiplier. Using them in the World Wide Contest in October and November where the country identity was the important factor, gave you no advantage. As a matter of fact it was a disadvantage as you were constantly being asked, QTH?

Looking back on the happenings of the past year I can't help but reflect on the sudden departure of Bob and Ellen White from the ARRL. Although we did not see "eye to eye" on many things regarding DX and Contests, our relationship was always very amiable. Probably no one has contributed more to these two phases of amateur radio than Bob and Ellen. May their new life in Florida be a happy and productive one.

I just can't seem to come up with any other ideas for this month's Column. Since this is being written just before the Christmas and New Year Holidays I hope you will forgive me for not being more productive.

Just a final reminder, don't forget to submit your entry for the *CQ* 160 Contest. Time will be running out about the time you will be reading this.

73 for now; Frank, W1WY

ARRL DX CONTEST

Phone: March 3-4 C.W.: March 17-18
Starts: 0001 GMT Saturday
Ends: 2359 GMT Sunday

This is the 45th year for what we used to refer too as the ARRL Marathon. That name however is no longer applicable since the contest has now been reduced to single weekends for each mode. A very sensible decision that will meet the approval of the majority of contesters, and their exYLs, I am sure.

I have been advised that there are no changes in the rules and briefly are as follows:

Single operator stations can compete in any one of the three categories. All Band, High Band (10, 15 & 20) and Low Band. (40, 80 & 160) Multi-operator stations, single and multi transmitter, All Band only.

Exchange: RS (T) plus state or province for W/K and VE/VO. RS(T) plus 3 figures indicating power input for DX stations. (KH6 & KL7 are considered DX)

Scoring: Three points for each completed QSO on each band. Ws and VEs multiply total by the number of DX countries worked on each band for their score. DX stations will use the 48 continental states and VO, VE1 -VE8 for their multiplier. A possible 57 per band.

Awards: Certificates to the top scoring single operator station in each category, in each DX country, and each U.S. and VE ARRL section. Awards to multi-operator stations, both single and multi transmitter, will be made in each W/VE call area and DX country. In addition DX stations making 1000 or more QSOs will also receive certificates. Plaques to continental leaders. There is a Club award too.

It is recommended that you write ARRL for log forms and check sheets and more detailed information. A large s.a.s.e. will get you fast delivery.

Your entries go to: ARRL Communications Dept., 225 Main Street, Newington, CT 06111

*14 Sherwood Road, Stamford, CT 06905

Calendar of Events

Mar.	3-4	ARRL DX Phone Contest
* Mar.	3-4	YL-OM C.W. Contest
* Mar.	10-11	QCWA Phone QSO Party
Mar.	10-11	Virginia QSO Party
+ Mar.	10-11	Commonwealth Contest
Mar.	10-11	International SSTV Contest
Mar.	17-18	ARRL DX C.W. Contest
Mar.	**24-25**	**CQ WW WPX SSB Contest**
Mar.	24-26	B.A.R.T.G. RTTY Contest
Mr/Ap	31-1	North Dakota QSO Party
Mr/Ap	31-1	Tennessee QSO Party
Apr.	7-8	Polish "SP" CW Contest
Apr.	7-8	ARCI QRP QSO Party
Apr.	11-12	DX-YL to W/VE YL C.W.
Apr.	18-19	DX-YL to W/VE YL Phone
Apr.	21-22	Polish "SP" SSB Contest
Apr.	21-22	Common Market DX Contest
Apr.	28-29	Dutch "PACC" Contest
Apr.	28-29	Swiss "H-26" Contest
Apr.	28-30	ZERO District QSO Party
May	**26-27**	**CQ WW WPX C.W. Contest**

* Covered last month
\+ Not official

Virginia QSO Party

Starts: 1800: GMT Saturday, March 10
Ends: 0200 GMT Monday, March 12

The Sterling Park A.R.C. is sponsoring this one. The Central Virginia Contest Club plans to put a number of rare Virginia counties on the air for the party.

Exchange: QSO no., RS(T) and QTH, county for Virginia stations, state, province or country for all others.

Scoring: One point per QSO. Virginia stations multiply total QSOs by sum of states, provinces, countries and Virginia counties worked. Out of state stations will use Virginia counties for their multiplier. (max. of 98)

Frequencies: CW - 60 kcs from low end of each band and novice bands. Phone - 3930, 7230, 14285, 21375, 28575, (Check phone bands on even hours)

Awards: Certificates to high scorers in each state, province, DX country and each Virginia county. Also to the top scoring Novice in and out of state. A special certificate to the top out of state score.

The same station may be worked on each band and mode for QSO points. Virginia stations may work in state stations for QSO and multiplier credit. Summary and check sheets are requested with your entry. Indicate each multiplier as worked.

Logs must be received by April 15th and go to: Virginia QSO Party, P.O. Box 599, Sterling, VA 22170

Commonwealth Contest

Starts: 1200 GMT Saturday, March 10
Ends: 1200 GMT Sunday, March 11

This is the old BERU contest in which eligibility is limited to RSGB residents in the United Kingdom and amateurs licenced to operate within the British Commonwealth and British Mandate Territories. This makes it of special interest to our Canadian and Caribbean neighbors.

Activity will be on c.w. only, and it is requested that operation be confined to the lower 30 kHz. of each band. Contacts in own call area.

Exchange: Just a signal report.

Scoring: Each completed contact is worth 5 points. In addition, a bonus of 20 points may be claimed for the 1st, 2nd and 3rd contact with each Commonwealth call area. (All of the British Isles is considered as one area.)

Entries may be single or multi-band, with separate log sheets required for each band. Add total from each band for your final multi-band score. Multi-band entries are not eligible for single band awards, but you may request that a single band be judged for competition. (Only single operator permitted)

There is a *s.w.l.* category with scoring same as above. Report of station heard as well as call station being worked should be listed. Credit may be claimed for both entries heard. Include a check list of call areas heard on each band.

Awards: Certificates to the first three places, multi-band in the U.K. and overseas. And for each single band. There are Rose Bowl Trophies to the overall winner and runner-up, and to the leading U.K. station.

Logs go to: D. J. Andrews, G3MXJ, 18 Downview Crescent, Uckfield, East Sussex TN22 1UB, England. They must be received before May 15th to be eligible.

International SSTV Contest

Starts: 1500 GMT Sat. March 10
Ends: 2200 GMT Sun. March 11

This is the second time around for this one although this is the first time I have heard about it.

The same station may be worked once on each band for point credit. Keep in mind that FCC regulations require a verbal exchange of call signs for U.S. stations.

Exchange: Picture must show call signs, RST and contact number. (Do not give QSO number verbally).

Scoring: One point for each station worked. 1 point for each state or province worked. 5 points for each country, and 5 points for each continent.

Sum of all above points is your final score. (There is no multiplier)

Frequencies: 3845, 7171, 14230, 21340, 28600.

Awards: Top scoring station will be awarded a certificate and a years subscription to the magazine of his choice. And certificates to stations working the most countries, and the most continents.

Mailing deadline for your entry is April 10th to: R. Brooks Kendall, W1JKF, 10 Stocker Street, Saugus, Mass. 01906.

CQ WW WPX Contest

SSB: March 24-25 C.W.: May 26-27
Starts: 0000 GMT Saturday
Ends: 2400 GMT Sunday

Rules were published in the January issue and are the same as in previous years.

This year for the first time we have included a c.w. section, and as in last year there is a separate section for QRPp operation. The Club competition award will be continued.

Briefly the rules are as follows: Contacts between stations on different continents count 3 points on 14, 21 and 28 MHz, and 6 points on 7, 3.5 and 1.8 MHz.

On the same continent but not the same country, 1 point on 14, 21 and 28 MHz., and 2 points on 7, 3.5 and 1.8 MHz.

Exception: Contacts between North American countries are worth 2 points on the high bands and 4 points on the low bands.

Contacts are permitted between stations in the same country for the purpose of obtaining a Prefix multiplier, but have no QSO point value.

The multiplier is determined by the number of different prefixes worked.

Each prefix may be counted *once only*, not once per band.

The exchange is simple, the RS(T) report plus a progressive contact number starting with 001.

Only 30 hours out of the 48 hour contest period may be used for scoring. The 18 hours of non-operating time may be taken in up to 5 periods. That's for single operator stations, who must also show 12 hours of operating time to be eligible for an award. There is no time limit for multi-operator stations who must show a minimum of 24 hours of operating time.

Beside the usual certificates for the different categories there are 20 Trophies for the Top Scorers.

Mailing deadline is May 10th for the SSB section and July 10th for the c.w. They go to: CQ WPX Contest Committee, 14 Vanderventer Ave., Port Washington, N.Y. 11050 Please indicate SSB or C.W. on the envelope.

BARTG Spring RTTY Contest

Starts: 0200 GMT Saturday, March 24
Ends: 0200 GMT Monday, March 26

Sponsored by the British Amateur Radio Teleprinter Group this contest is open to all amateurs and s.w.l. There are three categories, Single opr., multi-operator and s.w.l.

All bands may be used, 3.5 thru 28 MHz, but not more than 30 hours out of the 48 hour period may be used for scoring. The 18 hours off may be taken any time but not in less than 3 hour periods. Indicate on/off times in your log and summarize your summary sheet.

Exchange: RST plus a three figure contact number and time in GMT. (full 4 figures)

Points: Contacts with station within ones own country 2 points. With stations in other countries 10 points. And a bonus on each band, including own. The same station may be worked on each band for QSO and multiplier credit.

Multiplier: Total sum of countries worked on each band, and number of continents worked (counted once only). Use the ARRL country list and each W/K, VE/VO and VK call areas.

Final Score: (a) Total QSO points x country multiplier. (b) Country multiplier x bonus points x continents worked. Add sum of (a) and (b) for your final score.

Awards: Certificates to the leading scorers in each category and also each continent. And in each W/K, VE/VO and VK call areas.

Final position will be valid for entry in the World RTTY Championship. There are also awards for working 25 DXCC countries and for working all 6 continents. (Get info from G8CDW)

Logs must be received by May 31st and go to: Ted Double, G8CDW, 89 Linden Gardens, Enfield, Middlesex, England EN1 4DX.

North Dakota QSO Party

Starts: 1800 GMT Sat. March 31
Ends: 2400 GMT Sun. April 1

This contest sponsored by the Fargo Repeater Association should create quite a bit of activity since North Dakota is one of the rarer states.

The same station may be worked once per band and each mode. North Dakota mobiles may be worked with each county change.

Exchange: QSO no., and QTH; country for North Dakota, state province or country for others.

Scoring: One point per QSO. N.D. stations multiply total number of QSOs by the sum of the number of different states, provinces and DX countries worked. All others will use North Dakota counties for their multiplier. (max. of 53)

Frequencies: 3560, 3895, 7060, 7230, 14060, 14285, 21060, 21355, 28060, 28600, 29005 AM.

1978 CAN-AM Contest Results

VE3BMV, Yuri Blanarovich

Trophy Winners - Single Operator

AMERICAN CHAMPION - MIXED:	K6LL/7,	David Hachadorian
CANADIAN CHAMPION - MIXED:	VE5DX,	Jim Bearman
AMERICAN TROPHY CW:	K5NW,	John Hawkins
AMERICAN TROPHY PHONE:	W5JW,	Jack Webb
CANADIAN CHAMPION CW:	VE7CC,	Lee Sawkins
CANADIAN TROPHY PHONE:	VE7BGK,	Sid Kemp
MULTI OPERATOR CHAMPION:	CG3IXE,	Walt Tillner
CLUB COMPETITION CHAMPION:	BC CONTEST CLUB	

Top Ten - Canada

Mixed		CW		Phone		Multi-Operator Mixed-Canada/U.S.	
1. VE5DX	1219884*	VE7CC	418964	VE5DX	816180	CG31XE	556584*
2. VE7CC	1134987*	VE5DX	403704	VE7CC	716023	VE3HBX	355794*
3. VE7BGK	704217*	VE7CMK	288673	VE7BGK	704217	VE2FU	291088*
4. VE7CNY	517310*	VE3KZ	238044	VE7CNY	517310	VE1AWN	171304*
5. CG4SW	435778*	VE4OY	176900	CG4SW	397458	W9YH	137904*
6. VE3KZ	397308	VE1AIH	147030	VE6MP	210177	N4UF	101822
7. VE7CMK	288673	VE1AJP	137475	CG3FFA	194584	N5TV	92844
8. VE6MP	262071	VE7AV	106272	VE4IE	179634	WB3GPR	60277
9. VE4OY	218151	VE3DRB	105216	VE3KZ	159264	WD5EEF	29475
10. CG3FFA	194584	VE7DLM	101813	VE6AGV	146787	VE3FEA	27090

Top Ten - U.S.

Mixed		C.W.		Phone		Club Competition Canada - U.S.
1. K6LL/7	727192*	K6LL/7	214240	K6LL/7	512952	1. BC Contest Club 2683539
2. W5JW	466150*	K5NW	173404	W5JW	311526	2. Toronto DX Club 1369143
3. AA6DX	375756*	WA0LKL	166995	K5UR	295104	3. 807 Contest Club 194184
4. K5NW	335440*	K1ZZ	164794	WB4SKI	269698	4. Farout ARC 62399
5. K5UR	295104*	W5JW	154624	AA6DX	266388	
6. WB4SKI	269698	WB4OSN	142737	K5NW	162036	
7. WA4HRG/7	186410	AA6DX	109368	WB6RDA	133245	
8. K8MO	173816	WA4HRG/7	109347	WB7RFA	99246	
9. WA0LKL	166995	K4BAI	105644	WB5TAP	90474	
10. K1ZZ	164794	WD8DPB	91542	K8MO	85176	

*certificate winners

Free one year subscription to CANADX bulletin LONG SKIP winners are:

WE5EEF, Rick Donelly; W9YH, ARC Urbana 111.; WD8DPB, Phil Alman; WB4OSN, Joe Picior W1ECH/1, Gary Fosket.

Multi Op - CW

CG31XE	ON	302400	607	175*
VE2FU	PQ	291088	633	161*
VE3HBX	ON	185148	470	139
W9YH	IL	137904	477	136*
N5TV	LA	71900	327	100*

Multi Op - Phone

CG3IXE	ON	254184	729	119*
VE1AWN	PE	171304	633	92*
VE3HBX	ON	170646	493	119
N4UF	FL	101822	494	98*
WB3GPR	PA	60277	256	109*
WD5EEF	TX	294475	176	75*
VE3FEA	ON	27090	156	63
N5TV	LA	20944	165	56*

Multi Op operators: VE1AWN + VE1LI; VE2FU + VE2BPT; VE3FEA + VE3EZU; VE3HBX + VE3HLC, VE3HLS; CG3IXE + VE3BMV; WB3GPR + WB3FWZ; N4UF + WB4YEY; N5TV + WB5VAN; WD5EEF + WD5GXO, WB5OFB; W9YH - K9GL, K9MK;

1978 Contest Results U.S.A. and Canada "PACC"

W1NG	1326	W4YN	70
K5UR	608	W1OPJ	42
W7ULC	264		
N6ZX	160	CK1AW	1792
W3ARK	132	VE3CDK	143

"SP" DX

SSB

All Band

W1RLV	4,950	N4OL	3,933
LU1BAR/W3	4,140	WB9NXT	3,900
WB2RLK/VE1	10602	W2KHT	3,588
		N6ZZ	3,168
14 MHz.		K8GL	2,967
W9OA	1,089	W6UA	2,580
W9SS	90	K5UR	1,440
VE7DTO	297	K2TV	1,275
		N3AX	840
21 MHz.		W9QWM	270
WB9TBU	6	CK1AW	17,325
		VE3DAP	693
C.W.			
All Band		14 MHz	
W1PL	33,066	WA2GJS	1,200
K1CC	17,238	VE7AV	1,653
WB8RSW	12,744		
W9OA	10,302	21 MHz	
K1WT	9,765	WA4OML	648
W3ARK	6,210	W9LKI	210
W1DMD	4,200		

Awards: Certificates to the top scorers in each state, province, DX country, and the top ten North Dakota entries and top five N.D. mobiles.

Mailing deadline is April 30th to: Fargo Repeater Association, WD0CCL, 2826 Evergreen Road, Fargo, ND 58102. Include a large s.a.s.e. for copy of results.

B.A.R.T.G. RTTY

W3FV	447,678	W2KHQ	28,800
W2NZ	403,374	WD8CQN	26,750
W1GKJ	365,904	W9BTQ	26,050
K8NN	323,520	W7IE	23,840
K0PJ/6	304,192	W7CBY	15,532
W4CQI	249,642	K2RYI	15,532
WB6CYA	201,280	WB6DEB	8,176
W0HAH	193,104	W8TCO	6,840
WA2OQO	187,180	WB2VTD	6,720
WA6WGL	177,408	W6IWO	5,000
K6WZ	162,792	WB9GOJ	1,350
WA0YDJ/4	156,840		
W6JOX	155,490	VE5RG	288,470
WA9AKT	151,872	VE2QO	221,336
W3KV	147,400	VE2JR	180,200
K4RN	142,688	VE7DTA	111,100
W9RY	87,138	CG6CL	70,072
WA2GCL	85,554	VE2ATS	27,850
WA2VAQ	72,234	VE6ALR	23,040
W5HEZ	64,750	VE2AIT	14,100
K0BJ	49,830	VE7DLX	7,840
WB2QFE	35,112	VE1AHG	3,120
WB2WZX	31,698		
WA8GVK	30,590	KZ5OD	8,400

W3FV, W2NZ and W1GKJ placed 1st, 4th and 7th respectively world wide.

Tennessee QSO Party

Two Periods (GMT)

2100 Sat. March 31 to 0500 Sun. April 1
1400 to 2200 Sunday, April 1

This one is again sponsored by the Tenn. Council of Amateur Radio Clubs.

The same station may be worked on each band and each mode, mobile and portables in each county change. (No county line operation however.) Tenn. stations may work in state stations for QSO and multiplier credit.

Exchange: Signal report and QTH. County for Tenn., state, province or country for others.

Scoring: One point per QSO. Tenn. stations multiply total by sum of (states + provinces + Tenn. counties) worked. Out of state stations total QSOs by Tenn. counties worked. (max. of 95)

There is a 200 point bonus for mobile and portables for each county change outside own county. (min. of 10 QSOs per county)

Frequencies: C.W. - 50 kc up from edge of each c.w. band. Phone - 3980, 7280, 14280, 21380, 28580. Novice - In their authorized bands.

Awards: Certificates to each station submitting a log with 15 or more contacts. Plaques to top Tenn. scores, home, portable and mobile stations. Also to out of state winner.

Use separate log sheet for each band with 25 or more contacts, and a check sheet if you have over 200 contacts. (Single operator only)

Mailing deadline for entries is May 1st to: Dave Goggio, W4OGG, 1419 Favell Drive, Memphis, Tenn. 38166. Include a large s.a.s.e. if elgible for a certificate.

modern electronics

A Constructor's Compendium

Of Weekend Projects

BY JEFFERY A. SANDLER*

Listen to your lawn

Although most lawns don't, in the normal course of events, provide an afternoon concert, yours can! Imagine being able to plug a set of headphones into your backyard lawn and being treated to your favorite *music*. It's just the thing for your next yard party. If nothing else, it should make an excellent conversation piece.

All you need is a high-level audio output from your tuner/amplifier. Although you may be able to drive your lawn directly from the tuner/amplifier output, you'd be safer using a buffer amplifier, such as the LM386 circuit shown. The stakes used to connect the amplifier to the lawn can be just about any metal rods you have handy. Copper lightening rods are ideal.

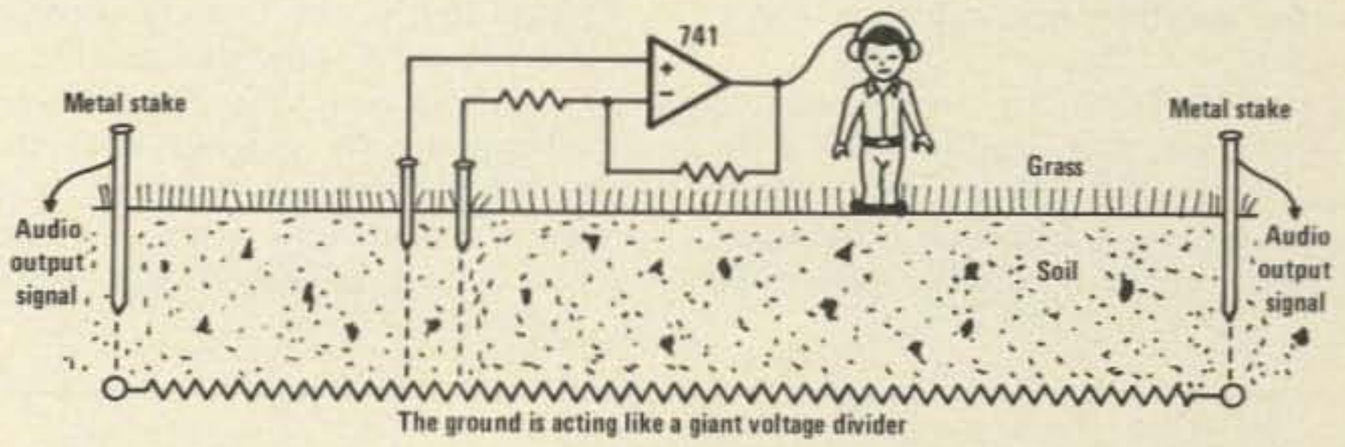
The audio signal impressed in the lawn will be located between the stakes, as shown. So, position the stakes at opposite ends of the lawn.

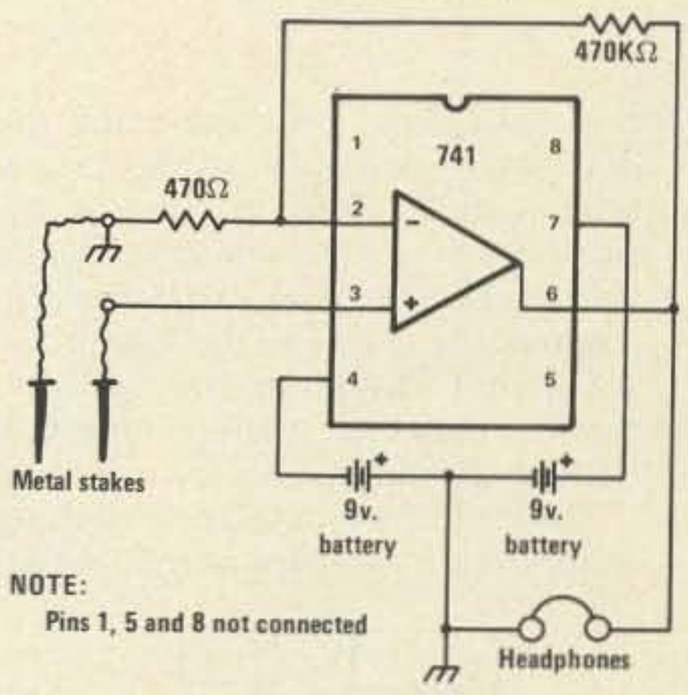
To tune in on the lawn, you'll need a set of monaural headphones, such as the Radio Shack 279-200, and a high-gain preamplifier such as our 741 circuit. All you have to do then is drive a pair of pickup stakes into the lawn. The volume depends a great deal on the location of the stakes.

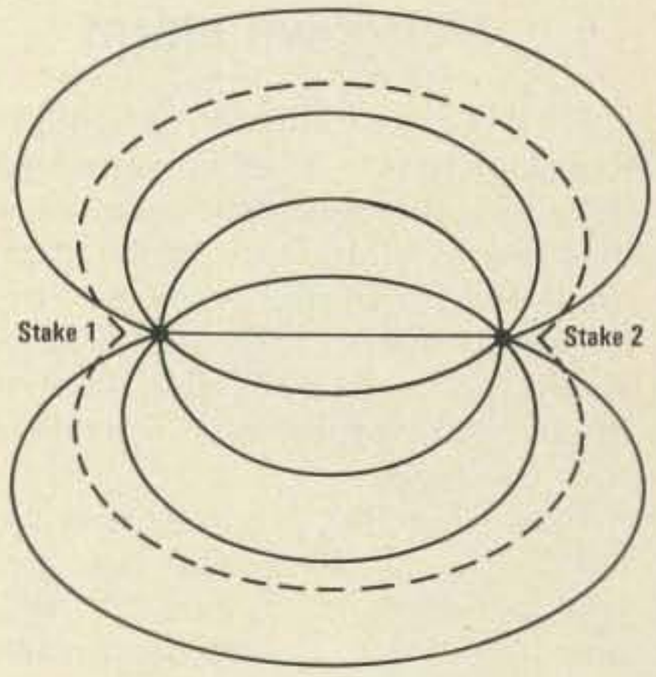
Generally, the farther apart they are, the louder the sound. However, since the soil conductivity varies from place to place, moving one stake just a few inches can make an appreciable difference.

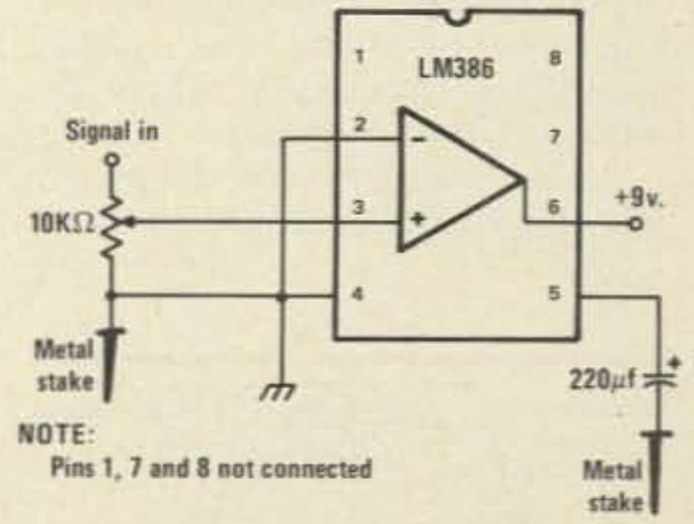
Overall performance depends on many factors including the gain of the headphone preamp, the distance between the stakes at the input and the output end, ground conductivity, background noise, and the alignment between the two sets of stakes.

Because of the many variables, this project is ideal for an experimenter interested in conducting a science project, perhaps as part of school work.









*10 Idell Rd., Valley Stream NY 11580

No-103-104

Look and listen

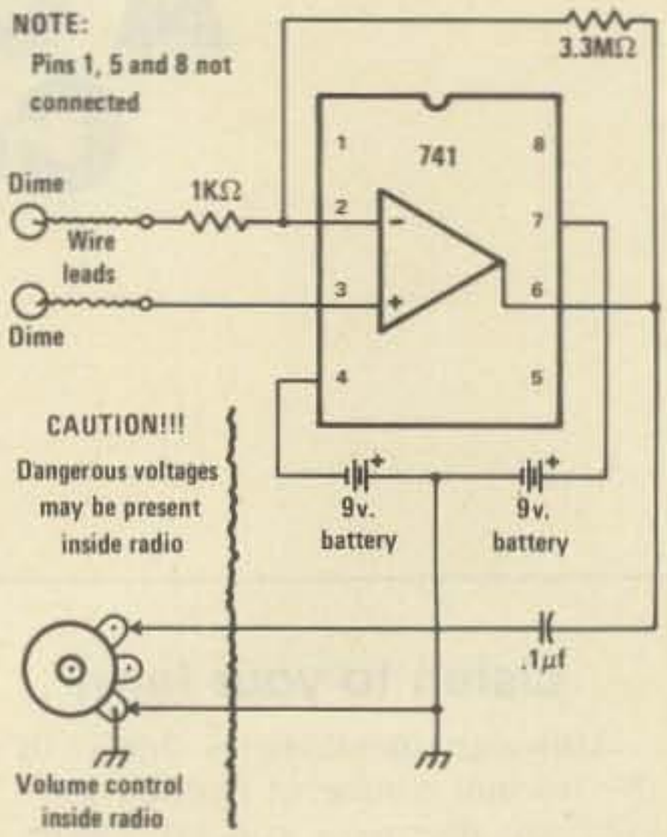
Ever wonder what a muscle sounds like when it moves? Or what kind of electrical signals stimulate your heart to beat? Well, here's a simple way to listen in on your own body's electrical communications.

The heart of the system is a 741 op-amp, connected to provide an amplifier gain of about 300,000. The body pickups are ordinary ten-cent pieces—dimes—to which flexible wire leads have been soldered. The output of the op-amp is connected through a 0.1 mfd capacitor to an audio amplifier to complete the system.

If you have an audio system handy, you can simply connect the output of the 741 to an auxiliary input on your amplifier. However, you can make a portable system by using a battery-powered transistor radio as your audio amplifier. Just connect the 741 output to the *hot* side of the radio's volume control. This is the contact opposite the one connected to chassis ground. Then find a spot on the tuning dial where no radio signal is present. Turn up the volume and you're in business.

When listening in on your body, placement of the electrodes is very important. Generally, the dimes should be placed about four inches apart across the muscle to be listened to. As the muscle contracts, you'll hear a static-like crackle.

You can hear your heart's electrical signals by placing your dime pickups about five inches apart, one on each side of the heart. The sound you'll hear is very much like that



heard in a stethoscope, but is electrical rather than acoustic.

Meltdown alarm

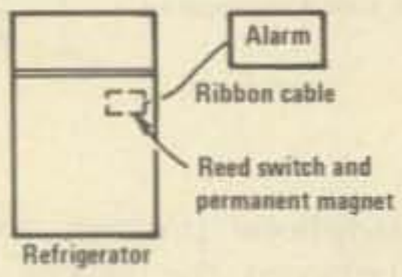
Each year, millions of dollars worth of frozen food is ruined by freezers losing refrigeration because of power failures or mechanical breakdown. In many cases, the freezer owner isn't aware his food is slowly going bad. By the time he discovers the problem, its too late to save the food.

Here's an inexpensive, easy-to-build *meltdown alarm* that can save you hundreds of dollars the first time it operates. The circuit consists of a reed-switch actuated audio oscillator and amplifier. Only the reed switch is located inside the freezer. The rest of the circuit can be placed in any remote location where the alarm will best be heard.

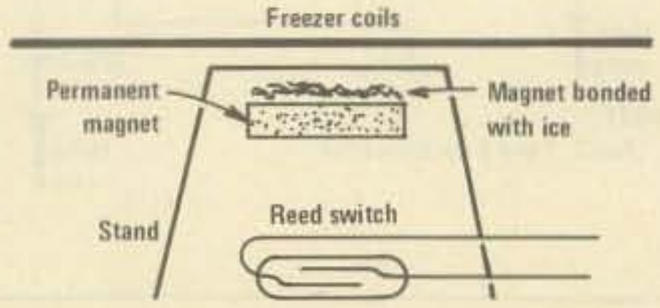
Connections between the switch and the a arm circuit are made by two thin wires. To maintain the door seal, a pair of 28-gauge magnet wires can be used to connect the reed switch to a terminal outside the freezer. Heavier wire can be used to connect the alarm to the terminal.

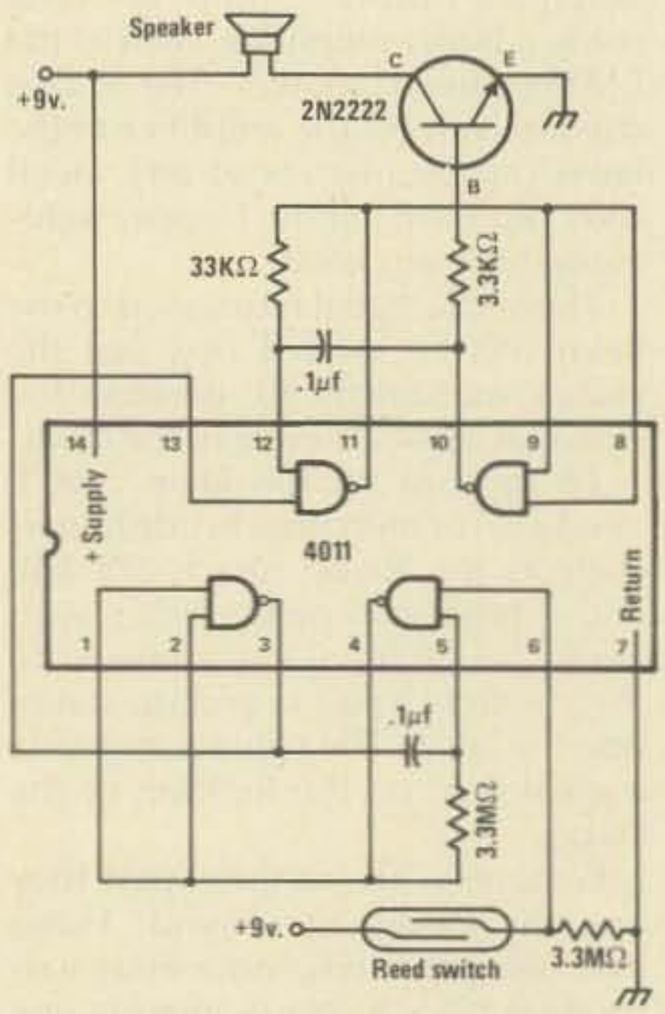
Current drain in the standby mode is very low. A single nine-volt battery should last a year or so.

The meltdown detector is nothing more than a permanent magnet at-



tached to a small stand by *ice*. The reed switch is positioned below the magnet. When the ice melts, the magnet will fall onto the reed switch, closing it and completing the alarm circuit. The stand should be constructed to guide the magnet onto the reed switch and hold it there—the alarm will only sound while the magnet is resting on the reed switch tube.

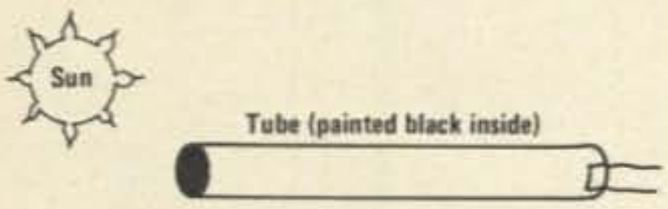




The temperature at which the ice "glue" holding the magnet melts can be set by mixing the right percentage of anti-freeze and water. Check the temperature chart on your anti-freeze container.

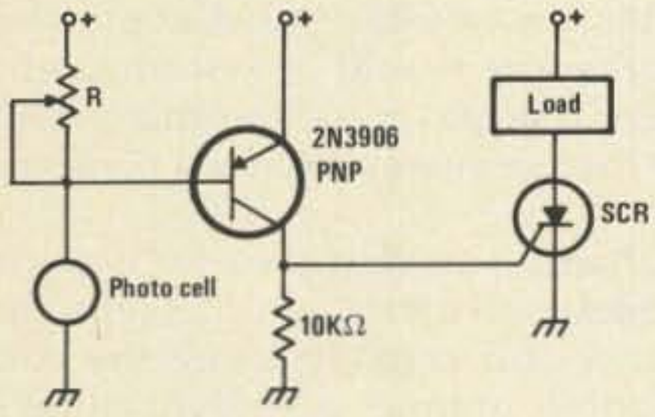
Sun-powered alarm

Here's a neat alarm clock based on the tried and true *sundial*. Although the alarm circuit is quite simple, placement of the detector may be a little tricky. It consists of a photocell mounted in a relatively long black tube. When the sun is in just the right position, its rays will shine down the tube, striking the cell at the bottom, actuating the circuit.



Because the sun's rays must strike the photocell, the tube must be aimed very carefully. The degree of accuracy depends on the length of the tube and its diameter. The greater the ratio of the tube's length to its diameter, the greater the accuracy required, and the more precise the timing of the alarm.

Although a longer tube takes more care in positioning, it greatly reduces the likelihood of the alarm being set-off accidentally. Even with a long tube, however, you may have to partially cover the solar cell with black tape so that the alarm isn't triggered by a bright sky.



The actual alarm circuit is straightforward. Parts layout and wiring are not critical. The circuit can be powered by any convenient six to 12 volt source. The SCR load can be an alarm buzzer, light, or even a relay to actuate other circuitry. The SCR should be chosen on the basis of the load voltage and current requirements. The potentiometer, R, should be selected so that the circuit will trigger at the desired light level with the control set at about the midpoint of its rotation.

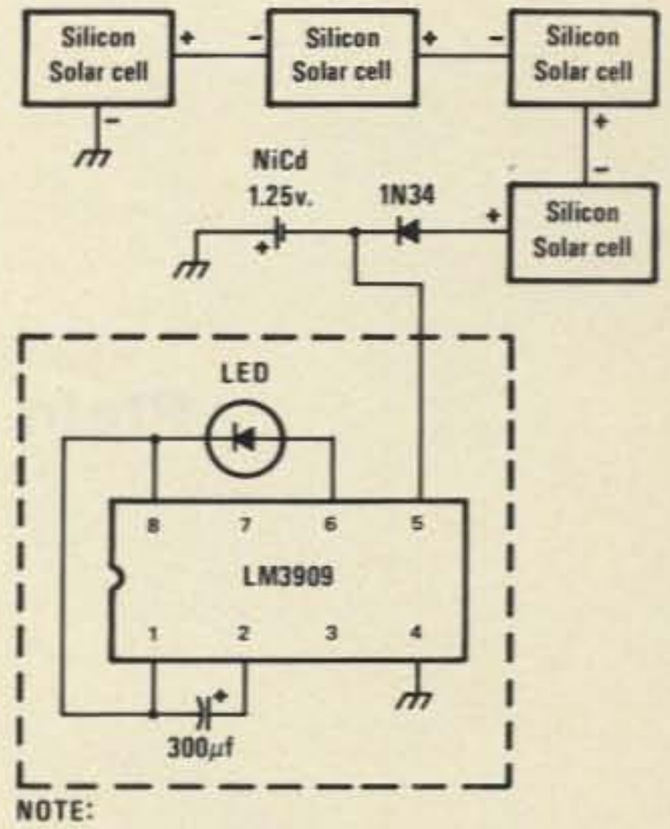
LED flasher

Here's an unusual LED flasher that uses sunlight to charge its battery—just like the system used in space satellites. The basic flasher uses the LM3909 integrated circuit. The 3909 contains all of the required circuitry except for the LED itself and a timing capacitor.

During the day, the sun hits the solar panel's cells, charging the NiCad battery. At night, the battery provides the power to flash as many as 15 LM3909 LED flashers.

If you'd prefer to run the show from an ordinary battery, a single AA penlight battery can power one LM3909 flasher for three months while a D battery will run it for well over one year. Adding more flasher units will shorten the battery life, but a single number six dry cell should power a dozen flashers for well over a year.

Since the circuit consists of just a single IC and capacitor, you can mount as many as you want on a small perfboard. Then, just string some fine-gauge wire to your LEDs, which can be arranged in any artistic manner you'd like.



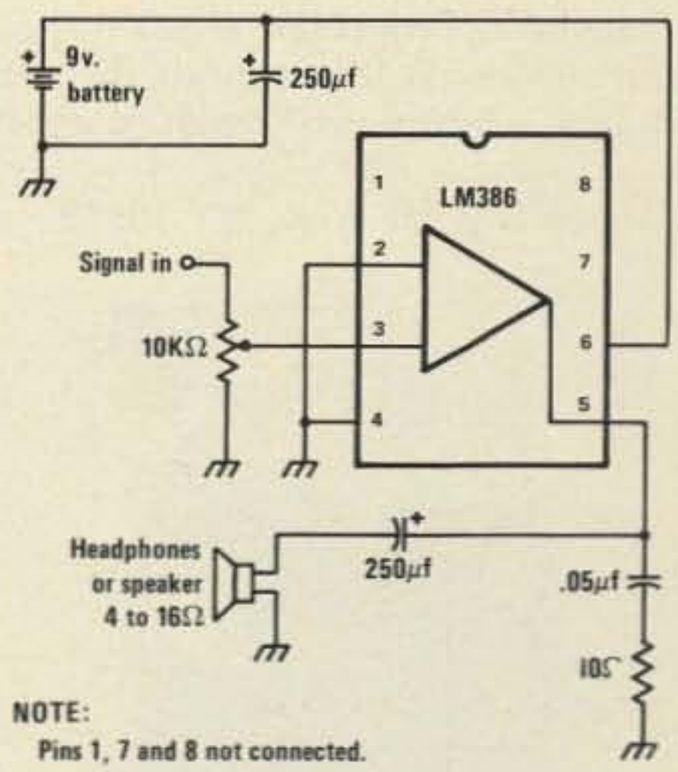
NOTE:
Duplicate "boxed in" circuit for each additional flashing LED desired. Boxed in part ('3909, LED, 300μf) costs approximately one dollar.

Headset amplifier

Have an fm tuner with beautiful sound, but not quite enough *umph* to drive a set of headphones. Well, here's an inexpensive amplifier that will give you that missing *umph*, and sound fidelity that will amaze you.

The circuit uses the common LM386 integrated circuit and a small handful of junkbox parts. The whole thing will easily fit on a one-by-one perfboard. Even at high listening levels, a standard nine-volt battery should provide several hours of enjoyment.

The amplifier can be mounted right on your headphones, if you don't mind the weight of the battery and have the space required. You may find it more desireable to put the amplifier and battery into a small box mounted in the headphone cable. Or, if you'd rather not make a permanent installation, output the amplifier through a connector into which you can plug your headset.



NOTE:
Pins 1, 7 and 8 not connected.

The diagram shown is monaural. If you have stereo, you'll need two amps, one for each channel.

Here's an easy-to-understand primer on how to teach the most popular language to your home computer (and yourself).

BASIC

Plain Talk For Your Home Computer

BY PETER A. STARK*

Basic is probably the most popular and widely used computer language for small computer hobbyists, and with good reason—it is powerful, yet simple. I'm sure you're ready to learn more about what Basic is and what it can do.

Originally invented at Dartmouth College in the early 60s, it was intended to bring the computer to the average Dartmouth student in a way that had never been tried before. The traditional approach was to place a large computer center in the corner of the campus and then force students to go to the center to run their computer programs.

Dartmouth tried the exact opposite. It placed computer terminals throughout the campus, even in dormitories, within easy reach of every student and then tempted students to use them, not only by having the terminals easy to get to but also by having a simple computer language to program the computer with. That was the beginning of Basic!

Unlike earlier languages such as Fortran or Cobol, which were intended for large programs, Basic was intended for the small uses. A Fortran and Cobol user had to prepare his programs on punched cards away from the computer. Only when he had the entire set of cards ready, would he go into the computer room and enter the cards into the computer. His problem would be run on the computer, his results printed or punched back into cards, and then he would be encouraged to leave to make room for the next user. In other words, these languages kept the user away from the computer as much as possible.

Basic, on the other hand, was designed for use with terminals, such as teletypewriters, which were connected to the computer and actually using the computer for extended periods of time. A student could sit down at a terminal and play a game against the computer for hours on end.

To make this entire idea practical in the days of million-dollar computers required the use of *time-sharing*, where dozens or perhaps even hundreds of terminals were connected to the computer at the same time. Since the computer is so fast, it easily could take care of many students using the computer at the same time, with each student having the impression he was the only user.

But now, in 1978, the entire approach has changed. For just a few hundred dollars, you can buy a small computer which can run Basic programs. Since it is no longer necessary to time-share, the computer system can be quite simple and cheap, and yet still be power-

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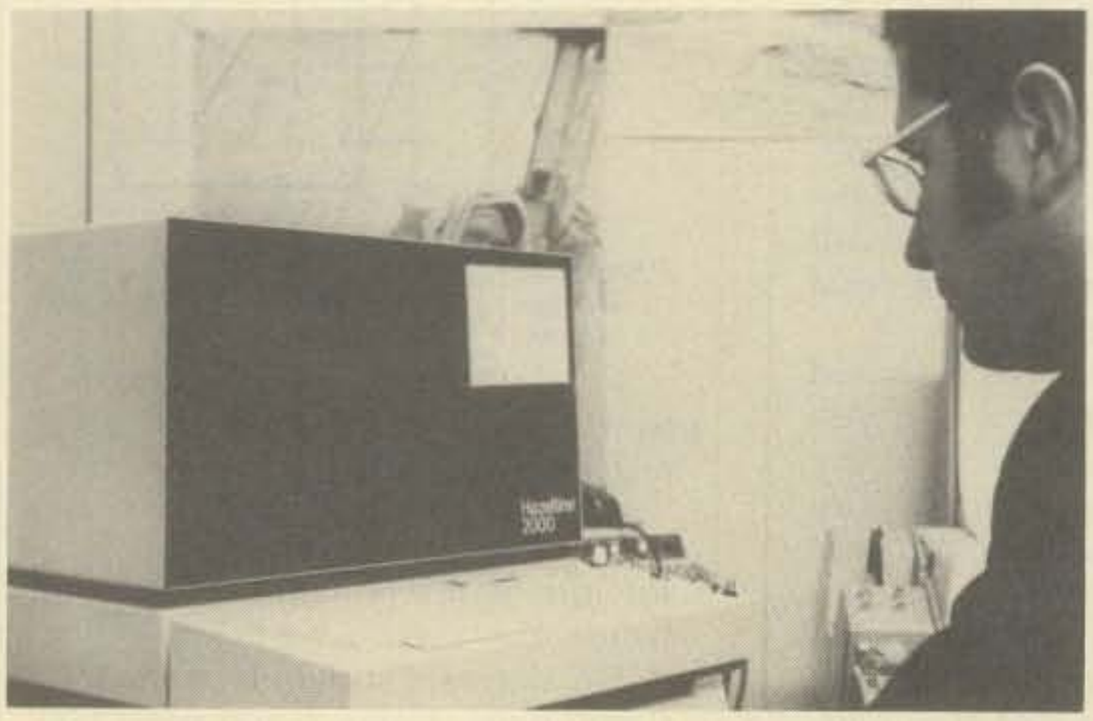


One popular computer terminal is the CRT or Cathode Ray Tube which displays a program and its results on a screen similar to a tv set.

ful enough to run sizable programs, although only one at a time.

To see just what Basic is and what we can do with it, let's sit down at a computer terminal and type in some commands, seeing what the computer does. These examples were run on a Southwest Technical Products MP-6800 home computer, but would be the same with any small home computer system.

The first thing we notice is the terminal has a keyboard similar to a typewriter, except some symbols are in new places and some keys have symbols not found on a typewriter.

For instance, above the comma is the symbol <, and above the period is the symbol >. Of special importance is a key labelled CR or RETURN, which means carriage return. This key means you are finished with a line and want to return the carriage, the part that prints on the paper, to the left, ready for the next line. Every line you enter into the computer must be followed by a CR to tell the computer you are done.

Let's sit down at the terminal and start with a CR. The computer responds with

```
READY
```

and returns to the beginning of the next line. Sometimes the computer will print a #, > or ? on the next line. This is the *prompting character* and its purpose is to tell you it's your turn to type something and the computer is waiting.

In our case we get the message

```
READY
#
```

which tells us the computer is ready, and waiting for a command. Let's enter a simple program telling the computer to print something:

```
10 PRINT 2+3
```

A one-line program like this is about as simple as you can get. Don't forget the carriage return or CR at the end. This simply tells the computer to add 2 and 3 and print the result.

Notice the number 10 in front. Every instruction of a Basic program must have a *line number* before it, and this is line number 10. The 10 does not necessarily mean that this is the tenth line of a program; it just means that we have decided to give this line the number 10. We could have just as well numbered it 1 or 500. The point behind line numbers is that every line of a program has a different line number, so at some later time we can go back and remove or change lines at will, referring to them by line numbers.

Once we have typed in a program such as this one, we can do two things with it—get a listing of it on the printer to check that we have typed it correctly, or run it. To get a listing, we type the word

```
LIST
```

and, as soon as we hit the CR, the computer responds with

```
0010 PRINT 2+3
READY
#
```

With minor changes, the computer simply types the program as we have entered it.

Notice that, up until now, we have not gotten the actual answer of 5, which the computer is supposed to print. We merely have entered the program and checked it. To actually perform it and get our answer, we type

```
RUN
```

and the computer prints

```
5
READY
#
```

Notice that there is a difference between *lines of a program*, which *always* get a line number, and *commands* to the computer telling it what to do with the program, which *never* get a line number. The commands we use most often are LIST and RUN, but each computer system has a number of other commands such as:

- NEW or CLEAR—Erase the program
- SAVE—Save the program on tape or other storage for later use
- LOAD—Load a program previously saved back into the computer

Let's erase the simple program we wrote and enter a new one:

```
NEW
READY
#10 LET I=3
#20 LET J=I+17
#30 PRINT I, J
#
```

With one exception, every program instruction starts with a short word such as LET or PRINT right after the line number. The one exception is that the word LET may be omitted. Notice that each line has a line number. We could have numbered the lines 1, 2, 3 but this is a bad habit to get into. Very often we find, after trying to run the program, we made a mistake and have to add a few lines. With lines numbered 10, 20, 30, and so on, it's easy to slip in extra lines such as line 15 or 18. Even though we may enter them at a later time, giving them a line number between 10 and 20 will automatically tell the computer that we want them placed in that order.

In the above program, lines 10 and 20 mean just what they say. Line 10 says to let a number I be equal to 3. We have to learn the difference between *constants*, which are constant and never change, and *variables* which can vary and change. In this line, the number 3 is a constant while I is a variable. We could, for example, insert another line into the program as follows:

```
22 LET I=5
```

I thus changes—it was equal to 3 at line 10, but becomes equal to 5 at line 22. We could now get a listing of the program as follows:

```
LIST
0010 LET I=3
0020 LET J=I+17
0022 LET I=5
0030 PRINT I, J
READY
#
```

Notice the computer automatically put line 22 in the right place, between 20 and 30.

Constants are plain numbers such as 3, 5, 17, or -12.597. There is a way of expressing very large or very small constants by using powers of 10, but that does

not concern us at this point. By their very nature, they obviously never change.

Variables, on the other hand, are represented by letters such as I or J. In fact, any of the letters A through Z can be used for variables. Since this only would allow 26 different variables, Basic also allows variables to be represented by a letter followed by a number from 0 through 9. This is very convenient for calculations on electrical circuits, since the values of resistors can be represented by the variables R1, R2, and so on.

Let's take the above program and run it.

```
RUN
5     20
READY
#
```

To understand what has happened, we have to examine the above program line by line. Line 10 told the computer to let the variable I equal 3. Line 20 says to add I (which is 3) to 17, and let J be the answer. Thus J becomes equal to 20. Then, line 22 says to let I equal 5. From this point on, I is 5, not 3, so that line 30 prints 5 for I and 20 for J.

As you can see, the computer performs these instructions in the order of their line numbers, not in the order we typed them in. This is another important use of line numbers—they specify the order in which the computer will perform its instructions.

The opposite of a PRINT statement is an INPUT. For an INPUT, the computer stops, prints a ? prompting character, and then waits for you to type in something. Let's write a short program to allow you to type in a number, have the computer multiply it by 3, and print out the answer. First erase the old program:

```
NEW
READY
#
```

Now enter a new program:

```
#10 INPUT N
#20 S = 3 * N
#30 PRINT S
```

Line 10 allows you to type in a number, which becomes the variable N. Line 20 multiplies it by 3; notice how a star * is used to mean *times*. Finally, line 30 prints out the product. If we now type:

```
#RUN
```

the computer prompts with

```
?
```

and we supply a number, such as

```
1.2
```

the computer comes back with

```
3.6
READY
#
```

This would not be much fun if we could only enter and print numbers, but Basic also allows us to use letters and words. For example, let's add the line:

```
#5 PRINT "TYPE IN A NUMBER AND I WILL MULTIPLY IT BY 3"
```

and change line 30 to read

```
#30 PRINT "THE ANSWER IS", S
```

If we list it, we get the printout

```
#LIST
0005 PRINT "TYPE IN A NUMBER AND I WILL MULTIPLY IT BY 3"
0010 INPUT N
0020 S = 3 * N
0030 PRINT "THE ANSWER IS", S
```

Now try running it:

```
#RUN
TYPE IN A NUMBER AND I WILL MULTIPLY IT BY 3
? 7
THE ANSWER IS 21
READY
#
```

As you can see, enclosing a message in quotes " and placing it in the PRINT statement makes the computer print it exactly as it stands.

Another type of variable is the *string variable*. It is signified by a letter A through Z, followed by the $ sign. Its function is to hold a string of letters or other characters from the keyboard, but allow them to be changed, like variables, throughout a program. To illustrate, let's try a new program:

```
#NEW
READY
#10 PRINT "WHAT IS YOUR NAME?"
#20 INPUT N$
#30 PRINT N$, "IS A NICE NAME"
```

Line 20 lets us input a string of letters, while line 30 prints them out again. Watch what happens when we run the program:

```
#RUN
WHAT IS YOUR NAME?
? PETE
PETE      IS A NICE NAME
READY
#
```

After inputing the name PETE, the computer printed it out again, followed by the words IS A NICE NAME. There is a large space after PETE which is put in by the computer because Basic normally prints its output spread out across the page to be in nice columns if numbers are being printed. In this case it makes the output look messy, but that is easy to get around if we use a semicolon ; in line 30 instead of a comma. This is one of the fine points in Basic, which are of little interest to the beginner but are very useful to the expert.

The tremendous power of the computer comes from the fact that programs, or portions of them, can be repeated over and over. Suppose we add one more line to the above program:

```
#40 GO TO 30
```

and run it again:

```
#RUN
WHAT IS YOUR NAME?
? PETE
PETE      IS A NICE NAME
PETE      IS A NICE NAME
PETE      IS A NICE NAME
PETE      IS A NICE NAME
PETE      IS A NICE NAME
PETE      IS A NICE NAME
PETE      IS A NICE NAME
PETE      IS A NICE NAME
PETE      IS A NICE NAME
```

Computer experts would now say the computer is *stuck in a loop*. It would keep on printing out the same line over and over if we didn't stop it by pushing a

button on the control panel. Our last line, line 40, is the culprit. It told the computer to go back to line 30 and repeat from there. Thus the computer does the printout in line 30, and the very next line sends it right back to do another printout, and so on. This is an *infinite loop*, since it never stops—unless we push a button to stop it, that is.

A better way of controlling a GO TO is with an IF instruction. For example, we can say IF X=3 GO TO 30, and the GO TO will only be done by the computer if the value of the variable X happens to be 3.

Let's change the above program so it will ask for a name, and will only print out "IS A NICE NAME" if the name happens to be PETE; otherwise, the computer will answer that the name is a poor one:

```
#10 PRINT "WHAT IS YOUR NAME?"
#20 INPUT N$
#30 IF N$ = "PETE" GO TO 60
#40 PRINT N$, "IS A POOR NAME"
#50 GO TO 10
#60 PRINT N$, "IS A NICE NAME"
#70 GO TO 10
```

As before, the computer asks WHAT IS YOUR NAME. If you answer PETE, then line 30 tells the computer to go to line 60, so that it will print the name again, followed by the words IS A NICE NAME. For any other name, the computer will *not* go to line 60, but will instead continue to line 40 and print IS A POOR NAME. Either way, a GO TO 10 returns to the top, so the computer asks for another name. Let's run it to see what happens:

```
#RUN
WHAT IS YOUR NAME?
? SAM
SAM         IS A POOR NAME
WHAT IS YOUR NAME?
? GEORGE
GEORGE      IS A POOR NAME
WHAT IS YOUR NAME?
? PETE
PETE        IS A NICE NAME
WHAT IS YOUR NAME?
?
```

As before, the computer is stuck in a loop since it keeps returning to step 10. This is usually not quite what we want. A good loop is one which has an end to it. In some way, we like to tell the computer when to get out of the loop. One common way is to count the repetitions of the loop, and stop at some predetermined number of them. For example, the following program prints out the numbers from 1 to 12 and their squares:

```
#NEW
READY
#10 LET N = 1
#20 LET S = N * N
#30 PRINT N, S
#40 LET N = N + 1
#50 IF N < 13 GO TO 20
```

Line 10 starts the number N at 1; line 20 squares it by multiplying it by itself; line 30 then prints the number N and its square S. Now, line 40 says something a bit different from what a mathematician would expect from N = N + 1 (which is not really a good equation after all.) What it means is that the computer should take the value of N, add 1 to it, and then place the result back as a new N. In other words, line 40 adds 1 to N. Since N started at 1, it is now 2. But since this is in a loop, in a little while N will go to 3, and then 4, and so on, all the way up to 12.

The symbol < in line 50 means *less than*, so this line says "if N is less than 13, go back to line 20." But eventually N will go from 12 to 13, and when that happens, line 50 no longer sends the computer back to line 20. So we have here a loop which is repeated exactly 12 times.

A computer terminal's keyboard has several added keys you won't find on an ordinary typewriter. Otherwise it's similar. An important key always used is the CR or Carriage Return key, shown at right.

The IF statement is very useful, since it allows checking whether two things are equal or not. In addition to the less than or < symbol, we also use > which means *greater than*. The combination <> means *less than or greater than*, which is the same as saying *not equal*, so IF X <> 5 GO TO 300 means that if X is not equal to 5 the computer should go to line 300. Moreover, instead of ending the IF with a GO TO, we can also end with the word THEN followed by any other valid Basic instruction. Our program to judge whether a name is nice or not could have been written with these two IFs:

```
#40 IF N$ = "PETE" THEN PRINT N$, "IS A NICE
NAME"
#50 IF N$ <> "PETE" THEN PRINT N$, "IS A POOR
NAME"
```

Two other combinations are <= which means *less than or equal*, and >= which means *greater than or equal*.

The idea of using a variable to count the repetitions of a loop is so common and useful that Basic has a special pair of instructions just for that purpose—the FOR and NEXT pair. These always go together, the FOR at the start of the loop and the NEXT at the end. To see how they work, let's rewrite the program to square the numbers from 1 to 12:

```
#NEW
READY
```

```
#10 FOR N = 1 TO 12
#20 LET S = N * N
#30 PRINT N, S
#40 NEXT N
```

Line 10 tells the computer that N is the counter, and it is supposed to vary from 1 to 12. Initially, N starts at 1, and the computer continues down through the following steps until it gets to NEXT N. Now it adds 1 to N, and goes back to the first statement inside the loop, which is line 20. It will repeat the loop, adding 1 to N each time, until N reaches 12. When N tries to go to 13, the loop ends.

There is a variation on the FOR which lets N change in different ways; this is done by adding one more word to the line:

```
#10 FOR N = 1 TO 12 STEP 1
```

This specifies that N is supposed to go from 1 to 12 in steps of 1. If we said

```
#10 FOR N = 1 TO 12 STEP 3
```

then N would go up in steps of 3. Or if we said

```
#10 FOR N = 12 TO 1 STEP -1
```

it would go from 12 back to 1 in steps of -1. That is, N would go 12, 11, 10, 9, 8, and so on, all the way to 1. Just to see what happens, let's try running the program:

```
RUN
12   144
11   121
10   100
9    81
8    64
7    49
6    36
5    25
4    16
3    9
2    4
1    1
READY
#
```

Basic has several more possible instruction types. Some, like REM (remark) and STOP, are useful to the beginner and we will see them later in some of the demonstration programs. Others are for more advanced users and we will skip them here.

In addition to the various instruction types, Basic also has *functions* which perform specific math calculations or some other operations. For example, a mathematician or engineer might use the SIN or COS functions when working with angles. The functions likely to be used by the beginner, out of the dozen or more most computers have, are these:

■INT ( ) converts whatever is placed inside the parentheses into the next lower integer (whole number). For example, saying

```
#10 LET J = INT(3.14)
```

would make J equal to 3.

■RND (0) makes the computer invent a random number between 0 and 1. This is usually used in games for coming up with random moves or random numbers. For instance,

```
#10 LET J = RND(0)
```

would result in J becoming equal to some unknown value between 0 and 1.

Sometimes we combine the RND and INT functions to generate other random numbers. For instance, suppose we are writing a game where the computer is supposed to pick a card from a deck of cards and print out what it is. Since there are 13 cards in a suit, we need a random number which is a whole number between 1 and 13.

If we use RND to make a number from 0 to 1, and then multiply it by 13, the result will be a number from 0 to 13. Add 1 to this, and you have a random number between 1 and 14, but always just a bit smaller than 14. Convert it to an integer with INT, and you have a whole number ranging from 1 to 13 (and never equal to 14.) The result of putting all this into one line is

```
#100 LET C=INT( RND(0) * 13+1)
```

One more function useful to beginners is the TAB( ); which makes the terminal's printer or display move over to the right to the position indicated by whatever is inside the parenthesis. For example

```
#50 PRINT TAB(15); I
```

would print the value of I fifteen places from the left end of a line on the printer. Note that the TAB is used in a PRINT statement, and that it is usually followed by a semicolon.

Finally we are ready to put all this together into several simple programs. How about a program to pick five cards at random and print out what they are? We will program it as a loop which is repeated five times, use the RND function to pick a random number, and use IF statements to print out words like JACK or KING:

```
#NEW
READY
#10 FOR I=1 TO 5
#20 LET C=INT(RND(0)*13+1)
#30 IF C<11 THEN PRINT C
#40 IF C=11 THEN PRINT "JACK"
#50 IF C=12 THEN PRINT "QUEEN"
#60 IF C=13 THEN PRINT "KING"
#70 NEXT I
#RUN
1
7
QUEEN
7
2
READY
#
```

Now let's add a few more steps to add the suit. We will use RND again to pick a number between 1 and 4, and use it to print out the suit. Add the following steps:

```
#25 LET S=INT(RND(0)*4+1)
#62 IF S=1 THEN PRINT TAB(6); "OF HEARTS"
#63 IF S=2 THEN PRINT TAB(6); "OF DIAMONDS."
#64 IF S=3 THEN PRINT TAB(6); "OF CLUBS"
#65 IF S=4 THEN PRINT TAB(6); "OF SPADES"
```

To see what the program now is, we list it:

```
#LIST
0010 FOR I=1 TO 5
0020 LET C=INT(RND(0)*13+1)
0025 LET S=INT(RND(0)*4+1)
0030 IF C<11 THEN PRINT C
0040 IF C=11 THEN PRINT "JACK"
0050 IF C=12 THEN PRINT "QUEEN"
0060 IF C=13 THEN PRINT "KING"
0062 IF S=1 THEN PRINT TAB(6); "OF HEARTS"
0063 IF S=2 THEN PRINT TAB(6); "OF
DIAMONDS"
0064 IF S=3 THEN PRINT TAB(6); "OF CLUBS"
0065 IF S=4 THEN PRINT TAB(6); "OF SPADES"
READY
#RUN
KING
        OF HEARTS
5
        OF DIAMONDS
JACK
        OF CLUBS
6
        OF DIAMONDS
JACK
        OF CLUBS
READY
#
```

We could neaten the output so each card is printed on one line, but that's more complicated. Let's do another example. How about a program to input the names of two people and print them out in alphabetical order?

```
#NEW
READY
#10 PRINT "ENTER TWO NAMES"
#20 INPUT A$, B$
#30 IF A$<B$ THEN PRINT A$, B$
#40 IF B$<A$ THEN PRINT B$, A$
#RUN
ENTER TWO NAMES
? SMITH,JONES
JONES           SMITH
READY
#
```

Notice how we are comparing two strings of letters as if they were two numbers; whichever is less is printed first. Although this example only sorts two names, we could do it for more names with a more complicated program.

Suppose a math student needs to plot an equation for his homework. The equation is $y=x^2-10x+26$, and he is supposed to find y for x going from 0 to 10. This program would do it:

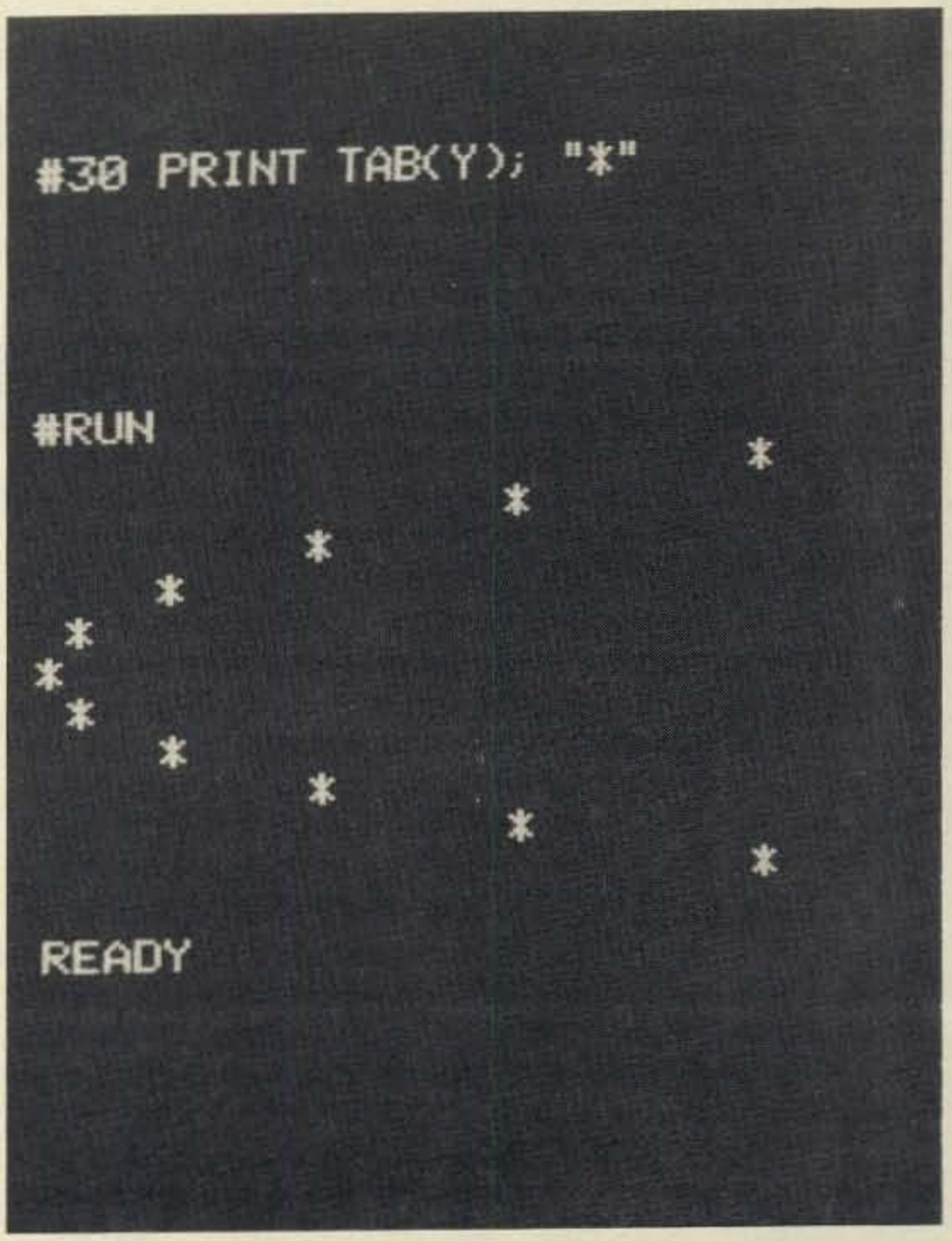
```
#NEW
READY
#5 REM THIS IS A REMARK
#7 REM LET X GO FROM 0 TO 10
#10 FOR X=0 TO 10
#20 LET Y=X*X -10*X+26
#25 REM PRINT BOTH X AND Y
#30 PRINT X, Y
#35 REM END OF LOOP
#40 NEXT X
#50 REM WHEN LOOP IS DONE, STOP
#60 STOP
#RUN
0               26
1               17
2               10
3               5
4               2
5               1
6               2
7               5
8               10
9               17
10              26
READY
#
```

Better yet, why not have the computer draw a picture? Change line 30 to

```
#30 PRINT TAB(Y); "*"
```

and run:

```
#RUN
```



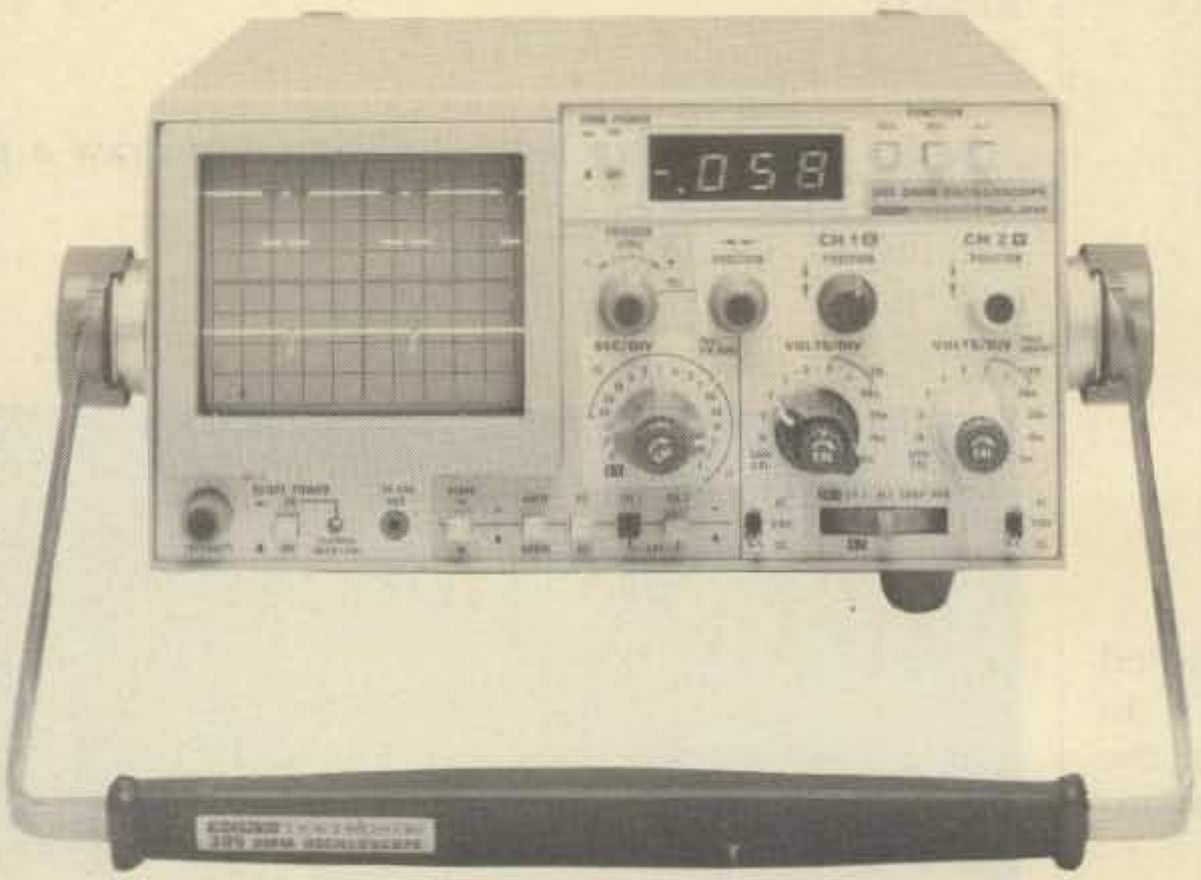
The computer draws a picture, as instructed in a program, to solve a math equation.

```
READY
#
```

The graph may be sideways and a little coarse, but it certainly gives the picture.

With this introduction to Basic, you're on the way to writing your own programs.

Showcase



Tektronix' Model 305 Oscilloscope/Digital Multimeter

Tektronix' 305 is the first combination oscilloscope/d.m.m. to offer 5 MHz performance, dual-trace displays, built-in rechargeable battery power and full function digital voltmeter capability is a single package weighing only 10 pounds. In addition, it is small, measuring only 4.4. x 9.3 x 14.2 inches.

The 305, priced at $1725, has a vertical bandwidth of 5 MHz, 5 mV sensitivity and six modes of operation. The horizontal circuits offer a sweep speed range of from 1 μs/div to 50 ms/div, an X10 magnifier and a choice of three trigger sources.

The d.m.m. section has a d.c. volt range of from 0 to 100 (accuracy ±.1%), an a.c. volt range of from 0 to 700 volts, r.m.s. (accuracy ±0.5%) and an ohmic range from 0 to 2 megohms (±.6% accuracy).

For further information contact Tektronix, Inc. at P.O. Box 500, Beaverton OR 97077, or circle number 71 on the reader service card.

NDI's 800 Channel Two-Meter Transceiver

NDI, Inc. has announced its new HC-1400, a high performance 2-meter f.m. mobile transceiver of advanced design. This microprocessor controlled, digitally synthesized unit has 800 channel capability within the amateur 144-148 MHz band, offers 5 or 10 kHz channel spacing.

A fast acting single knob selector shifts LED digital frequency readout in 10 kHz steps; it also has a 100 kHz "speed up" button.

Transmit offsets are preprogrammed, are switchable to plus or minus 600 kHz. Simplex operation is also available.

This set can be programmed to hold three TX-RX pairs in memory and has the capability of instant recall.

The f.m. transmitter delivers 25 watts output using a 13.8 v.d.c. source. Power is reducable to 5 watts.

The unit lists for $389.95 and can be obtained from NDE, Inc., 22125-1/2 South Vermont, Torrence, CA 90502, or circle number 60 on the reader service card for more information.

Ambico, Inc.'s Custom Carrying Case For The TRS-80 Computer

A matched set of custom-built cases to carry, protect and store the Radio Shack TRS-80 TM computer is now available from Ambico, Inc.

Each carrying case is made of durable vinyl and has a handsome black textured finish and a luggage-style handle. The cases are dustproof and have bottom skids for added protection.

The larger case "A" holds the computer's 12-inch video monitor, while case "B" is designed to accommodate the computer keyboard, cassette machine, power supply, cables, cassettes and accessories.

Suggested retail prices are $35 for case "A" alone and $25 for case "B" alone.

For further information, contact Ambico, Inc., 101 Horton Avenue, Lynbrook NY 11563, or circle number 62 on the reader service card.

National Semiconductor's Personal Computer Components Brochure

National Semiconductor Corp. has a 24-page brochure available on its broad range of components to serve computer enthusiasts.

The glossy-paged booklet is a guide to more than 100 components including microprocessors, memories, CRT controllers, LED displays, floppy disk interfaces, serial and parallel interfaces, sound synthesizers, analog interfaces and printer interfaces.

To receive your free copy, write to National Semiconductor Corp. at 2900 Semiconductor Drive, Santa Clara CA 95051, or circle number 68 on the reader service card.

Communications Product Corp's Model HF1030 V.L.F./H.F. Receiver

A new v.l.f./h.f. receiver, designed by Dr. Ulrich L. Rohde, is being introduced by Communications Product Corp. Model HF1030 is a fully synthesized tuneable solid-state comminications receiver which has provisions for all modes of reception and covers the frequency range of 10 kHz to 30 MHz in 10 Hz steps.

Other features include single-knob frequency control capabilities and preset capabilities with the thumbwheel switch and remote control and remote programmability. This allows the HF1030 to interphase into computer oriented systems. The two selectable tuning speeds give the optoelectrical shaft encoder the feel and smoothness of an analog v.f.o. in the quasi-continuous tuning with absolute backlash-free performance while retaining the accuracy and stability of the internal of external frequency standard. It does not require a separate MHz control and its fast switching synthesizer permits frequency jumps of 30 MHz in less than 10 ms.

The HF1030 is a very sophisticated piece of equipment. For further details, write to Rohde & Schwarz Sales Co., Inc., 14 Gloria Lane, Fairfield NJ 07006, or circle number 64 on the reader service card.

Radio Shack's TRS-80 Microcomputer Catalog (#RSC-2)

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.

A general section in the catalog explains what a computer is, what it can do, "Who can use the TRS-80," and "Why the TRS-80?"

The catalog then goes on to describe the TRS-80 System, Level-I and Level-II BASIC language, and the peripheral equipment available for use with the TRS-80 including its expansion interface, Mini-Disk system, printers, interfaces, manuals and new TRS-80 System Desk.

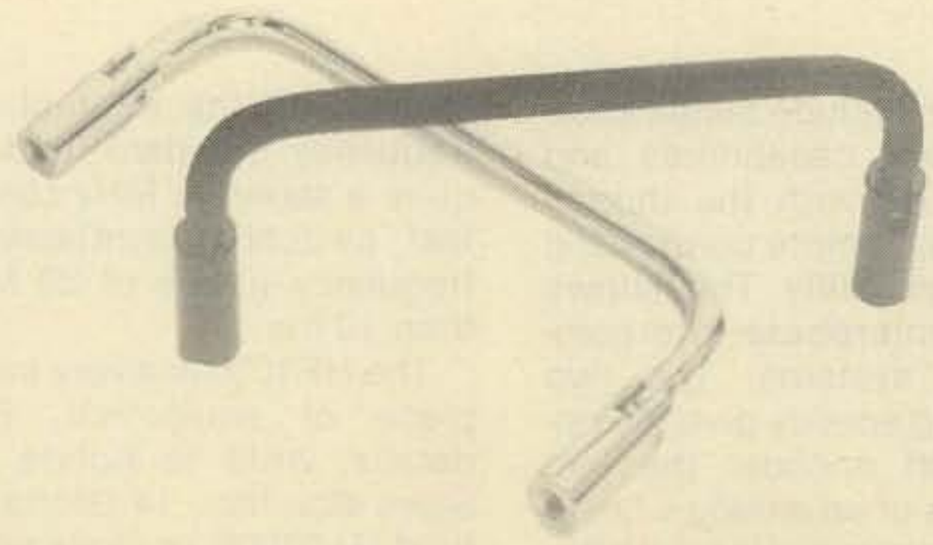
TRS-80 Microcomputer Catalog is #RSC-2 is available free, on request, from Radio Shack stores and dealers, or circle number 66 on the reader service card.

Cambion's Three-Position Folding Handle

Cambion's new 3-position, folding handle is designed for use when space inside an instrument, drawer or cabinet is limited. Only the heads of the mounting screws extend below the panel or drawer on which it is mounted. As a result of this unique feature, the extended mounting height, including folding mechanism, is only two inches above the panel.

Fabricated from 0.25" diameter brass, the folding handle features 10-32 tapped hole mounting on 4" centers. Cambion's 415-2725 handle is available in either nickel plated or black oxide finishes.

For further information write to Cambridge Thermionic Corp., 445 Concord Ave., Cambridge MA 02138, or circle number 67 on the reader service card.



J.W. Miller's Coil, Filter and Communications Essentials Catalog

A new 100-page catalog with specifications for more than 500 coils, filters and communications essentials is now available from the J.W. Miller Division of Bell Industries.

Newest additions include direct reading s.w.r./power meters, r.f. speech processor and coaxial switches

Included also is the broad line of high pass, low pass, audio and a.c. line filters.

Catalog 79 gives detailed specifications for r.f. coils, chokes, filters and related communication components.

To assist in selection, coils are categorized by frequency from 0 through 500 MHz in the table of contents.

Schematic diagrams for all shielded and unshielded coils, showing adjustment accessibility, are given.

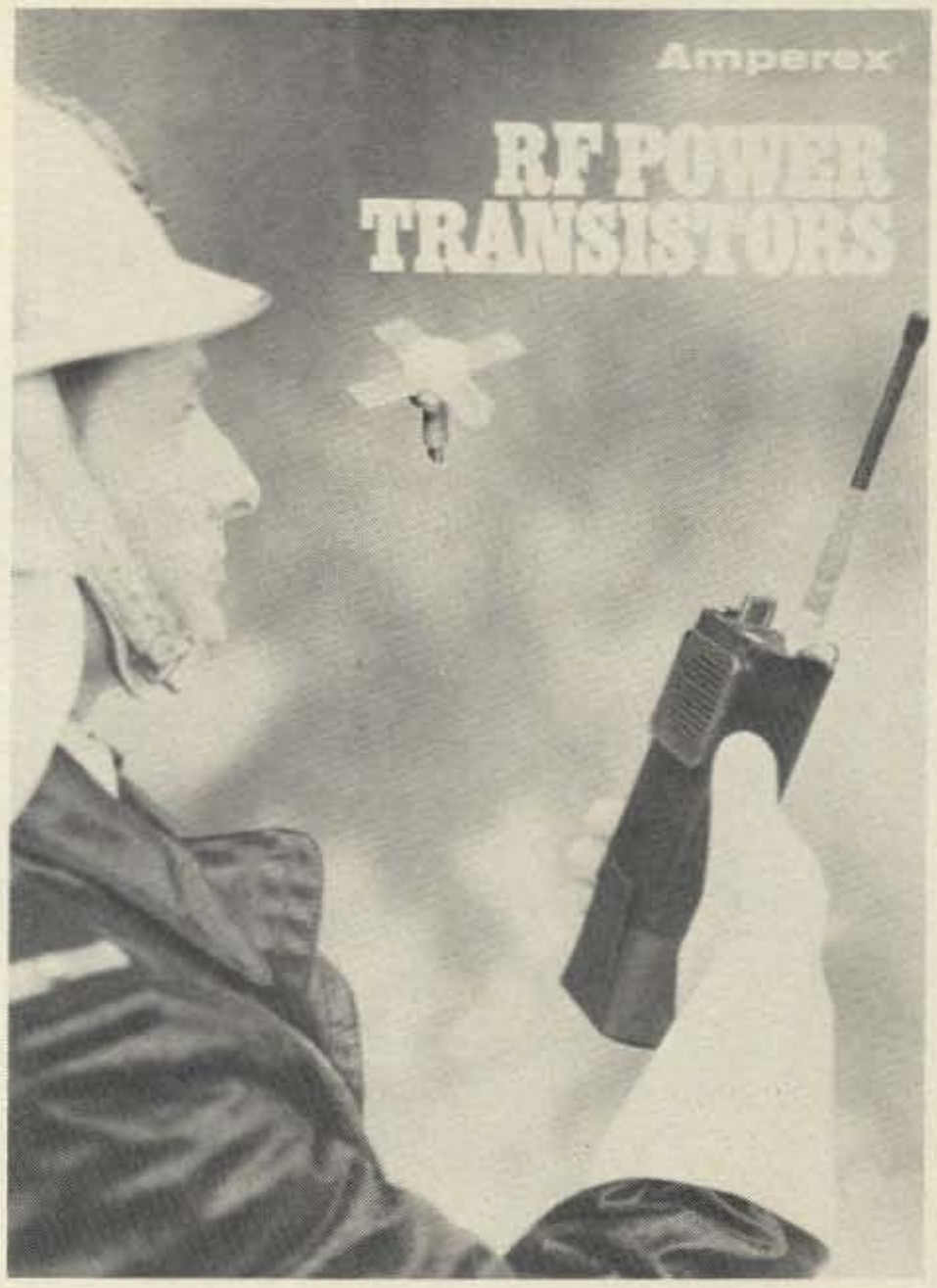
For additional information, contact Bell Industries, J.W. Miller Division, 19070 Reyes Ave., P.O. Box 5825, Compton CA 90224, or circle number 63 on the reader service card.

Amperex R.F. Power Transistor Catalog

Amperex Electronic Corp. has announced the availability of a new r.f. power transistor catalog.

In general, this catalog outlines transistors designed for use in applications above 1 MHz with r.f. powers above one watt. The catalog divides the transistors into two categories. The first is for those used at collector voltages of 12.5 to 13.6 volts. The second category of transistors are those used at collector voltages of 28 volts.

The catalog is available without charge from Amperex Electronic Corp., Hicksville Station, Hicksville NY 11802. For more information on Amperex products, circle number 69 on the reader service card.



"Learning Electricity and Electronics Through Experiments" by J.A. Wilson and Milton Kaufman

This new book, published by the Gregg Division of McGraw-Hill Book Co., teaches, through self-study, basic electronics and electricity.

There are 54 experiments, ranging from introductory types (static electricity) through more advanced topics (using the 555 timer as an audio oscillator) that gives the hobbyist a "hands on" learning experience.

Simple hardware requirements allow setting up and performing the experiments at little cost.

"Learning Electricity and Electronics Through Experiments" contains 256 pages and sells for $6.96. For more information, contact the Gregg Division at McGraw-Hill, 1221 Avenue of the Americas, New York NY 10020, or circle number 70 on the reader service card.

Gilfer's R.F. Preselector/Preamplifier With Automatic Antenna Switching

If you are missing out on those weak DX signals because your receiver needs more sensitivity, here's a low-cost way to hype it up. Add the new Mizuho SX-59 Preselector/Preamp from Gilfer.

The SX-59 adds 20 dB of gain (3 or 4 S-units) with low noise. Tunable in three switched bands from 3 to 30 MHz, the unit is completely automatic in antenna switching—turn it on and it connects itself to the antenna; turn it off and the antenna is reconnected to the receiver. No manual bypass is needed.

The unit has a built-in, switchable, 20 dB r.f. attenuator to cope with excessively strong signals, plus a range switch, r.f. gain control, tuning dial, LED "on" indicator, input and output coax (SO-239 and phono plug) antenna connectors, "remote" terminals and built-in power supply for 117 v.a.c.

The Gilfer SX-59 costs under $100 and is available from Gilfer, Box 239, Park Ridge NJ 07656, or circle number 65 on the reader service card.

No-117-118

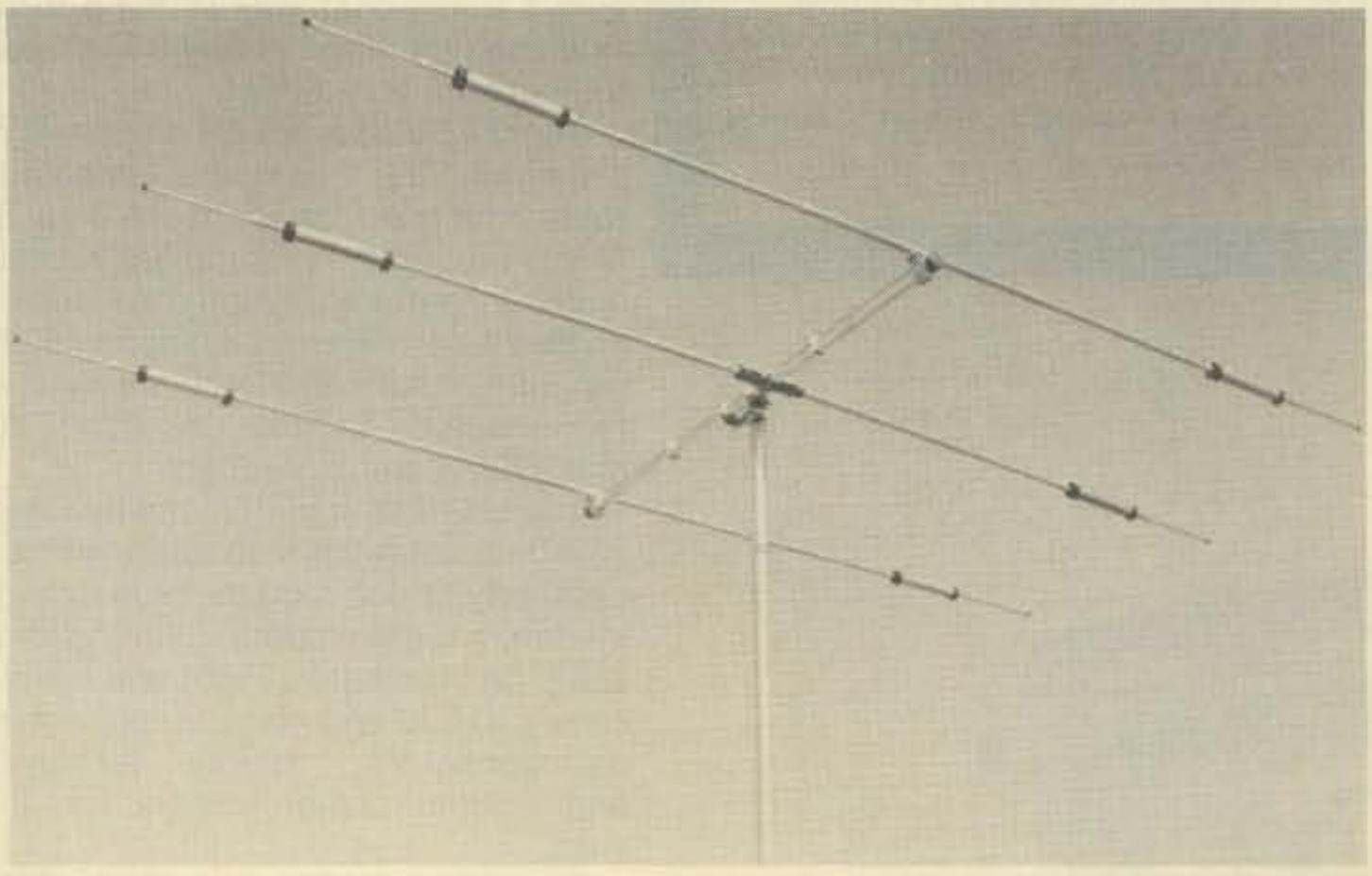
Continental Specialties Crop.'s Design Mate® Pulse Generator

CSC's DM-4 Design Mate® Pulse Generator makes digital trouble-shooting easier by substituting an external signal for the system clock oscillator.

Nearly every pulse parameter is variable over a wide range. The pulse repetition frequency is continuously variable from 0.5 Hz to 5 MHz in seven overlapping vernier-tuned decade ranges. Duty cycle, pulse width and pulse spacing are variable over a 10^7:1 range, from 100 nanoseconds "off." Pulse output is variable from 0.1 V to 10 V.

A special one-shot mode puts out a single pulse with every push of a panel-mounted button. External triggering to 10 MHz is also accepted. A separate sync output pulse leads the DM-4 pulse output by approximately 20 nanoseconds.

For further information on the DM-4, which sells for $129.95, contact Continental Specialties Corp. at 70 Fulton Terrace, New Haven CT 06509, or circle number 74 on the reader service card.



Wilson Electronics' "System Three" Tri-Band Antenna

Wilson Electronics announces the latest in tri-band antennas for 10-15-20 meters. The "System Three" features lightweight design, yet heavy duty materials, low s.w.r. across all three bands, boom length of 14 feet, wind survival of 100 mph, feeds direct with 52 ohm coax or with a balun, and will handle maximum legal power.

The "System Three' is list priced at $179.95. For more information, contact Wilson Electronics, Consumer Products Division, P.O. Box 19000, Las Vegas NE 89119, or circle number 61 on the reader service card.

ATV Research's MICRO-VERTER Model MVX-500

The ATV Research *MICRO-VERTER* is a computerized video-to-u.h.f. interface modulator. It is designed to interface microcomputers to color or monochrome television receivers, eliminating the need for video monitors.

The MVX-500 operates on a blank channel in the u.h.f. band above channel 14 and is tunable over a minimum of four channels. It is designed to interface directly with the Apple II as well as other microcomputers and comes complete with a video cable and an r.f. output stub coupler.

The unit is housed in a two-tone cowl type cabinet which has rubber feet. It is designed to sit on top of a television receiver.

The *MICRO-VERTER* requires no direct connection to the t.v.'s antenna terminals; rather, it is r.f. coupled directly into the u.h.f. tuner input.

The unit costs $35 and is available from ATV Research, 13th and Broadway, Dakota City NE 68731. For more information, circle number 73 on the reader service card.

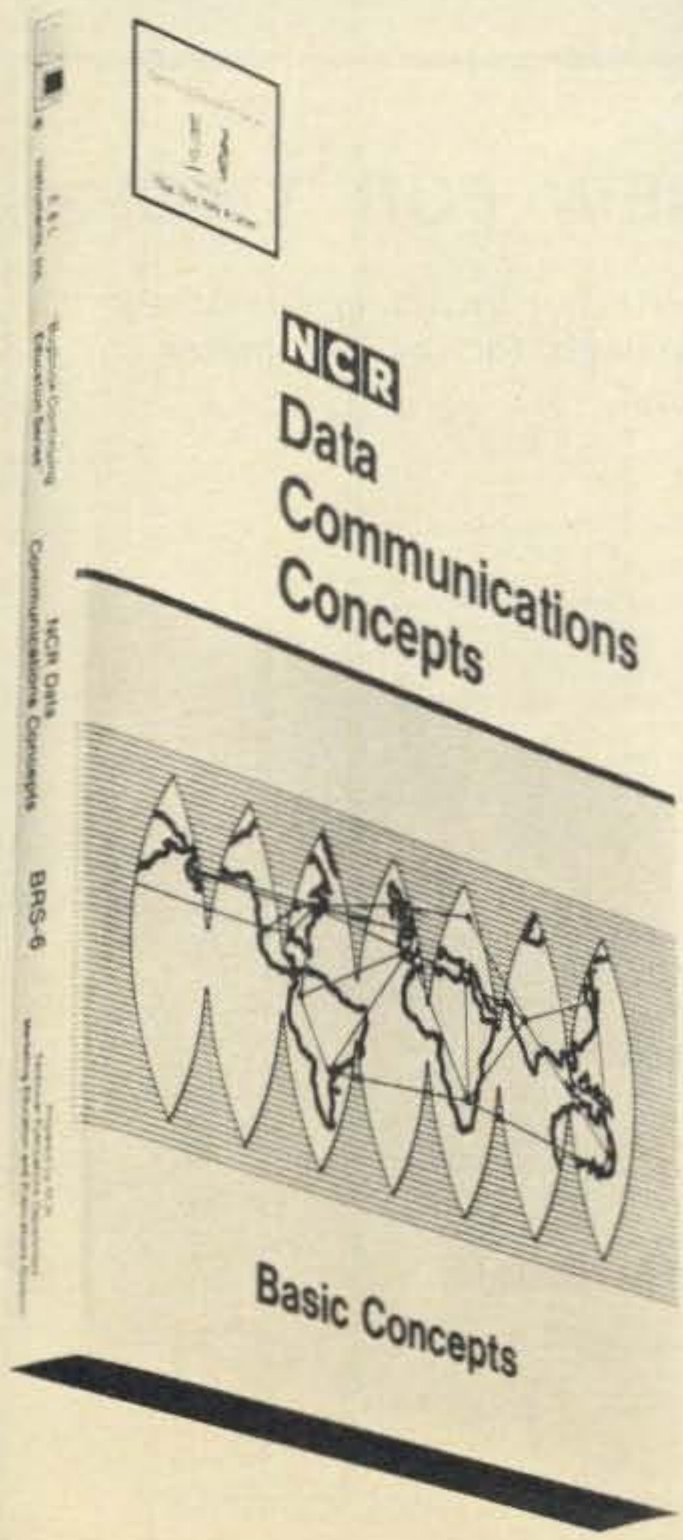
Chemtronics' Micro-Duster

Micro-Duster is a new Chemtronics product that permits compressed-gas dusting of delicate instruments and assemblies. It contains pure, moisture-free, non-flammable and non-toxic filtered gas which allows the product to be sprayed without depositing harmful contaminants.

Micro-Duster has a broad range of applications including mechanical and electrical miniature assemblies, audio components, computer tapes and heads, timepieces, camera lenses, negatives, slides, and a host of others.

A single 15 ounce can produces over 1800 one-second bursts, or 25 to 30 minutes of continuous dusting.

Each 15 ounce can costs $2.50 and can be obtained from Chemtronics, Inc., 45 Hoffman Ave., Hauppauge NY 11787, or circle number 72 on the reader service card.



E & L Instruments Adds Data Transmission Text To Bugbook® Reference Series

An introduction to the principles, characteristics and testing of data transmission has been added to the *Bugbook* Reference Series published by E & L Instruments. Edited by Titus, Titus, Larsen and Rony, the 6 x 9 inch soft cover text contains over 220 pages of practical and useful information for electronic data processing and computer hobbyists.

The reference book, designated BRS-6, discusses filters, equalizers and other corrective devices from the user's point of view, and explains the use and testing of modems and other terminal equipment. ASCII codes and detailed guides to interpretation of communications circuits are presented.

The NCR Data Communications Concepts volume is priced at $6.95 and is available from E & L Instruments, Inc., 61 First St., Derby CT 06418, or circle number 75 on the reader service card for more information.

HAM SHOP

FREE TO CQ SUBSCRIBERS

Advertising Rates: Non-commercial ads are 10 cents per word including abbreviations and addresses. Commercial and organization ads are 35 cents per word. Minimum charge $1.00. No ad (non-subscriber) will be printed unless accompanied by full remittance. Free to CQ subscribers (maximum 3 lines per month). Recent CQ mailing label must accompany ad.

Closing Date: The 10th day in the third month preceding date of publication. Because the advertisers and equipment contained in Ham Shop have not been investigated, the Publisher of CQ cannot vouch for the merchandise listed therein. Direct all correspondence and ad copy to: CQ Ham Shop, 14 Vanderventer Ave., Port Washington, New York 11050.

SELL: Drake SSR-1 Communications Receiver. Factory checked-aligned. Excellent condition. $225.00. G. Boettcher, WB3DTX, P.O.B. 255, Dingman's Ferry, PA 18328, (717) 686-1200.

SELL: Manuals Hammarlund SP600JX, $2.00 each, postpaid. Ken Murley, 13011 Crescent Rd., Surrey, B.C. Canada V4A 2V7.

CLUB CALL PINS 3 lines 1 1/4 x 3 1/4, $1.55 each. Call first name and club. Colors: Black, Blue, or Red with White letters. (Catalog). Arnold Linzner, 2041 Linden Street, Ridgewood, NY 11227.

REPLACE RUSTED ANTENNA BOLTS with stainless steel bolts. Small quantities, free catalog. Elwick, Dept. 317, 230 Woods Lane, Somerdale, N.J. 08083.

FOR SALE: Tempo-One TXVR-Great buy; Bob Gluck, Apt. 23A, 1945 Eastchester, Bronx, NY 10461.

SCANNERS AND WILSON radios, antennas, towers. Bearcat 250, $279.95. Regency K-100, $199.95. K-500, $299.95. SASE (long) speeds free price list. Visa/Master accepted. McDonald Electronics, Box 1385(C), Rohnert Park, CA 94928, (707) 544-4388.

QUICKLY BUY/SELL used amateur gear. Nationwide—we match buyers with sellers. Send make, model, number, price, name, address, telephone, $1. fee, SASE—Write: Amateurs Buy/Sell Exchange, Box 374-C, Visalia, CA 93279.

TRAVEL-PAK QSL KIT-Send call and 25 cents; receive your call sample kit in return. Samco, Box 203, Wynantskill, NY 12198.

BEAUTIFUL, Great Lakes Certificate. Requires one contact with each state bordering the Great Lakes. SASE brings information sheet. HAROAA, P.O. Box 341, Hinckley, Ohio 44233.

SELLING: An extensive collection of magazines, books, catalogues, and other materials pertaining to amateur radio 1905 to present. Complete sets of CQ, 73, Ham Radio, and many others. Many first editions, callbooks, handbooks, ARRL publications. Also QST 1921 to present complete. Many loose issues of rare journals. Also antique radio tubes and parts (no sets). Send SASE for list to: Richard Kampf, 9 Black Birch Lane, Scarsdale, New York 10583.

QSLs WITH CLASS! Unbeatable quality, reasonable price. Samples: 50 cents refundable. QSLs Unlimited, 1472 SW 13th St., Boca Raton, FL 33432.

TUBES: All brands, Jan, Com, Antique, Surplus. Send your want list to: P.O. Box 4357, Compton, CA 90224, (213) 774-1255.

FREE FULL COLOR QSL Card Catalog. Cards, Inc., Drawer P, Lexington, N.C. 27292.

WANTED: Hallicrafters S-1 through S-7, H8PA, 5-T, SX-10, SX-12, and other early Hallicrafters gear, parts, and manuals-any condition-for private collection. Price and condition first letter. C. Dachis, WD5EOG, 4500 Russell Drive, Austin, Texas 78745.

VP2M DXpedition! Villa with HW-101, SB-200, rebuilt Hy-Gain quad at 60 ft., $90 weekly summer, $135 winter, $40,000 for keeps. Great for retirement. "Doc" Beverstein, 60 Amsterdam, Toronto, M4B 2C2, Tel. (416) 755-2117.

EZ DEALS are hard to beat. Try me and see for new or used ICOM, Cushcraft, KLM, Yaesu, Drake, Wilson, VHF Eng., Ten-Tec, Swan, DenTron, CDE, Hustler, Larsen, and more. W0EZ, Bob Smith Electronics, RFD 3, Fort Dodge, Iowa 50501, (515) 576-3886.

SWAN 750CW with P/S new and unused. $700.00 U.P.S. Switching to solid state. W1GWA, Dennis, 144 Golden Hill St., Bridgeport, CT 06604. (203) 334-4837.

CUSTOM EMBROIDERED EMBLEMS, your design, low minimum, Emblems, Dept. 10, Littleton, New Hampshire 03561.

FREE ELECTRONICS SURPLUS Catalog. Bargain packed. Fascinating items, many never before advertised. ETCO-003, Box 762, Plattsburgh, NY 12901. SURPLUS WANTED.

QSL CARDS—500/$10. 400 illustrations. Samples: Bowman Printing, Dept. CQ, 743 Harvard, St. Louis, Missouri 63130.

MOBILE IGNITION SHIELDING Provides more range with no noise. Available most USA engines, some imports. Free literature. Bonding straps on sale now. Estes Engineering, 930 Marine Drive, Port Angeles, WA 98362.

FOR SALE: Ham gear, test equipment, books, magazines. Cleaning house. Send SASE for list. I. Schwartz, K2VG, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

Please send all reader inquiries directly

SCANNER OWNERS! It's here! "Top Secret" registry of U.S. Government radio frequencies 25 to 470 MHz, by K2ASE. First and only book of its kind ever published! Lists 2,250 + freqs. of Military, FBI, Treasury, FCC, Border Patrol, Customs, Secret Service, NASA, FAA, CIA, Federal Prisons, U.S. Marshals, satellites, National Park Service, Fish/Wildlife, and much more! Only $4.95 postpaid (USA, APO, FPO orders only, please); from CRB Research, P.O. Box 56-CQ, Commack, NY 11725.

VP5 PROVIDENCIALES. Your fam. won't mind your DXing. They will also have the time of their lives with swimming, snorkeling, fishing, beachcombing, etc. Our new home is completely furnished, including transceiver and antenna. Refer to June '77 issue of CQ. Info. Rene Weber, 2600 Douglas Road, Suite 1100, Coral Gables, FL 33134.

SST ANTENNA TUNERS-Your best buy. SST Electronics, Box 1, Lawndale, Calif. 90260.

ELECTRONIC PARTS lowest prices anywhere. Catalog free—Knapp, 4750 96th St., N., Dept. CQ, St. Petersburg, Fla. 33708.

CQ AND QST 1950-1975 issues for sale. Send SASE if ordering 73, Ham Radio, or other CQ and QST issues. One dollar minimum order and all issues cost 25 cents each including USA shipping. Send chronological list and full payment to: W6LS, 2814 Empire Ave., Burbank, CA 91504. Available issues and refund sent within one month.

CERTIFICATE FOR Proven Two-Way Radio Contacts with Amateurs in all ten (10) USA call areas. Award suitable to frame and proven achievements added on request. SASE brings TAD data sheet from W6LS, 2814 Empire Ave., Burbank, CA 91504.

ROHN TOWERS—Buy wholesale from worldwide distributor 25G sections, $35.97 each-45G sections, $54.89 each, 100 foot tower kit, $628.22, 48 foot fold over tower, $515.50, freight paid-40 foot free standing BX, $171.97-Hill Radio, 2503 G.E. Road, Bloomington, IL 61701, (309) 663-2141.

SSTV AND PHOTOGRAPHERS—Make offer-1 each, like new-Fujitar lenses, 135 mm, f 4.5 telephoto, 35 mm, f 3.5 wide angle. Cary Cowan, c/o CQ Magazine, or call (516) 883-6200.

SELL: CQ Magazines complete. Reasonable offers, cash or trade. Nagle, 12330 Lawyers Rd., Herndon, VA 22070.

WANTED: Pre-war issues of Short Wave Craft Magazine. Bill Orr, W6SAI, Eimac, 301 Industrial way, San Carlos, CA 94070.

WANTED: Collins 51-R receiver (VHF). Bill Orr, W6SAI, Eimac, 301 Industrial Way, San Carlos, CA 94070.

WANTED: Antique Glass—looking for old milkglass-purple, slag, carmel, and greentown. Tell me what you have. I pay the highest prices. Write: Jack Schneider, c/o Cowan Publishing, 14 Vanderventer Ave., Port Washington, NY 11050.

SALE: Heath IM-28 VTVM Kit. New, perfect. Ordered by mistake. $40. Schultz, Box "L", FPO, New York 09544.

MEDICAL: Any licensed amateur radio operator in the medical or paramedical field should join MARCO (Medical Radio Council). Contact: Stan Carp, M.D., K1EEG, 44 Main St., Saugus, MA 01906. (617) 233-1234.

LOOKING FOR old Lionel trains. Interested only in "O" Gauge, excellent to like-new condition. Primary interest is locomotives prior to 1952, but will consider complete sets or more recent models. Am willing to buy outright for cash or swap for radio gear to meet your needs. Write: Dick Cowan, WA2LRO, c/o CQ Magazine, or call (516) 883-6200.

FOR SALE: Cushcraft A147-22, stacked 11 element, 2 meter beam. New in carton. $70.00. A. Dorhoffer, K2EEK, 14 Vanderventer Ave., Port Washington, NY 11050.

No-123-124

The Rochester Hamfest & NY State ARRL Convention will be held on May 25-27, 1979. Add your name to mailing list. Send QSL to Rochester Hamfest, Box 1388, Rochester, NY 14603. Phone (716) 424-1100.

SELL: 2 mtr FM Sonar transceiver, AC P/S, mobile bracket $150. George Pataki, WB2 AQC, 34-24 76th St., Jackson Hgts., NY 11372.

QSL—QSL—QSL—Please send QSL cards to: Philip Steven Kurland, P.O. Box 1686, New Haven, CT 06507.

The book "CQ YL" has been updated again with a new supplement bringing the YLRL Officers section up to date through 1977, plus a report on the 7th International YLRL Convention held in Houston in June 1976. If you have a copy of "CQ YL" and would like to add the new supplement (the pages are "slotted" so they can be inserted directly into the book's spiral backbone), drop a note with your request to author/publisher W5RZJ, Louisa Sando, 9412 Rio Grande Blvd., NW, Albuquerque, NM 87114. Please enclose $1 to cover cost of printing and mailing. The one and only book about YLs in ham radio, "CQ YL" contains 23 chapters, over 600 photographs. Order your autographed copy, or a gift copy, from W5RZJ, $3.50 postpaid.

FOR SALE: Old issues of Ham Radio, 73, CQ, QST. Some complete runs. Send SASE for lists and prices. A. Dorhoffer, K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

WANTED: Extra coils for SW-3 receiver. I have odd-ball coils and need your single extras to make up complete set. Buy or trade. Bill Orr, W6SAI, c/o Eimac, 301 Industrial Way, San Carlos, CA 94070.

SALE: Sony ICF-5900W multi-band receiver designed for SWL's. Like new condition w/manuals. $100. Schultz, W4FA, Box "L", FPO, New York 09544.

FOR SALE: Tektronix 535 oscilloscope with dual trace and fast rise-time plug-ins. Very good condition. $425. Prefer local pick-up. Irwin Schwartz, K2VG, c/o CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

SALE: Surplus units, parts, ham gear, 73, CQ, QST, Ham Radio, pick-up only. 25 cents each. Cooper City, FL Tel. (305) 434-4245.

FOR SALE: Collins mobile mount with cables and 516E-1 mobile power supply for KWM-2, $125.00. A. Dorhoffer, K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

WANTED TO BUY: Old radio magazines and books. One or a thousand. Send list, description, and price, Radiographics, Post Office Box 18492, Cleveland Heights, OH 44118.

MONITOR—SCOPE, Heath Model HO-10, mint condx with manual. Needs some work, $20. Art Johnson, K2POA, 29 Boone St., Bethpage, NY 11714, (516) 931-3374.

SELL: Video machine and tape $150 or Swap HW-8 etc. Al Szablak, 6 Cromwell Pl., Utica, NY 13502.

SELL: Hallicrafters SX-117, HT44 and AC power supply/speaker, 6M kw amp, Viking Ranger. Regency HR2A. T.N. Colbert, 1800 Rhodes RD 612, Kent, OH 44240.

JOHNSON xmtg. Var. Capacitor, 100 pf, 2 each $25 pp. H. Anderson, 816 No. Cedar, Colorado Springs, CO 80903.

DX CALLBOOK, Pay $5 for late copy. H. Anderson, 816 No. Cedar, Colorado Springs, CO 80903.

HARVEY—WELLS: Bandmaster deluxe transmitter, 80 thru 2 meters, CW-Phone, 50 watts, $40. I ship UPS. DS, 15 Arcadia Rd., Andover, MA 01810.

CLIFF DWELLER: 80/40 meter rotatable motorized dipole (good for parts) $35. pcik-up only. W8VO-Clem Duval, 33727 Brownlea, Sterling Hgts., MI 48077, (313) 268-2467.

LINEAR BUILDERS: Send SASE for list of goodies. Mace, 8600 Skyline Dr., Hollywood, CA 90046;

WANTED: Webster bandspanner mobile antenna. Call or write: W0XM, RR 2, Garnett, KS 66032, Tel. (913) 898-2532.

FOR SALE: Electronic Parts: I have the following, assorted Phase lock loops, one five digit numeric display, display sticks, linear integrated circuit low noise stereo preamplifier chip, calculator chips, and a lot more. Please send SASE for list of parts. A.Williams, Jr., 576 Springtown Rd., New Paltz, NY 12561.

HEATHKIT SB303 solid state receiver with cw filter, mint condx, $295 postpaid. J.L. Hamilton, 414 Augusta St., Elmore, OH 43416.

100 percent QSL-Join the Carnival QSL Club of the world- a QSL Club that also gives SSB number-join now write for applications. Box 174, Dubuque, IA 52001.

SELL: As is-needs repair, SX110, $15. As is-needs repair, SX111, $25. Dr. Eric Palmer, W2RD, 1602 Mermaid Ave., Coney Island, NY 11224.

SELL/TRADE: Yaesu FR101D, FL101, processor, extras. Want 1kw linear. J. Shea, 59th Ord Bde., Stafelm Northag, APO NY 09011.

FOR SALE: Realistic general coverage receiver. DX-160 plus matching speaker. Like new, $140. Telephone-(715) 322-5672, WD9 ISQ.

FOR SALE: Henry 2K-3, 80-10, works great. $750. (803) 359-4131 days, (803) 359-3418 nights. K4RV, WA4OSM.

WANTED: Manuals for model 19 and Boehme 5-C freq. Shift conv. W3KXR, Box 166, RD 2, New Albany, PA 18833.

WANTED: Zenith Transoceanic model between years 1946-1956 working. B. Roome, 11 Trenton St., Dollard Des Orm, Quebec, Canada H9B1B6.

WANTED: Collins speaker model 270G-1 to match model 75A1 receiver. N.A. Parsons, 22 Forest St., Branford, CT 06405.

FOR SALE: Sayno M-139D telephone answering recorder. Like new condx, $75. Thomas D. Hauskins, WD5JDC, 140 N. 575W, Layton, UT 84041, (801) 376-0465.

SALE: KWM-1 mobile power supply, complete with mtg btk, cable, conn. Tom Rood, K2VC, RD 1, Penn Yan, NY 14527.

FOR SALE: Collins KWM-2, Waters, 516F-2, 516E-1, 351D-2, $750. E. Snow, W2UN/4, 613 NE 47th Ct., Pompano Beach, FL 33064, Phone (305) 941-6740.

SELL: FT-101E, FT-101EE, both w/fan and cw filter, FV-101B, SV-101PB, YC-601, all mint, W5USM, (318) 546-6769.

FOR SALE: 62S-1 (new) $995. R390, $300. KWM-1 no. 1073, 516F-1, $395. R390-A, $400. HQ215, $325. KWM-2 no. 15000, 516F-2, $995. Wanted; 30S1, KWS1, 3KA, KW1. James Craig, Portsmouth, NH 03801, (603) 436-2884.

QSL—QSL—QSL Please send QSL Cards to: Phillip Steven Kurland, Post Office Box 1686, New Haven, CT 06507.

Low income young ham wants good used gear at low cost: Ham M rotor, mono/tri-band beams, 2M-12v rig. Rick, N7ANL, 2324 NW Columbia, E. Wenatchee, WA 98801.

DXERs! Use ham sentences in 54 languages on outgoing QSLs and get results. K3CHP's DX QSL Guide, $3.95. Joe Mikuckis, 6913 Furman Pkwy., Riverdale, MD 20840.

SALE: TR4CW/RIT, RV4, AC4, MS4, $800. KWM2, DX-Eng. 516F2, $850. Hames Craig, 29 Sherburne Ave., Portsmouth, NH 03801, (207) 439-0474.

WANTED: 6 meter cw, am ssb, receiver to match my Heathkit HX30 nxtter. Send info to: WB0ZSA, 10925 Morris Ave., S., Bloomington, MN 55437.

TRADE OR SELL: BC-1206 CM converted to AC by Fair Radio for Homebrew 1750M (xperimenter band) TX or what you have? Bill Smith, Brown Terrace, Uxbridge, MA 01569.

WANTED: Drake R4C, T4XC, AC4. Mint condx, reasonable. Joe Beldovies, 30 Ridge St., Milford, CT 06460.

WANTED TO BUY: National converters NC 300C1-1 1/4 meters also NC 300C2-2 meter converter. Maddy Sowa, Rt. 1, Box 30, Auburn, NH 03032.

CASH FOR BACK ISSUES of CQ, QST, 73, Ham Radio. Ken Miller, K6IR, 16904 Geo. Washington, Rockville, MD 20853. (301) 774-7709.

WANTED: Hammarlund HQ140X mint only, Roy, N4CJ, (919) 967-8379, after 6 p.m. 114 Pine St., Carrboro, NC 27510.

CALLBOOKS: 1978 issue foreign or US with supplements $8 each. Please enclose sase for return of your check, if already sold. Art Johnson, K2POA, 29 Boone St., Bethpage, NY 11714.

TS-520 owners-only w new 250 Hz cw filters left at $45. Twice as selective as standard Kenwood cw filter, K8AQ, 949 Havensport Dr., Cincinnati, OH 45240.

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