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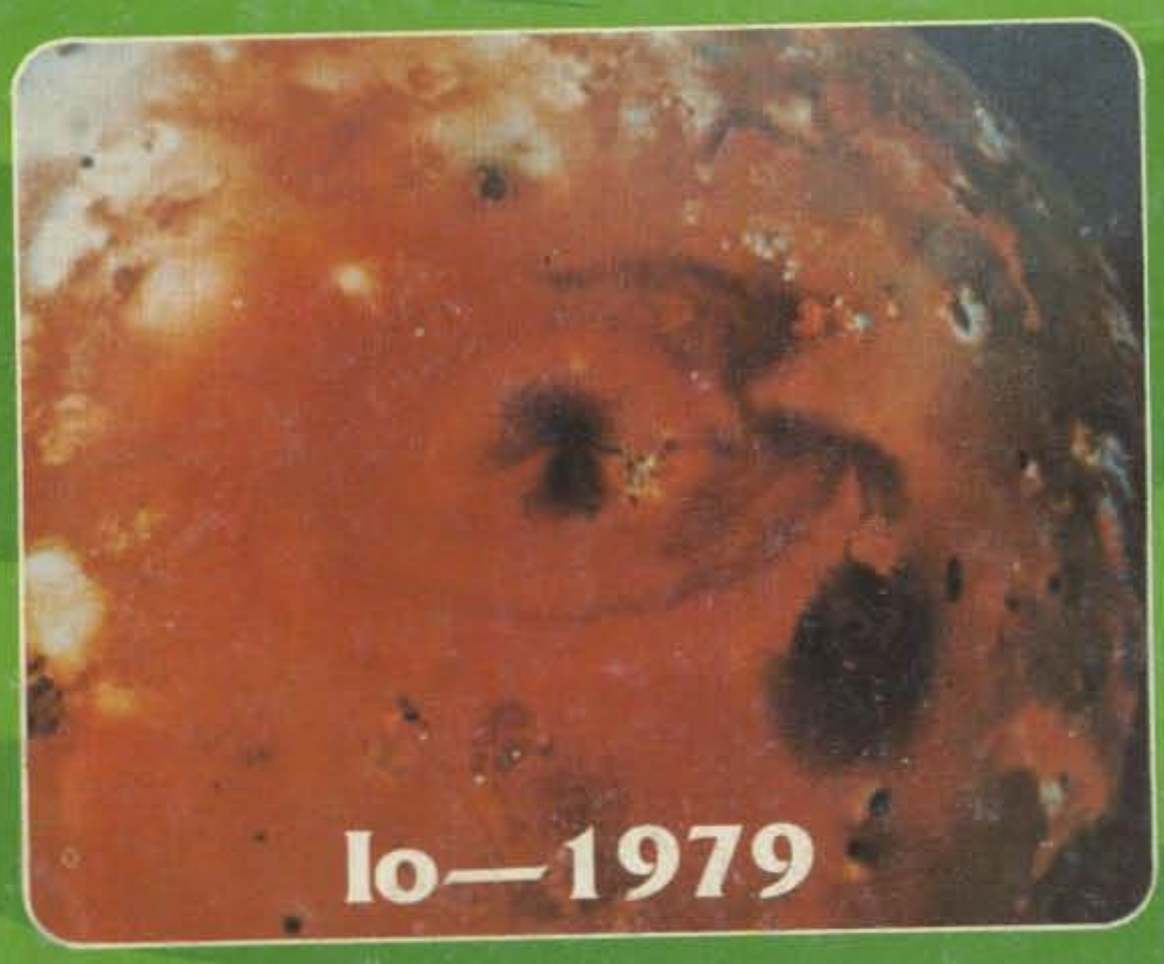

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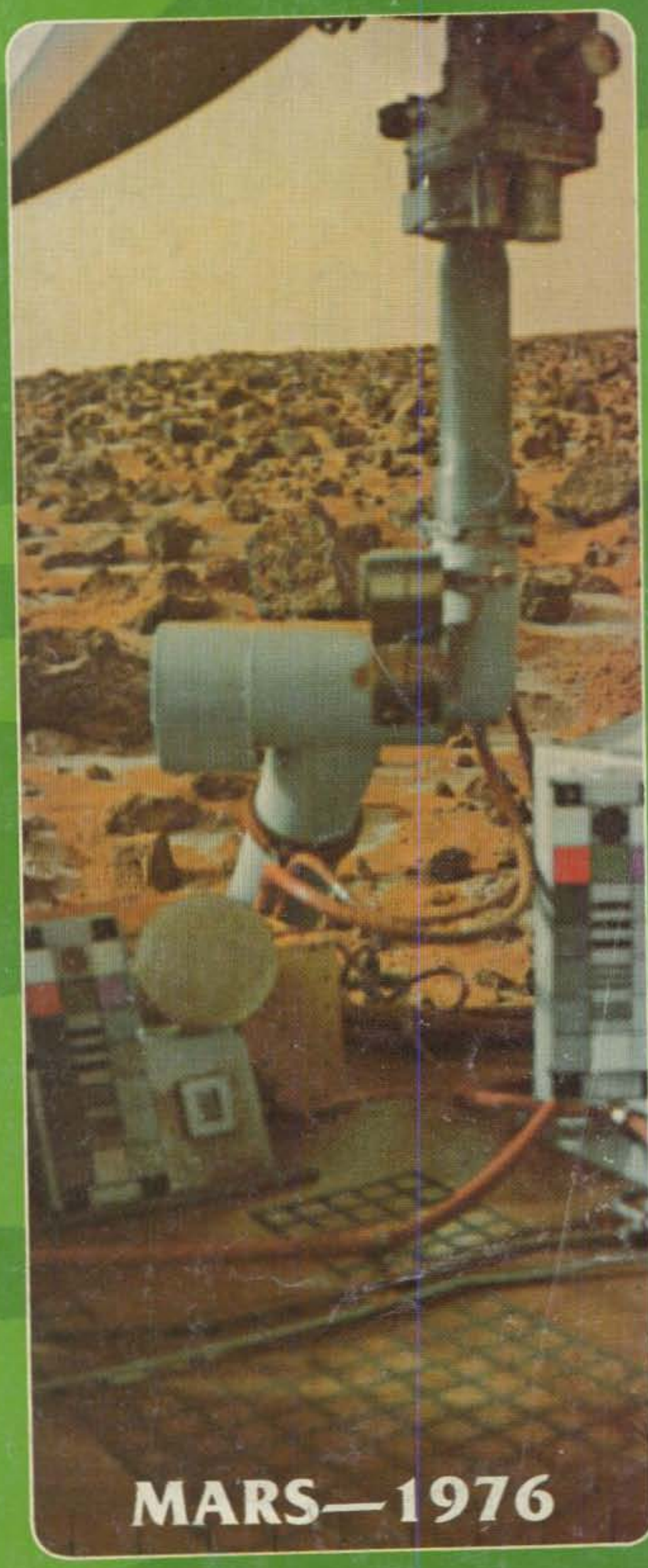

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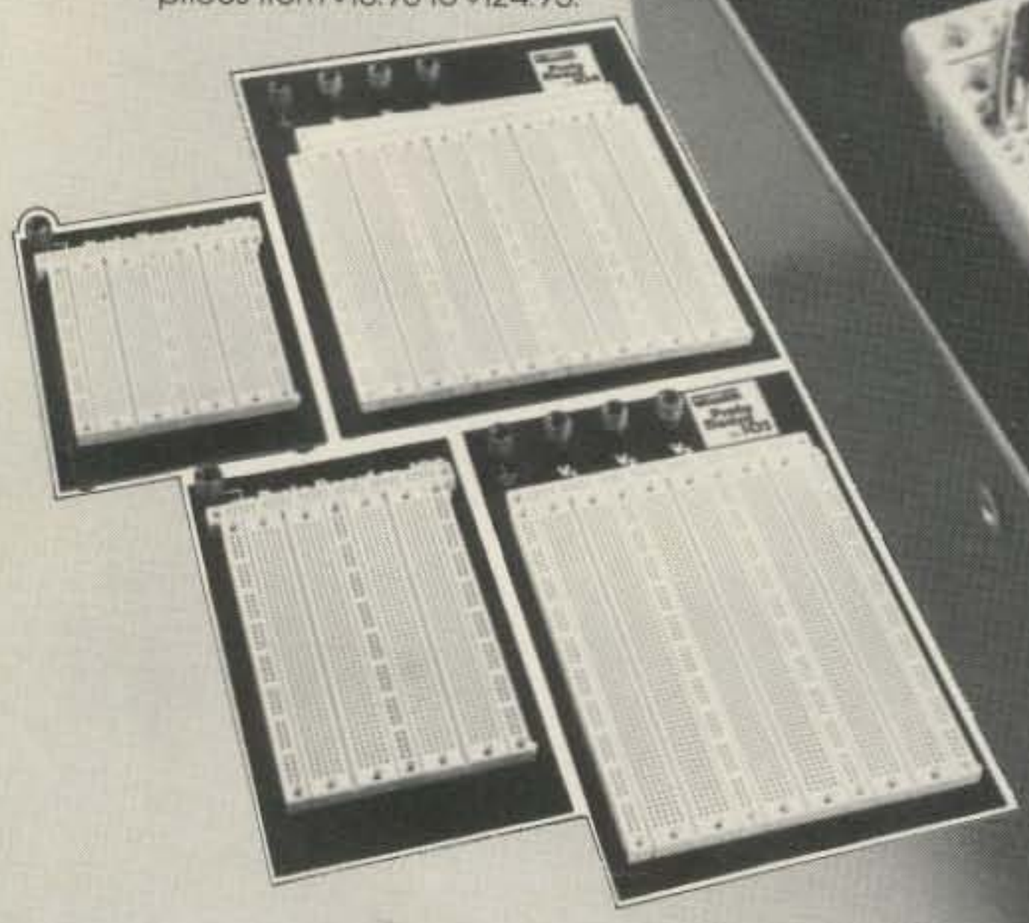

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JUNE, 1979 VOL. 35, NO. 6

The Radio Amateur's Journal

FEATURES

DEPARTMENTS

Novice, QRP, 200 w, deluxe — good, better, best — $299, $369, $399, $699, $869, $899, $1069. TEN-TEC has them all. A choice of seven HF transceiver models — a choice of power levels — a choice of operating features (and accessories) for beginner or old timer. Best of all, there's a wide choice of prices to fit every amateur budget.

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WIDEST CHOICE IN HF TRANSCEIVERS: TEN-TEC

Zero Bias

an editorial

In our excitement over that astounding cover shot of Jupiter last month I forgot to mention one important fact, where the picture came from. The impressive photo of Jupiter used last month and the terrific shots for this months cover come from the Jet Propulsion Laboratory (JPL) via Dr. Norman Chalfin, K6PGX. The larger photo shows Mars in 1976 and the smaller shot highlights the volcanos on Io, a moon of Jupiter. I for one am continually amazed at both the picture quality and the subject matter.

Elsewhere in this issue, Norman details some of the SSTV activities of W6VIO, the amateur radio club station of JPL. The SSTV operations were organized by Dick Piety, K6SVP also of JPL and I expect that you will be seeing more of Dick's efforts in the months to come in *CQ*.

This month we are also featuring an ATV Primer by Henry Ruh, KB9FO. Many of you recognize Henry as the Editor and Publisher of the amateur television magazine *A5*. Henry has long been a proponent of ATV on the air and in print. He is also the author of the book *ATV In A Nutshell*. We welcome Henry's contribution to *CQ* and recognize his efforts on behalf of ATV.

Our own resident expert Bill DeWitt, W2DD, rounds out the ATV scene this month with his In Focus column. Through the years Bill has kept *CQ* readers aware of ATV and its many facets while reporting on the activities of many SSTVers out there. Early on, he advocated fast scan techniques and has been responsible for numerous articles on TV appearing in *CQ*. It has been Bill, carrying on the work started by Copthorne MacDonald, that has kept SSTV alive and well within the pages of *CQ*.

Just as *CQ* pioneered the growing interest in RTTY through the years, I don't think it immodest to point out that we have continually supported first the existence and secondly the growth of ATV. The emergence of the computer in video terms has sparked the interest in both RTTY and ATV in that several aspects can be enjoyed within the same video framework. It's the way of the future and the shape of things to come (if you pardon the analogy). Commercial TV has made us all video conscious as a way of seeing the world. ATV can give us this world and worlds beyond. It's nice to see that other publications are beginning to see these possibilities and are offering ATV material. Welcome aboard.

The Sunfire Project

The Sunfire Project sounds like one of those sci-fi movies that usually means conspiracy and doom. The project however has nothing to do with sci-fi or monumental destruction. It does involve the monumental cooperation of over 500 young people for over 8 years to produce a very unique electrical generating system. For over 8 years and at their own expense, High School students living in the vicinity of JPL have worked together to construct a Solar Thermal Electrical Generator for use on Pitcairn Island (VR6). These young boys and girls, some of them amateurs, expect to complete the project this month (June) with the generator ready for shipment. JPL had donated the construction site to the youths and provided technical advice and an Adult Guidance Director for the project. The matter of funding, scrounging for materials and labor was left to them and they came through with flying colors.

David Broyles, the Adult Guidance Director for the group has steadfastly worked along with them even to the point of putting his own money in with theirs. Tom Christian, VR6TC, and the members of W6VIO (the JPL ARC) coordinated the communications for the project.

All told, the generating system will weigh in at about 11 tons and be able to supply between 5 and 8 kilowatts of power. At this writing (March) all that remains to be done is the installation of the 240 individually adjustable mirror facets, the boiler at the point of focus and the generator operated by a steam engine. The boiler is heated by the rays of the sun focussed on it from all points of the parabolic cylindrical section solar collector.

One remaining hurdle to be cleared is the matter of transportation. So far no one has come forward to provide the means for fee-transit. Negotiations are underway to provide the necessary crating for the generator which will be shipped in two parts, 8 tons and 3 tons respectively. Beyond the actual shipping, a military helicopter (tank transport) will be needed to lift the unit on to the island itself. What is needed is people of means and/or influence to help make this dream a reality. If you have any ideas or can offer any assistance to the project contact David Broyles at 213-354-5557.

I want to thank Norm Chalfin, K6PGX, for bringing this to our attention.

73, Alan K2EEK

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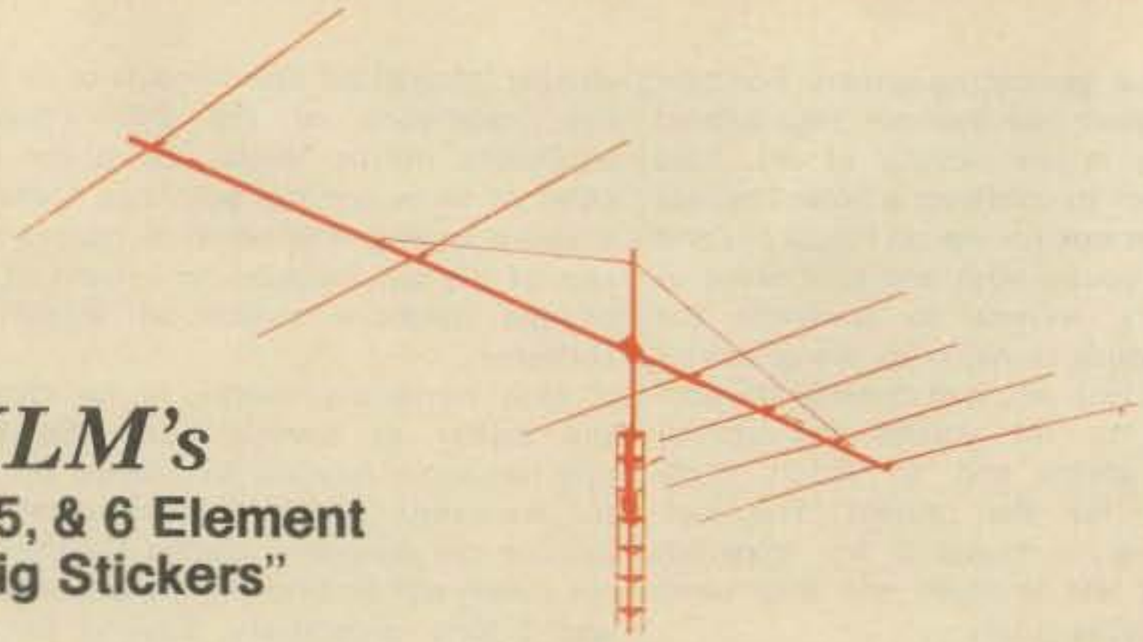

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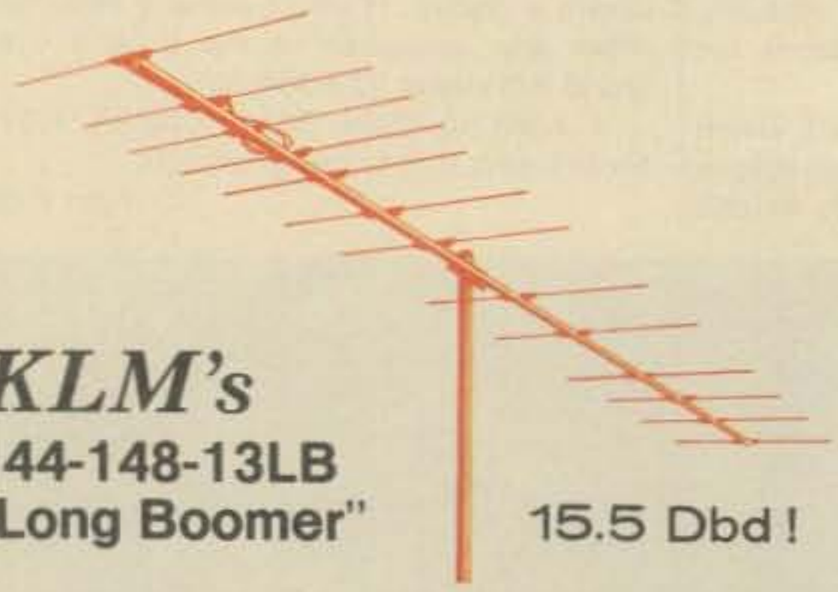

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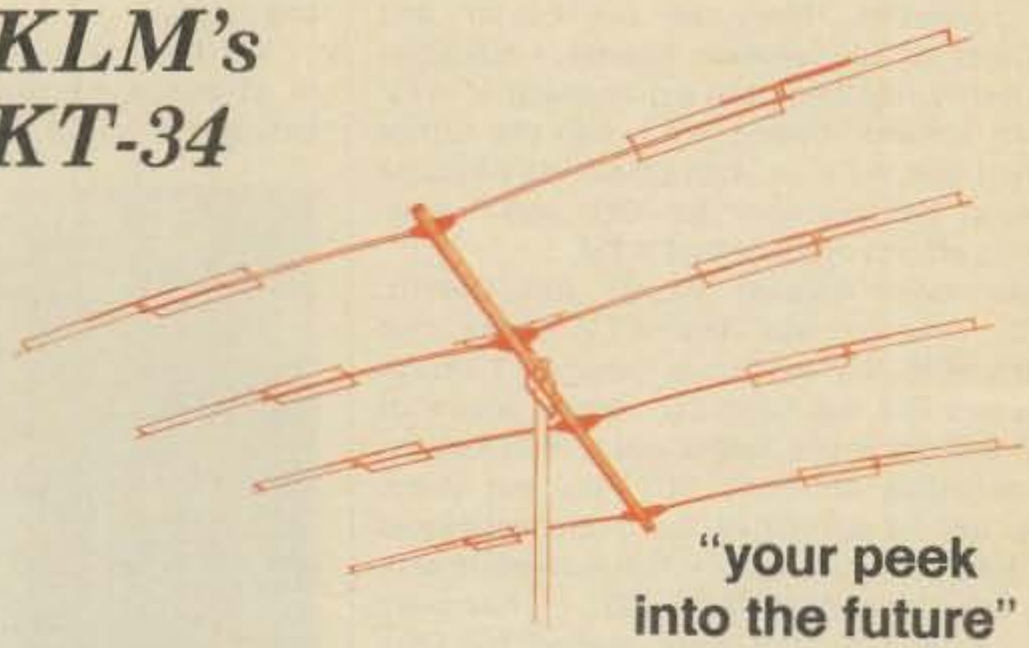

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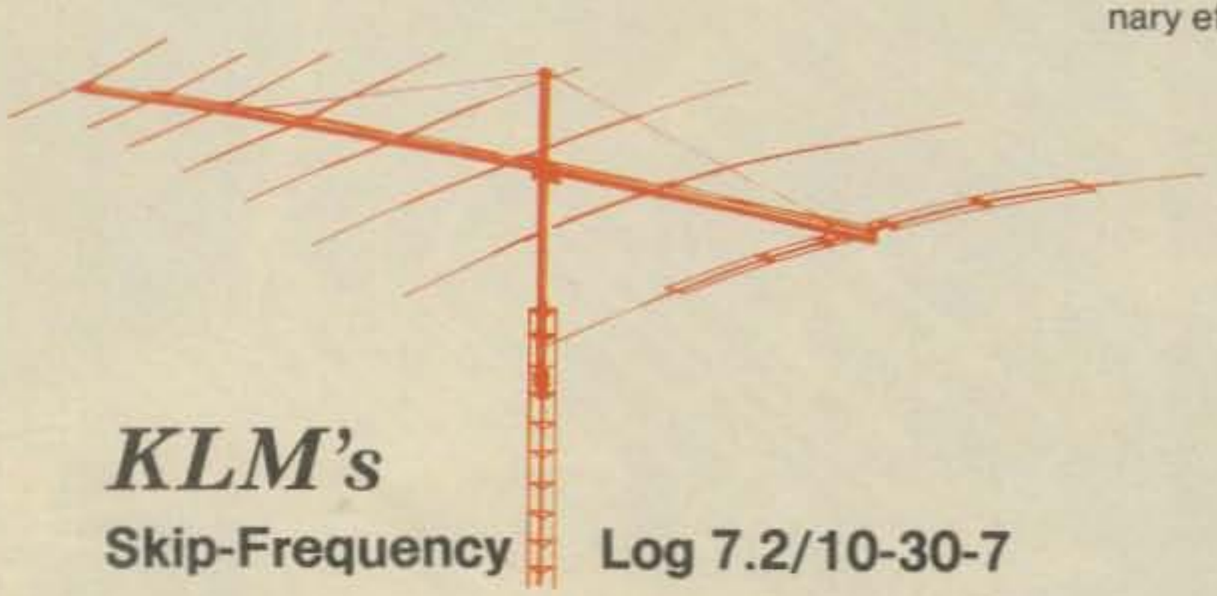

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QST Magazine, "Product Review", Dec. 1978

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  20.950 MHz - 21.550 MHz
  28.000 MHz - 30.000 MHz
  *28.500 MHz - 29.000 MHz
  *standard from factory (crystals available for entire range)
- Modes of operation: USB, LSB, CW, RTTY, SSTV
- Frequency stability: PTO; total drift is less than 100 Hz after warm up. Total frequency change is less than 100 Hz over 11 - 16 V-dc input supply change.
- Frequency readout accuracy: better than ± 4 KHz between 100 KHz calibration points.
- Power supply requirements:
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  750MA receive-full audio
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- Sensitivity: less than o.25μ V for 10dB S/N
- Intermodulation: intercept point + 20dBm
- Selectivity: 2.4KHz at -6dB and 4.4KHz at -60dB (1.8:1 shape factor)
- Ultimate selectivity: greater than 100dB
- Agc: I-F and A-F derived — less than 4dB output variation for 80dB input signal change 191 milliseconds rise time, 3.285 second decay time.
- I-F frequency: 9 MHz
- Image and I-F rejection: greater than 50dB
- Spurious response: greater than 60dB down
- Audio output: 1 watt 8 ohm load

Transmitter:

- Power input:
  SSB - 200 watts PEP
  CW - 200 watts
  RTTY and SSTV - 100 watts
- Load impedance: 50 ohms, nominal
- Spurious output: greater than 50dB down
- Harmonic output: greater than 40dB down
- IMD: 30dB below PEP
- Carrier suppression: greater than 50dB
- Undesired sideband suppression: greater than 50dB @ 1KHz
- Microphone input: low impedance — dynamic
- CW keying: requires a closed circuit to ground
- VSWR: no internal shut down of power amplifier at any SWR ratio. Recommend 2:1 SWR maximum for continuous operation.

- **Suggested Retail Price $699.50**

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The Field-Proven Rig the Whole World's Talking About.

235 Watt PEP and CW on **ALL** Bands

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20M — 13.8-16.0 MHz
40M — 6.0-8.3 MHz
80M — 3.0-4.5 MHz
160M — 1.8-2.4 MHz*
*in lieu of 10M band on Model Astro 151

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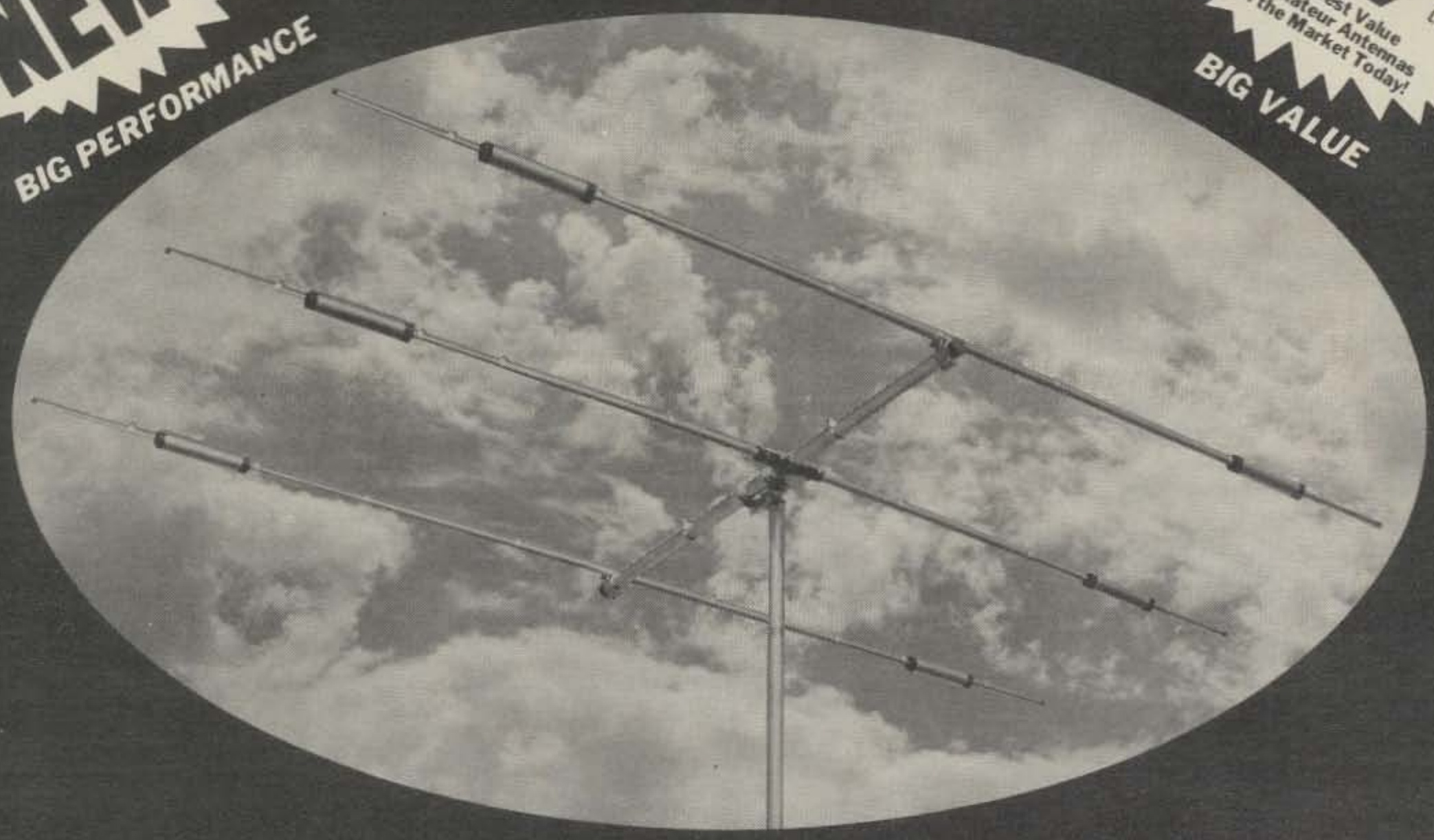

Capable of handling 2,000 watts, the "SYSTEM THREE" is the newest tri-bander available to the amateur.

Designed and produced by one of the world's largest antenna manufacturers, the traditional quality of workmanship and materials continues on with the "SYSTEM THREE".

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Superior clamping power is obtained with the use of a rugged ¼" thick aluminum plate for boom to mast mounting.

The use of large diameter High-Q Traps in the "SYSTEM THREE" makes it a high performing tri-bander with a very economical price.

A complete step-by-step illustrated instruction manual guides you to easy assembly and the lightweight antenna makes installation of the "SYSTEM THREE" quick and simple.

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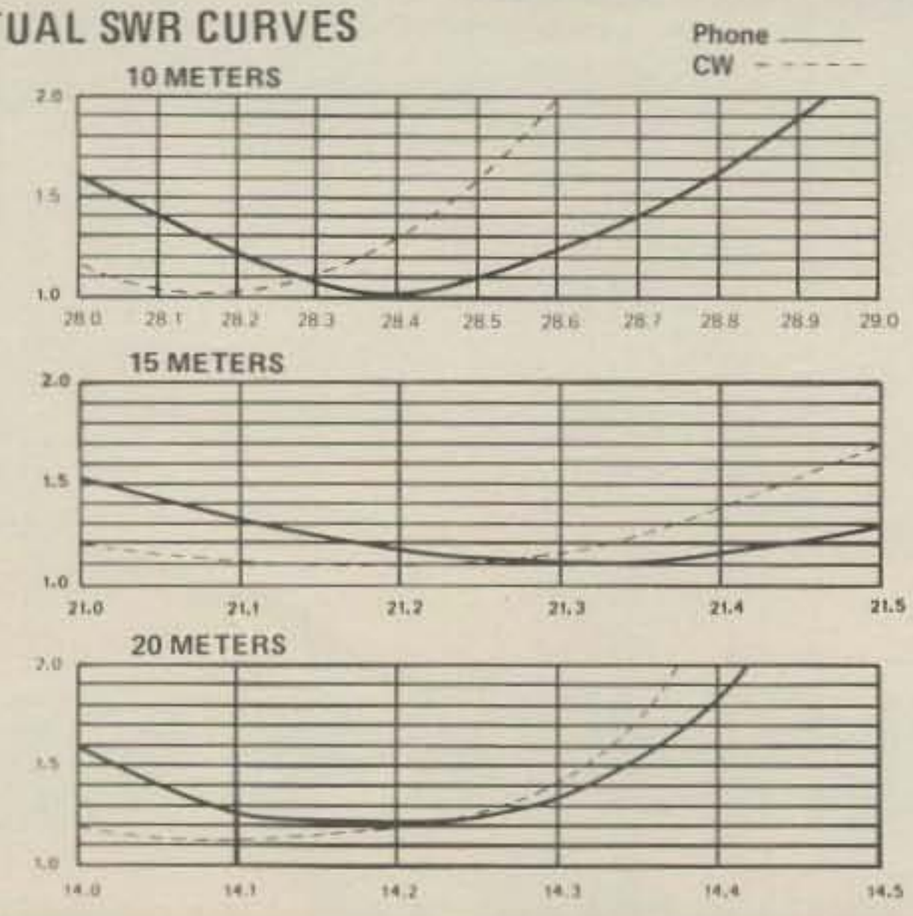

SPECIFICATIONS

Band MHz	14-21-28
Maximum power input	Legal limit
Gain (dbd)	8 db
VSWR at resonance	1.3:1
Impedance	50 ohms
F/B ratio	20 db
Boom (O.D. x length)	2" x 14'4"
No. elements	3
Longest element	27'4"
Turning radius	15'9"
Maximum mast diameter	2" O.D.
Surface area	5.7 sq. ft.
Wind loading at 80 mph	114 lbs.
Assembled weight (approx.)	37 lbs.
Shipping weight (approx.)	42 lbs.
Direct 52 ohm feed or balun maximum wind survival	100 mph

Consumer Products Division

Wilson Electronics Corp.

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Prices and specifications subject to change without notice.

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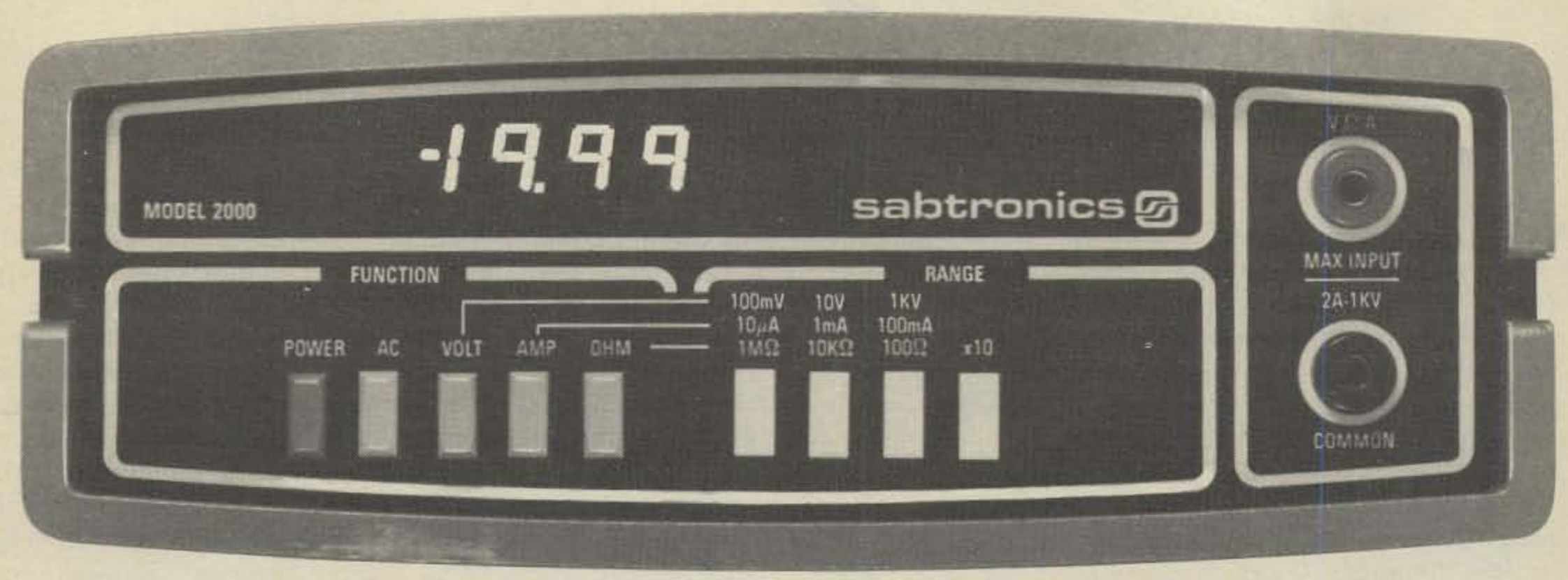

Incredible? True! Professionals and hobbyists alike are believers in this Sabtronics 2000, the only portable/bench DMM which offers such uncompromising performance at the astonishingly low price of $69.95.

Uncompromising performance you'd expect only from a specialist in digital technology such as Sabtronics: Basic DCV accuracy of 0.1% ± 1 digit; 5 functions giving 28 ranges; readings to ±1999 with 100% overrange; overrange indication; input overload protection; automatic polarity; and automatic zeroing.

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GUARANTEE:
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Announcing

● Dr. Jack London, K2JVA, one of the founders of the Medical Amateur Radio Council Ltd., and the president in 1968, died on Thursday, January 25, 1979. He was a graduate of the Long Island College of Medicine, and his specialty was neurosurgery. He was in private practice and on the staff of the New York City Bellevue Hospital. For many years, Dr. Jack was a consultant both for the Childrens Court in Brooklyn and the Episcopalian Diocese of Brooklyn, New York.

First licensed as an amateur radio operator in 1922, Jack was very active on the air. For his participation in the "MARCO to the Rescue" Bahamas incident in March 1972, he received the Public Service Award from the ARRL. In 1976 during the Guatemalan earthquake, he was in contact with YV5 AXU, a MARCO member in Caracas, Venezuela, and was given first hand information and reports on conditions in that stricken country, relaying messages to friends in New York State.

In an editorial published in Vol. 1, No. 1 of the MARCO Bulletin he stated "We in MARCO are twice blessed. We are human and trained in speech and communications and medicine. Through these gifts we can extend fulfillment of desires for health to all mankind."

Dr. Jack attended the convention in Hartford last fall, and his friends in MARCO, although noting his pallor and lack of an appetite, were given no indication that cancer was taking its toll within his body. His distinctive style of operation on the ham bands was evident on the MARCO and IMRA nets until the very end. He will be sorely missed by all of his friends in MARCO.

(Submitted by Joseph Boris)

● **Manassas, VA** – The "Ole Virginia Hams" Annual Hamfest will be held on June 3, 1979, at the Prince William County Fairgrounds. Tailgaters enter at 7 a.m. General admission at 8 a.m. General admission will be $3 per person, children under 12 free. Fantastic prizes, an FM Clinic, YL programs, and QSL Bureau programs will be featured. Indoor exhibit space for dealers and manufacturers is available; mail requests for information to: OVHARC, P.O. Box 1255, Manassas, VA 22110 Att: Sam Lebowich, WB4HAV.

● **St. Paul, MN** – Dakota Division's largest Swapfest and Exposition for Amateur Radio Operators and Computer Hobbyists will held on Saturday, June 2, 1979, at the Minnesota State Fairgrounds. Free overnight parking for self-contained campers, June 1st only. Talk-in on 16/76 and 52/52. Sell from your car in the giant flea market. Inside space available Many great prizes. Admission-$2.00. For further info or reservations for commercial space, write: Amateur Fair, P.O. Box 30054, St. Paul, MN 55175.

● **West Huntington, W. Va.** – The Tri-State ARA will be holding their 17th Annual Hamfest and Family Picnic on June 3, 1979, starting at 10 a.m., at the Camden Amusement Park. The FCC will administer amateur exams on Saturday, June 3, at Marshall University in Huntington. An informal banquet will be held that evening for those taking the exam. There will be prizes and a large flea market featured. For further info, write: TARA, P.O. Box 1295, Huntington, W. Va. 25715. Talk-in on 34/94 or 16/76.

● **Monroe County, MI** – The Monroe County Radio Communication Association's Annual Hamfest/Swap and Shop will be held on June 10, 1979, from 8 a.m. to 4 p.m., at the Monroe County Community College. There will be a donation of $1 at the gate. Plenty of free parking, free trunk sales and indoor table space will be available. A contest, an auction, commercial displays and more will be featured. For reservations and information, contact: Fred, WD8ITZ, P.O. Box 982, Monroe, MI 48161. Talk-in on 146.13/73 or 52 simplex.

● **Pottsville, PA** – The Schuylkill Amateur Repeater Association is sponsoring its 2nd Annual Hamfest on Sunday, June 17, 1979, rain or shine. Gates will open at 9 a.m. at Lakewoood Park, in Barnesville. Talk-in on 147.78/.18 and 146.52 simplex. Registration-$2 (XYL and children free). Tailgaters will be $1 additional. Indoor tables available at $2. For more info, write: S.A.R.A. Hamfest, P.O. Box 901, Pottsville, PA 17901.

● **Guelph, Ontario** – The Central Ontario Amateur Radio Club is sponsoring an indoor/outdoor Flea Market to be held on Saturday, June 9, 1979, from 8 a.m. to 4 p.m., at the Centennial Arena. Admission will be 75 cents per person, $2 for vendors. For further info, contact: VE3IZQ, 211 Elmore Dr., Acton, Ontario, Canada L7J 1T7.

● **Crown Point, IN** – The Lake County Amateur Radio Club is sponsoring its 6th Annual Dad's Day Hamfest on June 17, 1979, from 8 a.m. to 5 p.m., at the Lake County Fairgrounds. All indoors. Donation-$1.50 in advance, $2 at the door. Talk-in on 147.84-24. Ample parking, refreshments and a picnic area will be available. For more info and advanced tickets, write: LCARC, P.O. Box 1909, Gary, IN 46409.

● **Princeton, IL** – On June 3, 1979, the Starved Rock Radio Club's Annual Hamfest will be held at the Bureau County Fairgrounds. Lots of room for free swappers area and parking. Advance reservations at $1.50 if postmarked before May 20, $2 at the gate. Please include a large s.a.s.e. for map and motel information. Write: W9MKS/WR9AFG, Starved Rock Radio Club, RFD No. 1, Box 171, Oglesby, IL 61348, Phone (815) 667-4614, No collect calls please.

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HAL design experience now makes it possible to offer you an efficient, reliable, and cost effective terminal for your RTTY or CW station. Investigate the new DS2000 KSR from the people who KNOW HOW to build RTTY and CW equipment.® See how you can get great performance and save money too!

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Price: $449.00
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Optional 9" monitor: $150.00

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If you're looking for an RTTY demodulator with great performance on both the HF and VHF bands, take a look at the ST-5000 from HAL. The use of active filters with no phase-lock loop or 'single-tone' short-cuts ensure the kind of performance you expect. Full features in an attractive and conveniently small package make this demodulator a value that's hard to beat!

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Please send all reader inquiries directly

Our Readers Say

Give Me Liberty . . .

Editor, CQ:

The National Liberty Ship Memorial is attempting to contact as many people as possible who have ever served on Liberty ships, who have ever helped build them, or who are members of the family of those persons who have been involved with the Liberty ship especially during World War II. We are seeking stories, pictures, artifacts or anything that could be included in the collection to be maintained by the Memorial aboard the O'Brien when she eventually becomes the floating museum at Pier 3, Fort Mason, Golden Gate National Recreation Area, National Park Service, in San Francisco.

My part in the project is to locate and contact the men who were radio operators on any Liberty ship; but especially to locate the operators who served on the O'Brien during her short career from 1943 to 1946. She was under charter to the Grace Line during that time.

Interested parties should contact me c/o Jefferson Federal Savings and Loan Assoc., 1680 K St., N.W., Washington, DC 20006. Tel. (202) 833-3950. By contacting me, sorting out and filing of stories can be handled before filing them with the Memorial in San Francisco. However, direct contact can be made to: The National Liberty Ship Memorial, 215 Market St., Suite 532-533, San Francisco, CA 94105, Att: Mr. Barney Evans, Sec. of the Memorial.

Mr. Henry E. Johnson, K4IPY
Membor of the Board
National Liberty Ship Memorial
Washington, DC

A Shocking Experience

Editor, CQ:

I have been enjoying the old receiver articles (FB7-SW3-SW45) by William Orr and John Nagle, which bring back fond memories, and not so-fond-memories of the depression.

However, I wish to call attention to a lethal condition in some of these receivers. I hope some reader doesn't get booby-trapped.

The earphone jacks are live with high voltage. The frame of the jack which normally is grounded is inculated from ground with a fiber washer. The earphone jack in the FB7 is on the rear of the cabinet and you have to feel your way around to plug in the phones. You will get zapped if you touch any part of the phone jack or plug and chassis, cabinet, or ground simultaneously.

Incidentally, the above method was used by some constructors to meter transmitter plate current.

I found out about this condition in a curious way. I kept getting mosquito-bite like sensations on my cheekbones whenever I was sweating out (literally) rare DX. The phone cord would get moist with sweat and depending on how good a ground contact I made with my bare feet (in those days), these sensations would vary in intensity. I placed short pieces of rubber tubing on the front panel toggle switches for insulation as there was always some stray capacity which caused an unpleasant bite.

One day I happened to touch the terminals of my Frost earphones (Frost earphones had exposed terminals) and the cabinet. Needless to say, I hit the ceiling.

Katashi Nose, KH6IJ,
ex K6CGK
Honolulu, HI

Correction

'Tis A Puzzlement

If you tried the crossword puzzle last month ("Cranium Queries," pg. 35), it probably represented the most difficult challenge you've had in a long time. That's because the page was laid out by Mr. Murphy (of Law fame). Anyway, it's not as bad as getting some ham's call letters wrong.

If you're interested in the correct set of clues, here they are.

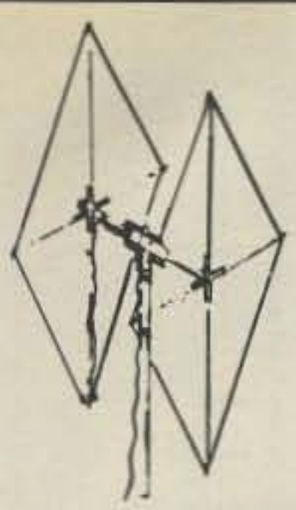
The solution (!) will appear next month.

Across

1. Having letters and numbers
4. System timer
5. A CPU has several of these
9. _____Logic Unit
13. A number of related bits of information.
14. Exclusive OR
16. Logic having a high impedance state

Down

1. Primary register of a CPU
2. Set of computer instructions
3. Abbreviations of an instruction set.
6. Permanently programmed memory chip
8. Volatile form of memory
9. A location in memory
10. Base sixteen
11. May be erased by ultraviolet light.
12. Another type of CPU register
13. Opposite of read
15. A Binary Digit



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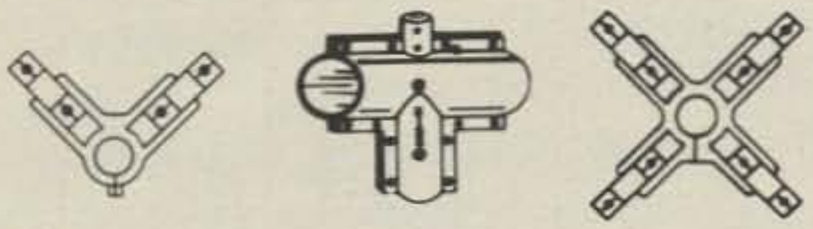

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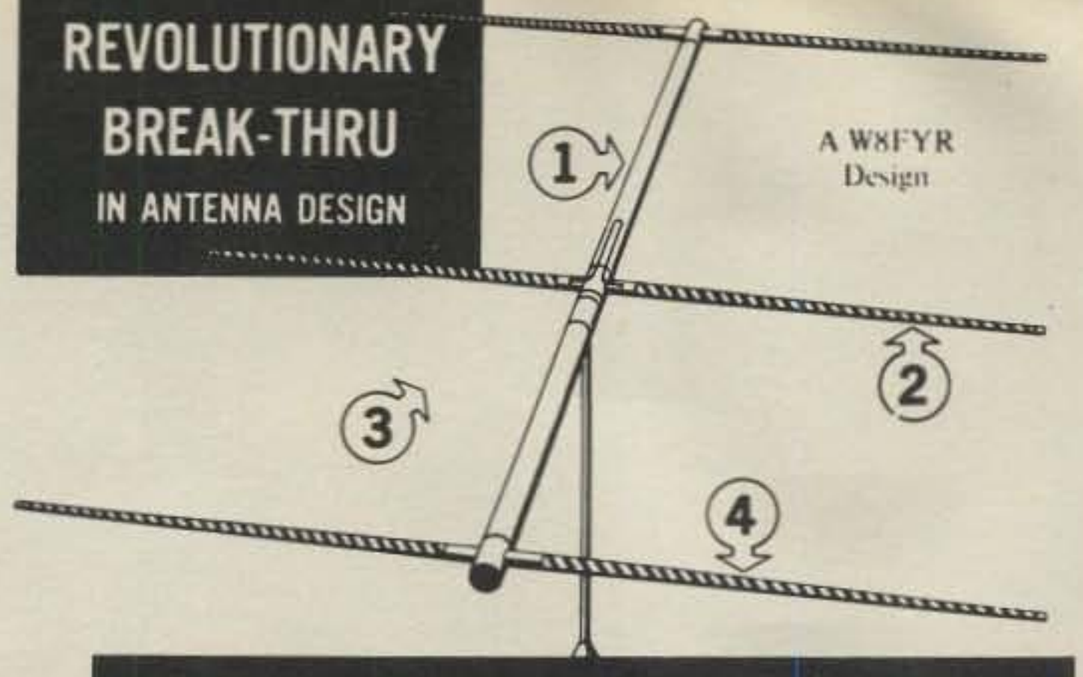
	(1)	1½" Boom to 1½" Mast T-Mount	$16.10
DL-2	(2)	2" Hub V-Supports	
	(1)	2" Boom to 1½" Mast T-Mount	$24.69
DL-3	(2)	3" Hub V-Supports	
	(1)	3" Boom to 2" Mast T-Mount	$40.64

QUAD MOUNT KIT

QM-1	(2)	1¼" Hub Spiders (Small Spider for VHF)	
	(1)	1¼" Boom to 1¼" Mast T-Mount	$11.95
QM-2	(2)	1¼" Hub Spiders (Heavy Spider for 6M & 10M)	
	(1)	1¼" Boom to 1¼" Mast T-Mount	$15.12
QM-3	(2)	1½" Hub Spiders	
	(1)	1½" Boom to 1½" Mast T-Mount	$16.10
QM-4	(2)	2" Hub Spiders	
	(1)	2" Boom to 1½" Mast T-Mount	$24.69
QM-5	(2)	3" Hub Spiders	
	(1)	3" Boom to 2" Mast T-Mount	$40.64

REVOLUTIONARY BREAK-THRU IN ANTENNA DESIGN



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3 Element 40 M	46 Lbs.	$589.50
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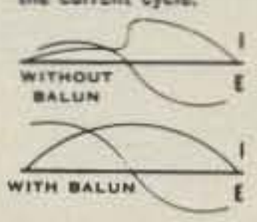
WORLD'S FINEST BROAD BAND BALUNS 1:1 Or 1:4 RATIO

Kirk Broad Band Baluns are designed for matching an unbalanced line, such as coaxial cable, to a balanced antenna to produce a symmetrical wave form of equal intensity from the current cycle.



Kirk Baluns provide the greatest breakdown insurance by use of mylar insulation between the tough poly thermaleze winding and the Ferrite Core and a final dip coating of low dielectric impregnation. Handle peak power of 2000 watts provided ratio error is low.

Unique in design, Kirk Baluns are produced in two distinctive models: One for Dipoles and one for Beam Antennas.

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5075-D	Dipole	3.4-52 mcs	2K PEP
5075-B	Beam	3.4-52 mcs	2K PEP
5075-LF	Dipole	1.7-10 mcs	2K PEP

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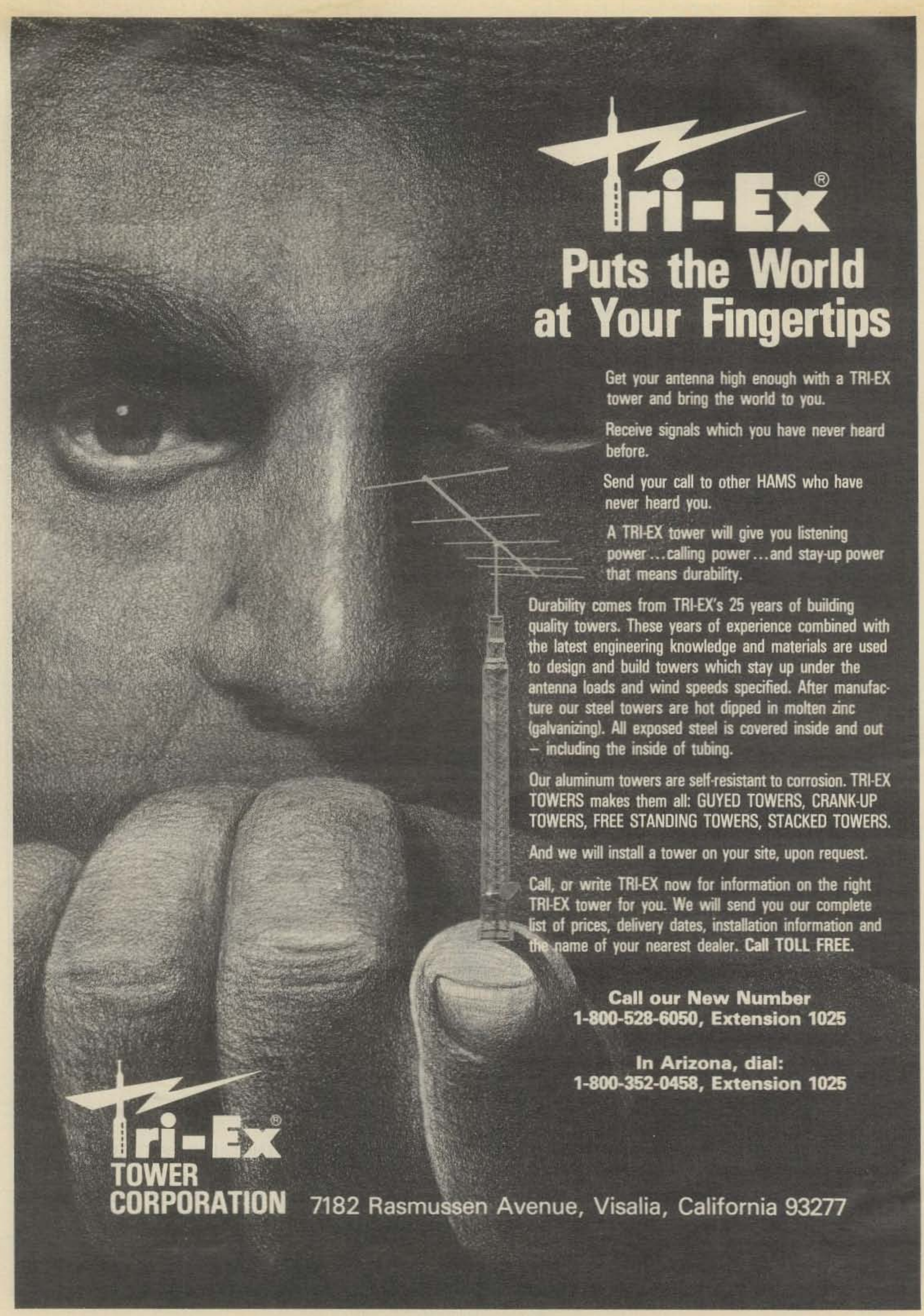

Introducing Kantronics' Field Day™
Morse Code/teletype reader and code speed display:

Kantronics' Field Day Morse Code/teletype reader and code-speed display reads code signals right off the air. Its powerful microcomputer system picks out signals, computes their speed, and reads even sloppy copy up to 80 words per minute!

1. Flys through the air with the greatest of ease.

Field Day is simple to use. You plug it into your station receiver just as you would a set of headphones.

Code and teletype conversations are converted from dots and dashes to standard alphanumeric text. The text advances across 10 big half-inch displays, and lab tests show that even the fastest CW is easily readable.

Field Day displays incoming or outgoing code speeds for you at the touch of a button. An accurate code speed-sampling program shows the speed right on the front panel. Everything is enclosed in a single, lightweight package that's small enough to fit in with the rest of your station.

2. Pay a little, get a lot.

In addition to a highly superior code-reading program and unique "on-board" speed display, **Field Day** has the specifications that make it a truly great code reader.

Modes: CW, RTTY and speed display. **Speed Range:** 3-80 WPM. **RTTY Speeds:** 60, 67, 75 and 100 baudot. **Code Display:** 10 alphanumeric displays. **Special Characters:** AS, AR, SK, BT, /, ?, (,), ", ', comma, period, colon, semicolon, "understood," "attention," and "error." **Filtering:** Active, 750 Hz center, 200 Hz bandwidth. **Input Impedance:** 1,000 ohms. **Power Requirements:** 117 Vac, 20 watts. **Dimensions:** HWD 3.44" by 8.50" by 9.25". **Warranty:** Limited, one year parts and labor. **Price:** $449.95 Shipments after 3/1/79.

3. C'mon, take a test drive.

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Shipping weight: 10 lbs./4.5 kg.

Height: 25 ft./7.5 meters

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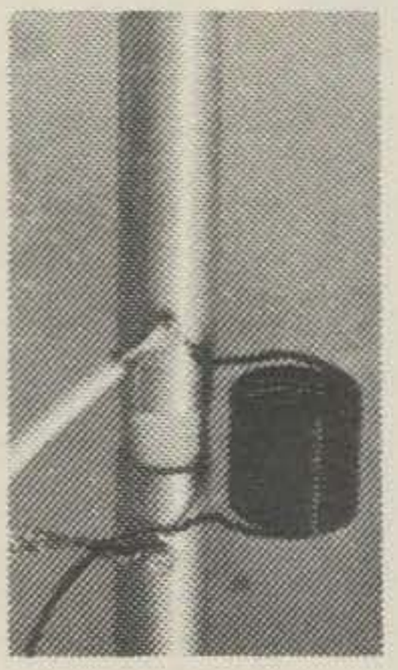

Model HF4V-II - - Automatic bandswitching 40-10 meters.

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.

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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.

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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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HF5V-S HF3V

HF4V-II HF4V-S

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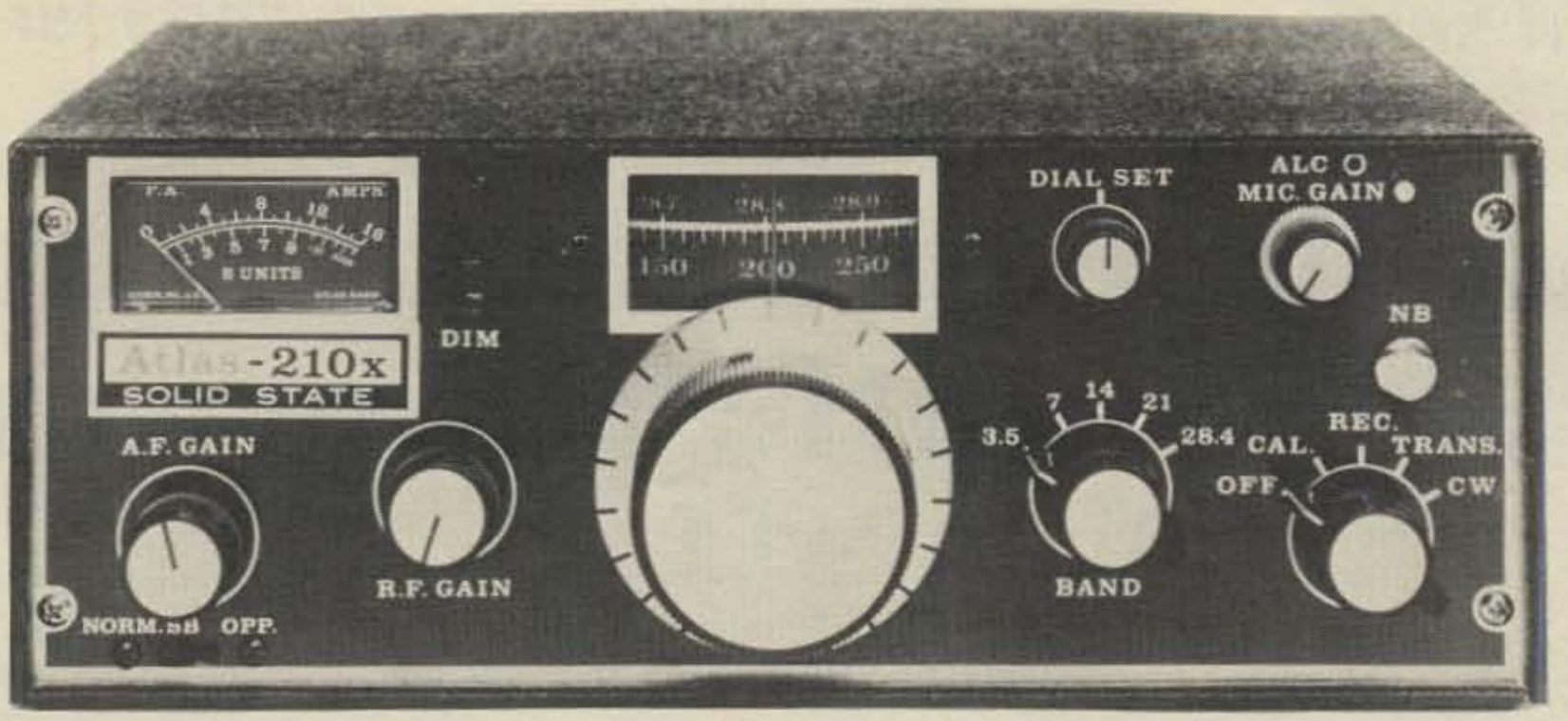

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210X/NB	Same as 210X except with NOISE BLANKER	810.00	645.00
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215X/NB	Same as 215X except with NOISE BLANKER	810.00	645.00
220-CS	110/220V AC Console Power Supply. Designed for plug-in of 210X or 215X	155.00	125.00
220-CS/VX-5	Same as 220-CS except with VOX/Semi-Break-In CW	210.00	169.00
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MT-1	Mobile Antenna Matching Transformer	29.00	23.00
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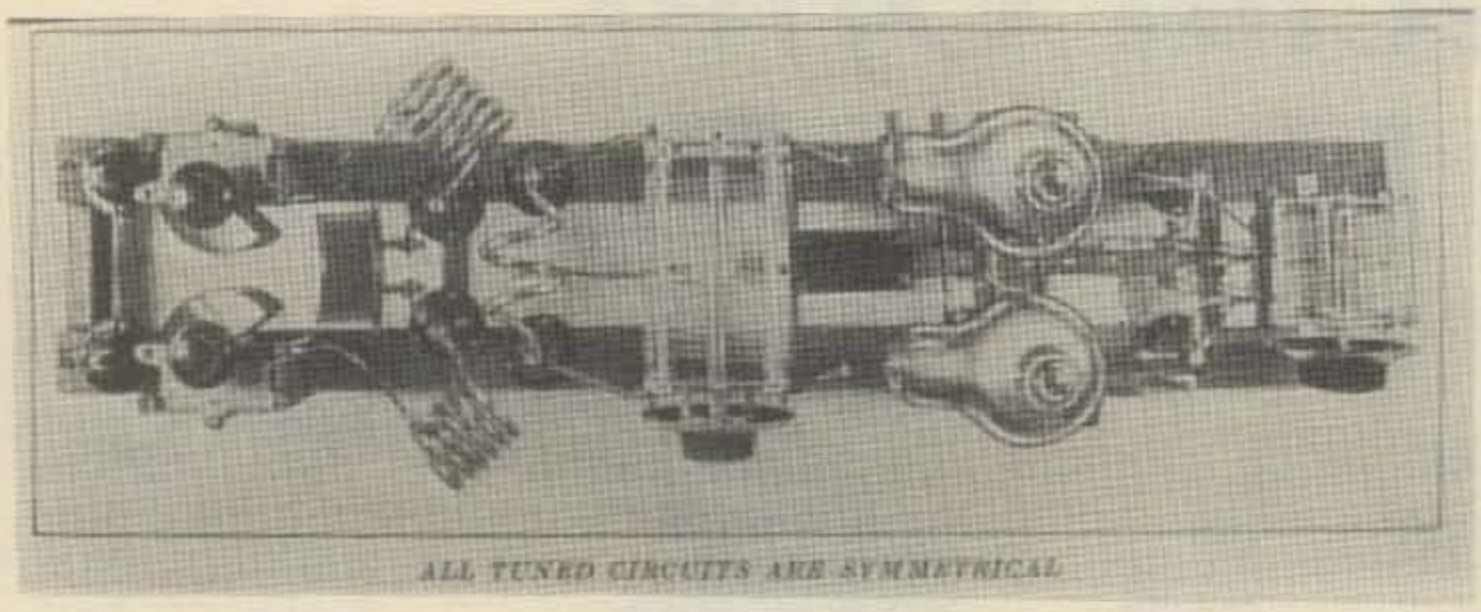
To some amateurs, schematic diagrams are nothing more than instructions for making connections. However, as author Cebik shows in this informative article, schematics can be road maps for not only wiring but servicing, circuit revision, design and learning.

Getting The Most Out Of Schematic Diagrams

Part 1

BY L.B. CEBIK*, W4RNL



ALL TUNED CIRCUITS ARE SYMMETRICAL

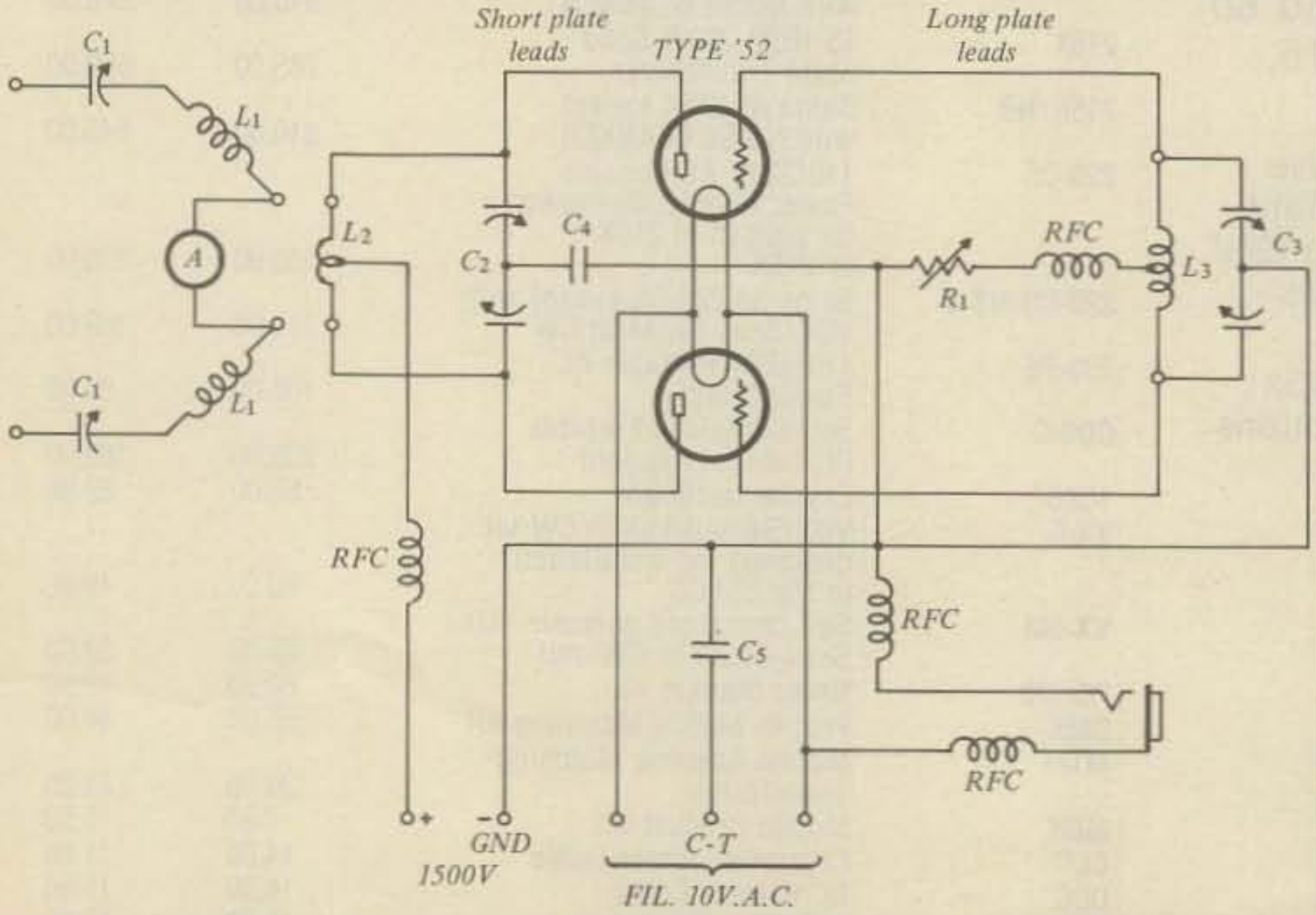


Fig. 1 - Schematic diagram and photograph of a push-pull amplifier which appeared in the A.R.R.L. Handbook *for 1930. The schematic has been redrawn to place circuit elements more directly under each of the components in the photo and thus show the relatively pictoral nature of early schematics. The original schematic is shown at the lower left.*

An intimate knowlegde of components and their schematic representations is imperative for amateurs who design, build and service their own equipment. The schematic symbols you see in electronics magazines and books were not, however, always the way you see them today. Here, L.B. Cebik takes you on an evolutionary and educational excursion through the meaning and functions of electronic symbols.

—K2VG

Schematic diagrams contain a wealth of information. Engineers, technicians, and teachers who use them nearly every day read them with ease and understanding. The ham who comes to amateur radio as a hobby and whose professional life is unrelated to electronics often stumbles over schematics. At first they appear to be little more than vague pictures of what is "inside the box." We slowly begin to understand that the pictorial representation shows how a piece of electronic gear is wired, but we often do not grasp the full significance of the interconnections and the components.

There is a systematic way to dig the wealth out of schematic diagrams. Where wealth is in the form of information, the way to dig is by asking the right kinds of questions. In fact, the way to approach everything we ex-

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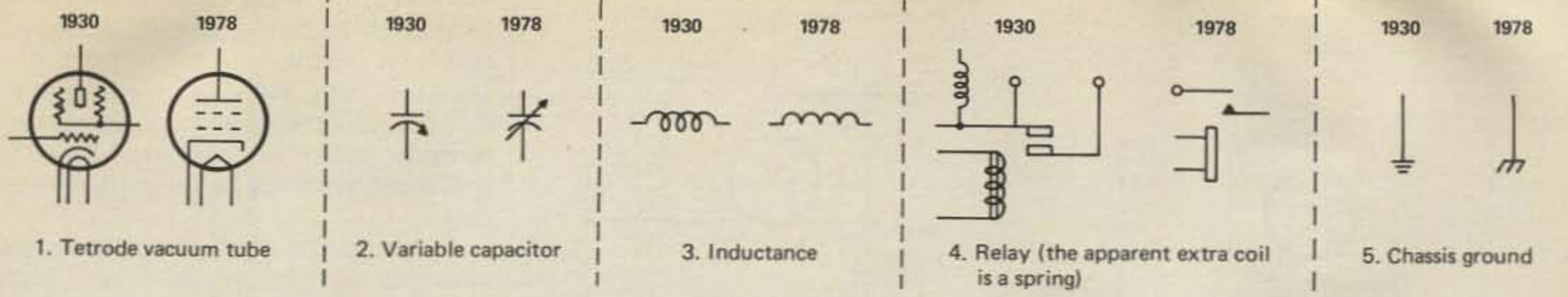
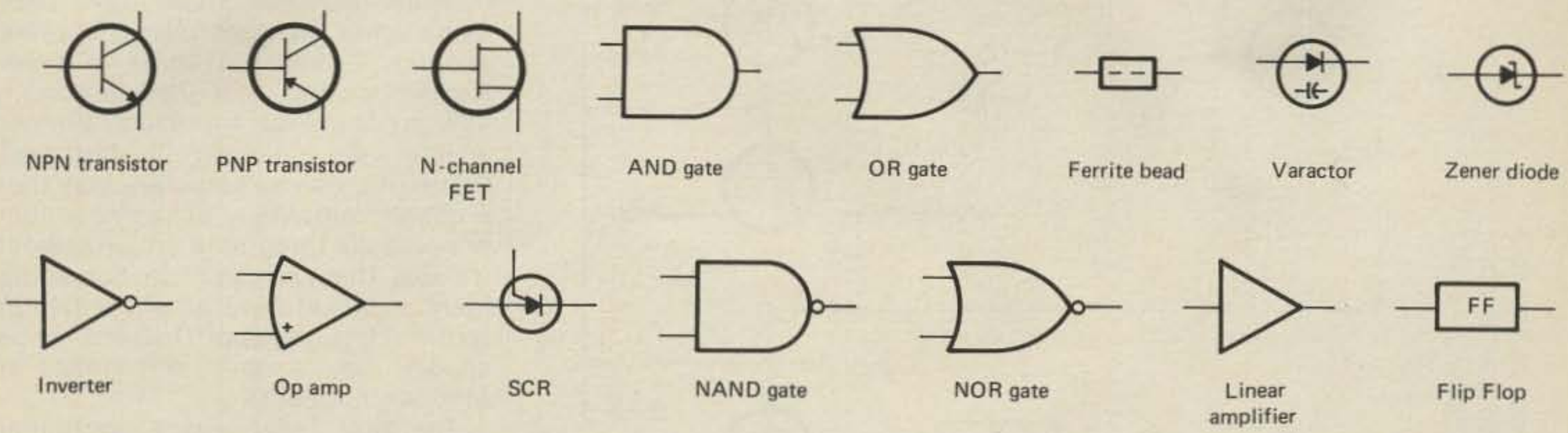


A. Some symbols which have changed their form in the last fifty years.



B. Some symbols that no one even dreamed of back in 1930. Notice that most of them involve solid state devices which emerged after 1947.

Fig. 2 - Samples from the history of schematic diagram symbols. Symbols used in the past are taken from the 1930 edition of the A.R.R.L. Handbook, *page 52, while current symbols come from the latest edition of the* Handbook *and other sources.*

perience is with questions; then, every situation becomes a learning experience. Amateur radio is no exception to this general rule, and reading schematic diagrams is a very good case in point. The right kinds of questions can turn every construction article in a ham magazine into a profitable reading adventure.

Given the tremendous variety of equipment and components which hams build these days, it would be impossible to codify precise questions for every variation of schematic diagram in one short article. However, there are some fundamental types of questions we can set down, and these will lead us, with a little experience, to formulating our own more precise questions. If you have come a little way into amateur radio and want to proceed further, this review of principles may be of help.

For What Do We Use Schematic Diagrams?

Schematic diagrams are not what they used to be. (But what is?). Long ago in the history of radio, they were a special form of pictorial diagram which showed not only the interconnection of components, but also the physical arrangement of parts. Fig. 1 shows a design from about 1929. Notice the neat symmetry in this drawing of a push-pull amplifier and compare it to the photograph. The builder of this transmitter followed the same symmetries in placing his parts on a wood frame. His wires, whether for r.f. or d.c. were neatly routed, well separated, and bent into crisp ninety degree turns where necessary.

Of course, we have learned some things since then. D.c. leads may be long, but r.f. leads should be as short and direct as possible. Parallel d.c. and r.f. wires make good capacitors and couple r.f. into the power supply. Shielding is now needed. The variety of available components gives a great many options as to component placement. In short, the schematic diagram and the actual piece of equipment became more and more physically dissimilar, although the schematic retained its function of showing how the parts are electrically interconnected.

As equipment deviated from the diagram, the symbols on the schematic needed to have less and less resemblance to actual components. For many people, the original reasoning behind the choice of symbols is lost. The zigzag, line used for a resistor seems odd to the new ham until he learns that in the early days of radio, wire-wound resistors were the standard: resistance was

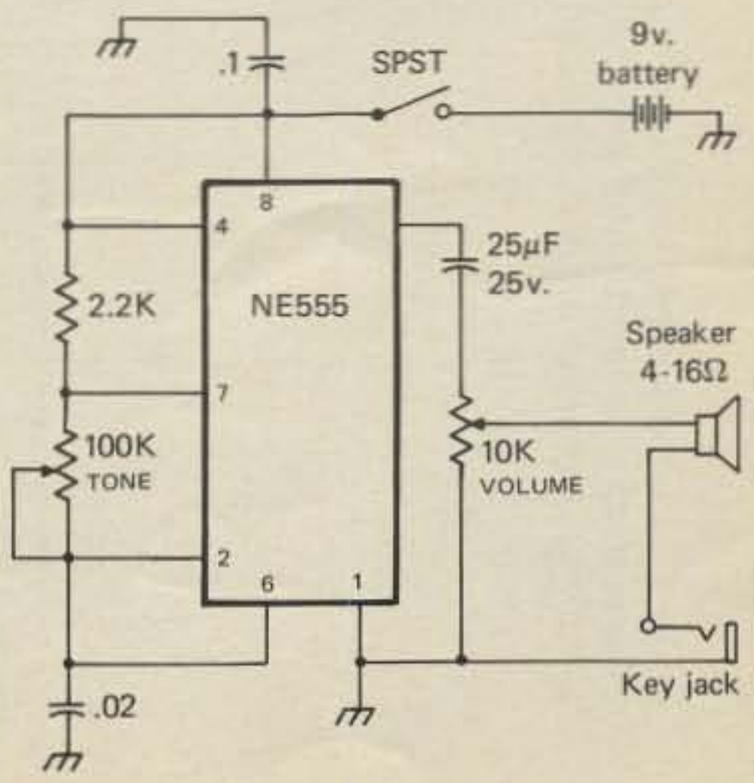


Fig. 3 - An example of a simple schematic diagram which we would be unlikely to analyze in terms of function, since the circuit seems to have a single function. The internal structure of the NE555 IC does contain several different functions in order to permit the device to serve as a code practice oscillator. However, we are likely to be more interested in construction note such as these: Do not alter the values of the 2.2k and 100k resistors or the .02 F capacitor, since these determine the frequency of oscillation. Other parts are not critical. Battery voltage can range from 5 to 18 volts. Since only the speaker output is keyed and the device is otherwise running, be sure to include the s.p.s.t. on-off switch. *Of course, the negative first note might lead us to read into NE555's and to try different values on the timing charts and formulas.*

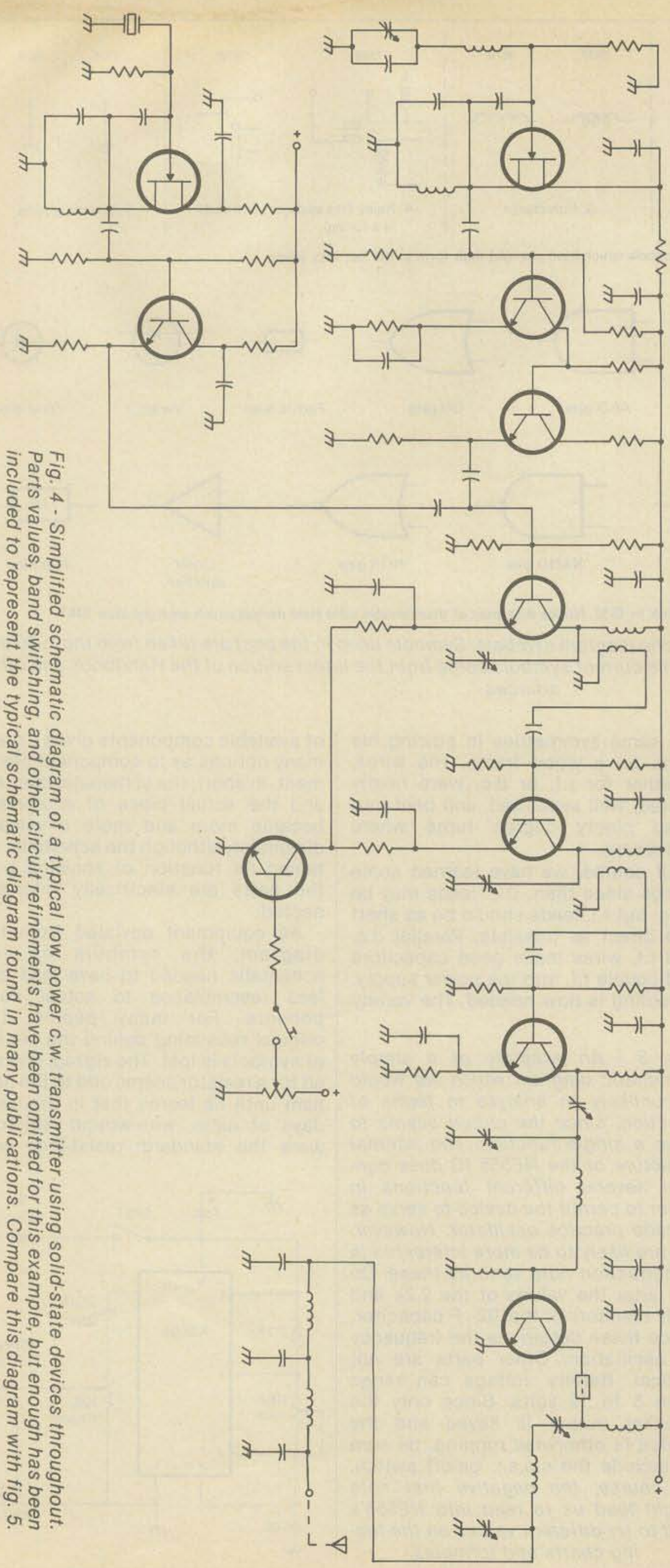


Fig. 4 - Simplified schematic diagram of a typical low power c.w. transmitter using solid-state devices throughout. Parts values, band switching, and other circuit refinements have been omitted for this example, but enough has been included to represent the typical schematic diagram found in many publications. Compare this diagram with fig. 5.

achieved by giving electrical energy a long path to cover, as the zigzag line implies. Now that composition resistors are standard, perhaps the symbol will change; some Europeans already use an oblong box for resistors, with the value written in the box.

Symbols for connectors have also changed over the years. Again, where once we showed one indiscriminate ground, we now distinguish earth and chassis grounds. There have been many other changes over the years, and fig. 2 presents some of them. Remember, too, that there are many new symbols to represent devices which were unknown in the past. Some of these symbols are less than a decade old. Many of the new components are integrated circuits. Since we use them as units in our equipment, schematics rarely show their internal circuitry, but instead show special box shapes with leads to other components.

The first task (and a continuing task) is to familiarize yourself with current symbols. Handbooks and occasional journal issues run a page showing the symbols used by the authors or editors. Although there are standard symbols nationwide, each publisher and many manufacturers will vary a bit from the standard in order to meet special needs. If you know all the basic symbols, the special ones will usually be easy to figure out.

Just because schematic diagrams have lost one function does not mean that they are less useful than they used to be. Here are some of the ways we can use schematics:

1. *To wire.* Schematic diagrams still show the interconnection of components in a piece of electronic equipment and thus they guide the wiring we do when building. Whether we etch a circuit board or use one form or another of point-to-point wiring, the schematic shows the way. Understanding the nature of components, the physical necessities of parts placement, the function of a lead (e.g., signal or d.c. path), and the type of interconnection needed are all required to do the job correctly, but the schematic is basic to the process.

2. *To service.* Maintaining a piece of equipment also requires attention to the schematic. Replacing bad parts obviously comes to mind, as needing a schematic to show us the value, rating, and function of the replacement component. However, service includes more than parts replacement. It also involves adjusting circuits to certain levels of operation. The schematic often gives signal voltages and other operational information useful in this process.

3. *To adapt or revise.* Hams often modify equipment in order to tailor it to their special and specific needs. To alter the circuitry of a piece of equipment requires that we know what the circuit was, as well as how the modification must fit in with the rest of the circuitry in the equipment. Here, the schematic is the basic point of reference.

4. *To design.* Many hams also design equipment for themselves. While many can develop circuits out of basic formulas, most of us design by adopting or adapting to our own needs circuits from many sources. Our home built equipment is a concatonation of tried and true circuits put together in a custom fashion. The design process is thus in large measure a matter of reading, selecting, copying, and originating schematic diagrams which embody our design objectives.

5. *To learn.* Reading a schematic diagram can be a pleasant end in itself. To attack a construction article and master every aspect of the equipment as shown in the schematic can teach us a great deal about more than just the author's prize project. It is a review and application of basic electronic principles. It is a survey of ordinary and special circuits. It is an introduction to new or special components. It is a lesson in equipment design. It is a help in evaluating commercially built ham gear. And much more.

These are not all the possible functions of schematic diagrams, but they are certainly enough to show the profit in learning to read them thoroughly and intelligently.

Asking the Right Questions

Back in the days when tubes reigned supreme, we used to read schematics this way: "What tubes did the author use? What pins of the socket connect to what elements? What circuits values did he use to make them function? How did he couple the circuits? What supply voltages did he use?" And that was about it.

Today, with the varieties of active devices available to the builder, the questions appropriate to tubes do not tell us all we need to know. We can perform a circuit function not only with active devices having different numbers, we can do the job with different kinds of devices, from tubes to discrete transistors, to integrated circuits (and integrated circuits include many types from digital to transistor arrays to op amps). Since solid state devices are generally inexpensive at low power levels, we no longer drive a device to its limits; hence, we may

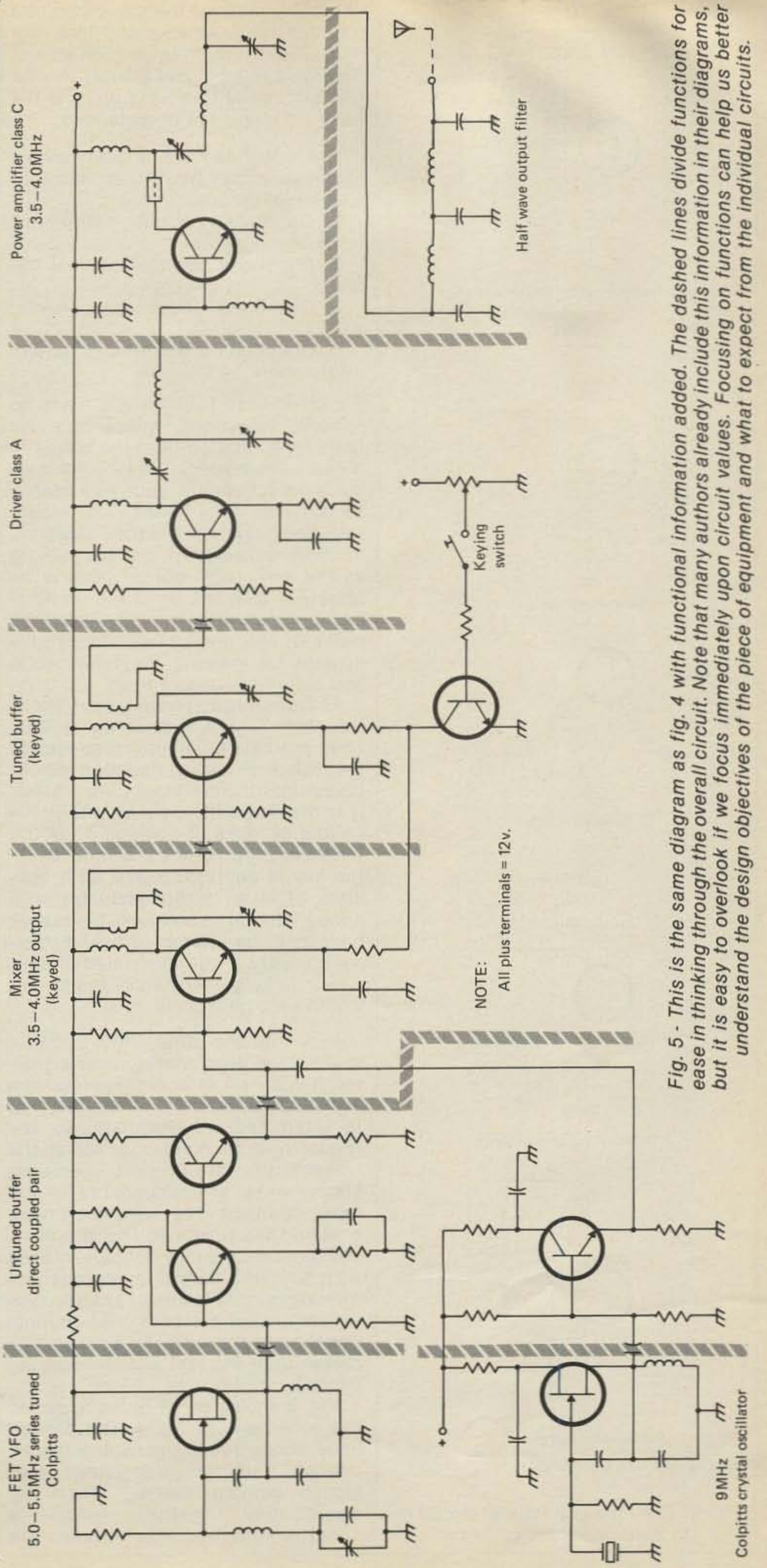
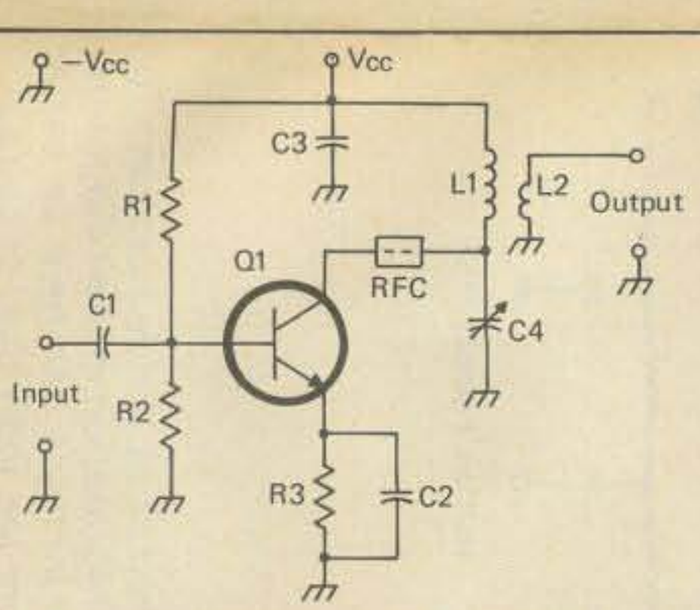
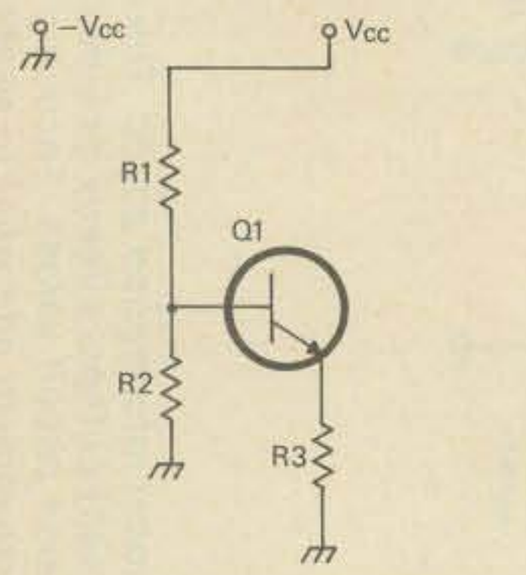


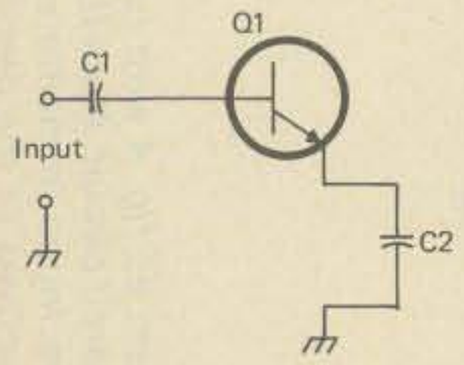
Fig. 5 - This is the same diagram as fig. 4 with functional information added. The dashed lines divide functions for ease in thinking through the overall circuit. Note that many authors already include this information in their diagrams, but it is easy to overlook if we focus immediately upon circuit values. Focusing on functions can help us better understand the design objectives of the piece of equipment and what to expect from the individual circuits.



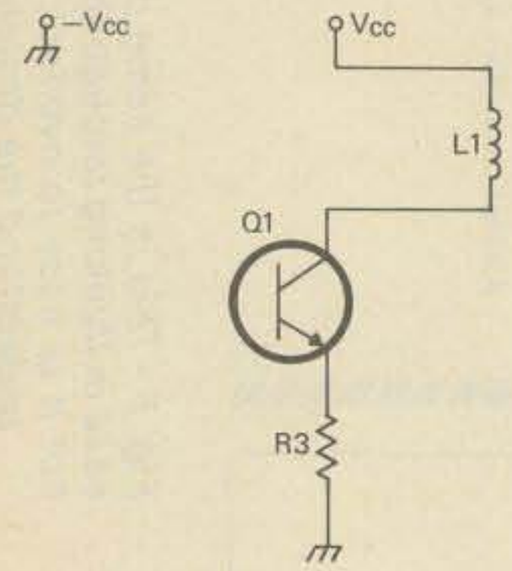
A. Typical transistor amplifier for low level r.f.



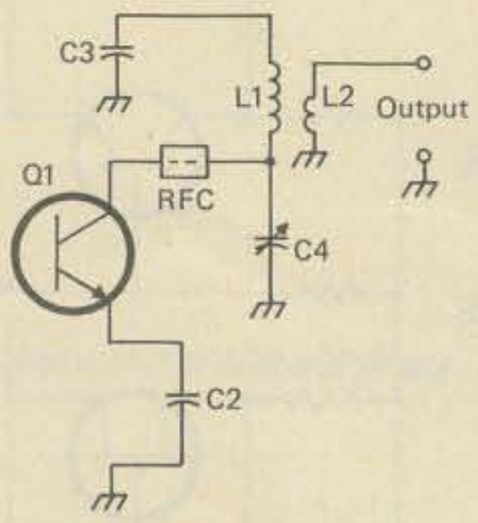
1. Base-emitter bias circuit



2. Signal input circuit



3. Collector-emitter bias circuit



4. Signal output circuit

B. Component circuits of "A" above

Fig. 6 - Example of a typical circuit into its component circuits.

use many more of them to perform a function more reliably and may use many more of them to perform a function more reliably and flexibly than in the past. What this adds up to is the need for a new set of questions.

The questions we should ask of schematics can be divided into just four initial groups:

1. Questions about equipment functions;
2. Questions about individual circuits;
3. Questions about components; and
4. Questions about supplementary information.

Each of these four groups leads to specific questions which help us gather information from the diagram. If you have a special reason for consulting a schematic, such as a search for a usable amplifier or v.f.o. circuit, then you need not take the categories in order. However, if you are looking at the schematic out of general interest, or to learn, or to file information for future reference, then the order of the groups will give you a system for keeping the information you acquire in usable form.

1. *Questions about equipment function.* Take a look at fig. 3. This code practice oscillator is so simple that this first type of question almost loses significance. In fact, we are likely to memorize the diagram with just a couple of looks. It obviously has the function of producing a tone when the key is depressed, and all it consists of is an audio oscillator with enough output to be heard. Unless we happen to be interested in the internal circuitry of the integrated circuit, a functional breakdown of the circuit would be out of place.

Fig. 4 on the other hand, shows a multi-stage solid state c.w. transmitter. It is drawn as it might appear in a construction article. The author, who is interested in describing to the reader how to build and adjust the transmitter for proper operation, simply links all components in the most compact way consistent with enabling the reader to find the interconnections. He may not label stages with anything more than component numbers. To understand the schematic, we must break it into functional parts according to what we can gather from the text and the drawing itself.

Fig. 5 shows some notes added to the schematic of fig. 4. The dashed lines divide functions. Some blocks contain only one transistor; other blocks contain several, since the group may together perform a specific function. Functions are noted for each circuit group. (Many authors do try to show this type of information in their schematics. If they do not, feel free to add information by making marks and notes right on the drawing.)

Functional information in a schematic diagram helps us to answer many kinds of questions. Here are a few samples. Does this unit have all the functions I would want out of it? For example, is the power output high enough for my needs? Do I need a v.f.o.? Are the functions performed in the way I need or want them to be? For example, do I want separate transmitters for each band or would bandswitching be desirable? Could the transmitter be modified easily to add other functions, e.g., a crystal controlled oscillator? Are the functional units going to be too complex and difficult to adujust and maintain?

Many of these questions have answers that are unique to each of us, depending upon individual interests and desires. Some of the questions concern wiring, servicing, modifications, or design. They all, however, help us learn a bit more about the equipment in question.

2. *Questions about individual circuits.* After breaking down a diagram into functional blocks, you are ready to tackle individual circuits. A circuit is nothing more than a complete path for electrical energy. Therefore, the idea of an individual circuit can be a bit misleading. We tend to think of active devices as the focal point of individual circuits. Each device, however, will contain at least four circuits. Fig. 6 expands one of the amplifier stages from figs. 4 and 5. In the fig. 6A, the entire circuit is shown as a unit, while 6B traces the four circuits: 1. the base-emitter bias circuit, 2. the signal input circuit, 3. the collector-emitter bias circuit, and 4. the signal output circuit. We can analyze each of these circuits, as well as the amplifier circuit as a whole.

In addition to the signal and bias circuit within this overall circuit, there are other circuit elements to find. Not every one of them will occur in each case. There may be control circuits to regulate operation of the amplifier, such as gain control. In some diagrams, the control element may be drawn at a considerable distance from the circuit, or the element may control several circuits simultaneously. Another circuit element which may be drawn at some distances from the circuit is the key or keying device. If you are tracing circuit paths, be sure to include them.

(To be continued)

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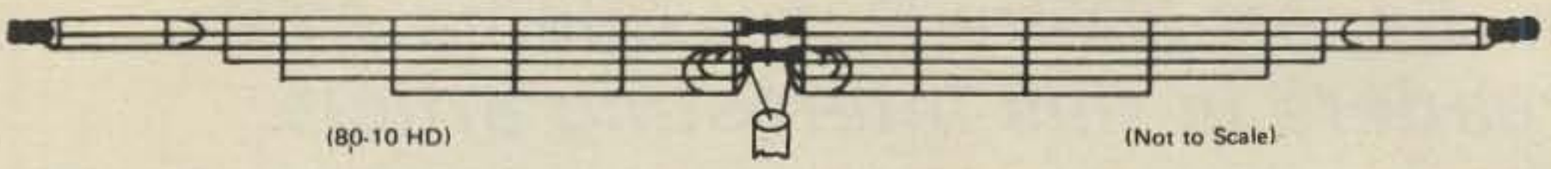

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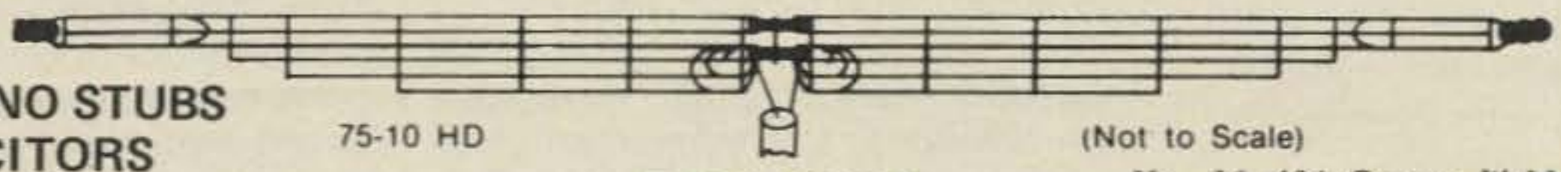

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MOR-GAIN HD DIPOLES . . . ● One half the length of conventional half-wave dipoles. ● Multi-band, Multi-frequency ● Maximum efficiency - no traps, loading coils, or stubs. Fully assembled and pre-tuned - no measuring. no cutting. ● All weather rated - 1 KW AM, 2.5 KW CW or PEP SSB. ● Proven performance - more than 15,000 have been delivered. ● Permit use of the full capabilities of today's 5-band xcvrs. ● One feedline for operation on all bands. ● Lowest cost/benefit antenna on the market today. ● Fast QSY - no feedline switching. ● Highest performance for the Novice as well as the extra-class op.

EXCLUSIVE 66 FOOT, 75-10 METER DIPOLES

● All models above are furnished with crimp/solder lugs. ● All models can be furnished with a SO-239 female coaxial connector at additional cost. The SO-239 male coaxial cable connector. To order this factory installed option, add the letter 'A' after the model number. Example: 40-20 HD/A. ● 75 meter models are factory tuned to resonate at 3950 kHz. (SP) models are factory tuned to resonate at 3650 kHz. See VSWR curves for other resonance data.

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80-40 HD	80/40 & 15	57.50	41/1.15	69/21.0
75-40 HD	75/40	55.00	40/1.12	66/20.1
75-40 HD (SP)	75/40	57.50	40/1.12	66/20.1
75-20 HD	75/40/20	66.50	44/1.23	66/20.1
75-20 HD (SP)	75/40/20	66.50	44/1.23	66/20.1
75-10 HD	75/40/20/15/10	74.50	48/1.34	66/20.1
75-10 HD (SP)	75/40/20/15/10	74.50	48/1.34	66/20.1
80-10 HD	80/40/20/15/10	76.50	50/1.40	69/21.0

NOVICE LICENSE OPERATION. The MOR-GAIN HD Dipole is the ideal antenna for the new or Novice operator. As the Novice progresses to higher license classes, he can easily re-tune the HD Dipole to the new frequencies of his higher frequency privileges. The HD Dipole is thus a one-time investment. HD Dipoles are available for all Novice frequencies.

LEAST COST. Dollar for dollar, the HD dipoles are the highest performance, least cost multi-band antennas on the market today. For example: the 5-band 75-10 HD dipole costs less than $15.00 per band - an unbeatable low cost.

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Above Models furnished with lug terminations. Cap-female SO-239 connector assembly – $3.75 additional. Include $2.50 for Shipping & Insurance with your order.

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CIRCLE 34 ON READER SERVICE CARD

Of the several "specialized communications techniques" available to amateurs, perhaps none is so exotic (and held in such awe) as television. Expert Henry Ruh explains ATV to CQ's readers in this interesting article.

An Introduction To Slow Scan Television

BY HENRY RUH*, KB9FO (ex-WB9WWM)

In addition to being among the most active ATVers in the world, Henry Ruh is the Publisher of A5 Magazine. *He is also the editor of "ATV in a Nutshell," a book which tells "everything you need to know to build and operate your own ham TV station." —K2VG*

Thousands of hams around the world are enjoying SSTV today. Here is how you can get started and what you need to know to have fun.

Technology has moved forward in slow scan to the point where older equipment is now appearing on the used equipment shelves and in flea markets. While the newer solid state digital scan converters have many advantages, the newcomer can save a lot of bucks and enjoy himself just as much using the older gear. In addition new equipment is being marketed which adds to the enjoyment of SSTV as never before. New horizons including different scan rates for motion and color are being developed by Don Miller, W9NTP, and others.[1]

Contrary to popular opinion, all licensees, except novice, have slow scan priviliges. The technician class license holder can enjoy SSTV on 6, 2, or higher in the phone portions of the bands. The general class license holder can also enjoy SSTV on 10 meters, which with the coming of the sun spot peak, is wide open to many parts of the world, making globe hopping SSTV on ten easy. Advanced and extra class holders also enjoy SSTV on subbands of the other h.f. bands. Ten meters is particularly important since this is where the medium scan systems are being tried by special permit, which will allow motion and color systems in the future.[2]

The real popularity in SSTV is found on 20 meters around 14,230. Here the SSTV "gang" are active all the time, including two weekly nets. The Thursday 2300Z net is hosted by Tom, N7AON, in Layton, Utah, and is primarily for those who have questions or problems about SSTV. "If we spend two hours getting someone's rig going so they can send pictures the next day, we will spend two hours fixing the rig," says Tom. The Saturday net at 1800Z is the news and DX forum.

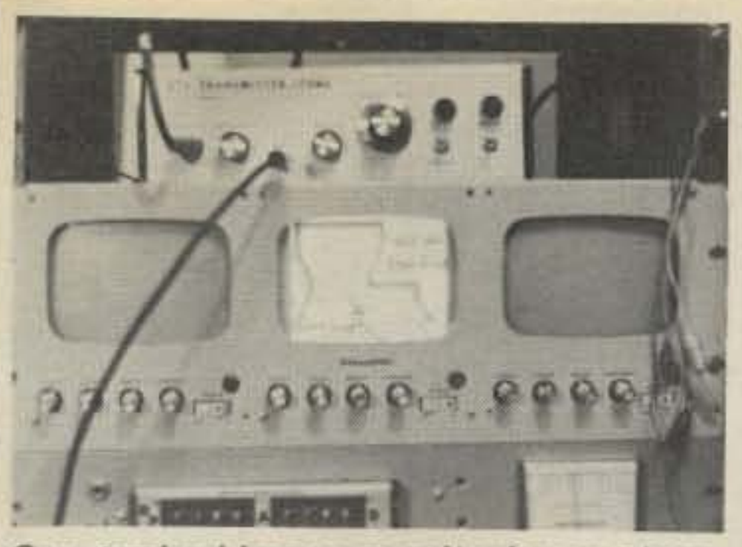
The other popular SSTV frequencies center around 3845, 7220, 21340, 28680 kHz. On v.h.f., there are pockets of local activity on 6 and 2 meters, with local nets meeting at various times. Check your local area for info on these. Fast scan stations also use SSTV on 436.00 when conditions do not permit full bandwidth transmissions.

*Box 1347, Bloomington IN 47402

Typical SSTV picture quality...and a typical subject!

This picture was received through some fairly bad QRM; but note that the subject is clearly distinguishable despite the interference.

Despite the higher detail quality in the picture, this one sent from K6SVP comes through with clearly identifiable characters.



One typical home monitoring system. Two blank monitors are used to view the camera video (right) and the transmitted signal (left). The center picture is "closed circuit quality" from an SSTV signal on 20 meters.

Getting on the air with SSTV is easy since you have most of what you need right now. Your regular s.s.b. transceiver is used in the normal manner as you would for voice. The additional equipment to transmit and receive the picture information simply connects to the speaker and microphone connections of your rig. They do not interfere in any way with the normal operation of your rig, and may be left connected even when not using SSTV.

Exactly how the extra equipment connects depends on which of two present technologies you use. The older system uses a separate slow scan camera and slow scan monitor. The older P-7 (the designation for the type of phosphor used in the CRT) monitor has an audio input which connects to the speaker terminals of your rig. Pictures are written by a bright scanning line, and the after-image or persistance image, represents the picture information. The special slow scan camera used with this type of monitor has an audio output which connects to the mic audio input of your rig. It can only be used to send pictures of still photos, or still objects because of the method in which it generates a slow scan picture from its vidicon and video circuits. More on this later.

The newer analog and digital scan converters comprise a single magic box which has connections to and from your transceiver. With the scan converter, you use *any* regular TV set and TV camera. An r.f. modulator is used to convert the fast scan video output to an r.f. signal at channel 2 to 6. The advantage is that the scan converter snatches an image and holds it in memory, so the image need only be still for 1/60 of a second. This allows live pictures without posing. It also allows you to set up the next shot while the first is being sent, as you can observe the camera signal without disturbing the picture in memory.

The SSTV signal is a simple frequency modulated system.[3] The audio tones range from 1200 to 2300 Hz. A 1200 Hz tone represents the sync information, and 1500 represents TV black, while 2300 Hz represents TV white. The frequencies and between 1500 and 2300 represent the various shades of gray in the picture. A simple discriminator circuit on the receive end converts these frequencies back into the correct video information. Because the SSTV signal is an audio signal, you can send a picture anywhere you can transmit your voice.

The difference between the old and new technology is in how the video information is changed from one scanning system to the other. In the older system the information is directly converted, by sampling or orthogonal (right angle) scanning of the picture, or scanning at a reduced rate to provide an output signal which is in the audio range. On receive, the signal is used to modulate the CRT much as one would look at an audio signal on an oscilloscope, with the addition of the Z (intensity) axis modulation. This was a simple and direct system and did not really involve any changes in the basic signal from beginning to end.

The new system actually produces a new representative signal by scan conversion methods to construct the audio signal from the video signal and to reconstruct the video from the audio at the receive end. This is done by using a memory system, now commonly done with digital memory in IC chips. The fast scan picture is read in at the normal scanning rate. The memory is written at the slow scan

The QRM level during the reception of this picture was 20 dB above the desired signal. Interference is more severe from the nearby voice signal which was splattering over. The offending station was about 10 kHz wide and had products throughout the band; but, as you can see, the picture came through. One of the nice things about SSTV and digital scan converters is the ability to punch through under all but the worst conditions.

By adjusting the WIDTH control on a Robot, *you can cause the incoming picture to distort, as in the bottom half of this cat's picture. This can provide a new expression to a character's face.*

rate, but read out on your TV at regular scanning rate. This eliminates the flicker, and opens the avenues to modern signal processing and modification techniques not possible in the older system.

The scan converter memory performs all these tasks. All you need to do is to supply the camera signal and a TV set to watch it on. The older P-7 systems are still available today either as used equipment, or new from Venus Scientific[4] the digital systems are available from Robot[5] which also marketed the P-7 system and an analog scan converter system known as the model 300, and Thomas[6] who markets a scan converter and ancillary items.

In addition to commercial equipment, there have been a great number of build it articles on slow scan converters, cameras and monitors as well as two books on SSTV, one by Don Miller, W9NTP[7] and one by Dave Ingram, K4TWJ[8]. These detail the many areas I am only touching on in this article. Whether you build or buy is determined by your skill and funds. The commercial digital scan coverters sell for $800 (Robot) to $945 (Thomas) and the older type cameras and monitors sold for $200-$500. An SSTV keyboard presently sells for $525, which allows you to title your pix or send graphic messages. The builder can save a lot of money by building these items himself. A typical W0LMD keyboard[9] can be built for about $150, and a reasonable scan converter for fast to slow can be built for as little as $100.[10]

The addition of a home computer also allows conversion only, many additional features such as graphics, and other related items to be added to your SSTV system. The SWTP and Digital Group computers have been successfully interfaced with SSTV systems allowing a greater varitey of programming for the SSTV station.

What can you show? Anything!

No - 29 - 30

A keyboard will also allow you to title your pictures so you don't have to break a series of video transmissions to ID or explain each picture as you go along. This makes for an easier and smoother QSO.

Shots of the shack, equipment, pictures, diagrams, visitors, XYL, jr. ops. Anything you can see with the camera, indoors or outdoors can be transmitted. Many ops record whole series of pix onto an ordinary cassette recorder for later playback. The tapes are also frequently worked with many rare stations now enjoying slow scan. Even VR6TC, Tom Christian of Pitcarin Island, will be on SSTV, possibly by the time you read this, as an entire SSTV station has been sent to him.

How to hook it up. In all cases, the equipment you use for slow scan connects to the same two places in your h.f. rig. The speaker terminals, and the mic input. The signal you send out is audio, so a switch or plug simply selects your mic or the SSTV signal on transmit. On receive, you need only bridge the SSTV monitor or scan converter input across the speaker leads. The units employ a high gain input with a tough limiter circuit, so volume level is not important. If you can hear the SSTV signal, the converter will decode it and present a picture.

In transmitting, you need to remember that you are sending out a 100% duty cycle signal, just as an RTTY signal. If your transmitter uses the cheap TV sweep tubes for finals (6KD6, 6JG6, etc.) you will need to limit your power to a level your unit can safely handle, usually 20-40% of its s.s.b. power. If your unit uses regular rf transmitting tubes (811, 8122, 6146, etc.) you still need to run within the ratings, but will enjoy a higher operating level. If your rig is solid state, you will likely be able to run full power or only slightly less. In any event, consult the manufacturer's instruction book. As long as you stay within the ratings of the transmitter you will not damage your transmitter operating SSTV.

Power is not necessary for SSTV either. Although QRM is always a problem on the h.f. bands, international (ocean hopping) can be done with 50 watts. I can say that having worked Portugal, Italy and Columbia on SSTV on 20 meters using 45 watts and a 40 (forty) meter dipole at 16 feet!

In the meantime, I'm happy to be on the bands and swapping pix. Be seeing you on SSTV! Our motto: Hams should be seen as well as heard!

Operating standards. Slow scan operates on one basic set of standards much as regular broadcast TV. However, just as there are different scanning systems from country to country, different scanning systems

As these four pictures show, international SSTV is just as easy and good as local/transcon SSTV. The pictures exhibit nearly perfect reception during a two-way QSO on 20 meters on a Saturday afternoon. The antenna was a 40-meter dipole at 16 feet!

Again, ghost images from multipath. The stations were about 150 miles apart on 20 meters, so some backscatter or similar multipath problem is likely the cause for the multiple image problem.

have developed in SSTV which take advantage of or provide some specific ability not found in the "normal" system.

The basic system uses 128 lines per picture, and a square aspect ratio (format) with one picture every 8 seconds. This is the type of signal you will encounter 95% of the time on the airwaves. There is also some interest in a higher resolution system which uses 256 lines and 16 seconds per picture. The transmitted signal is the same in both instances, with the audio frequencies denoting sync, black,white and shades in between being the same: 1200 Hz for sync, 1500 Hz for black, and 2300 Hz for white. The difference is in the scanning rates. The latter, 256 system, being twice as slow, but offering 4 times as much picture detail. For convenience sake, and because of the digital scan converters, it is easier to think in terms of picture elements or pixels. In a "regular" SSTV signal, there are 128 lines with 128 pixels per line or four times as much (2 times lines, 2 times pixels = 4 times total pixels per picture). You can receive the 256 line system on your P-7 monitor by simply halving the scan rates of the horizontal and vertical scanning signals. In a digital scan converter, it takes four times as much memory. However, by turning the WIDTH control fully couter clockwise, you can reduce the imcoming picture enough to see most of the 256/256 pix, displayed into a 128/128 format.

This is done because of the way in which the scan converter works.

The scan converter has a sample rate in which it takes a sample and puts it into one of the 128 "holes" or storage bins of the memory for each line. By slowing down the sample rate, you take 1 of 3 or 2 of 5 or some other ratio of incoming "bits" for each "bin" in your memory. When you run out of memory cells, the system

An SSTV keyboard, such as the W6LMD design, can add a great deal of enjoyment to SSTV. It allows you to QSO totally in video, or quickly return ID and verification of reception by calling the other station in video with their call or yours.

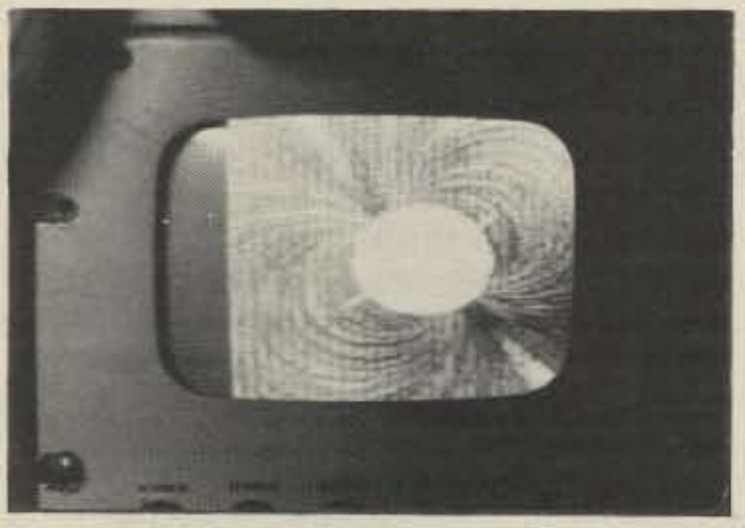
simply throws away the remaining information until a new sync pulse arrives, when it starts over in a new row again. So you can shrink the 256 line system towards the upper left corner of the memory page, and thus see most of the 256 line picture on your 128 line system. Neat!

However, you need a 256 line transmission system to send to a 256

An attractive "CQ" helps snare new stations.

line station. Usually, though, they will be glad to see your 128 line pix anyway, so don't feel you need a 256 line system right away.

There are other systems used by special permit on the 10 meter band which use a 35 Hz bandwidth, and high scan rates, called medium scan. Developed by Don Miller, this system



A graphic picture sent by N7AON in Layton UT, (operator is Tom). He heads up the Thursday night technical net.

promises to be able to provide motion or color and thus add some "liveliness" to the SSTV scene, on 10 meters, which would allow world-wide motion video. An exciting concept. Needless to say, it will take a few years for these advanced systems to reach a point where we average hams can enjoy them.

Contests! There are at least two SSTV contests world-wide every year. One sponsored by the U.S. hams, and one by the European hams. Both offer an opportunity to work new countries and win a few awards. The Italian contest usually offers a small prize of a magazine subscription. Also in 1979, the Italians offered a prize for the best home brew station used in the contest of some nice TV equipment.

Awards! Besides WAS SSTV, DX-CC SSTV, there are several other applicable awards. A5 Magazine also offers a master scanner award.[11] To qualify for this multi-level award you need to work five stations on each of five bands (25 contracts), working up to 10 stations on each of ten bands!

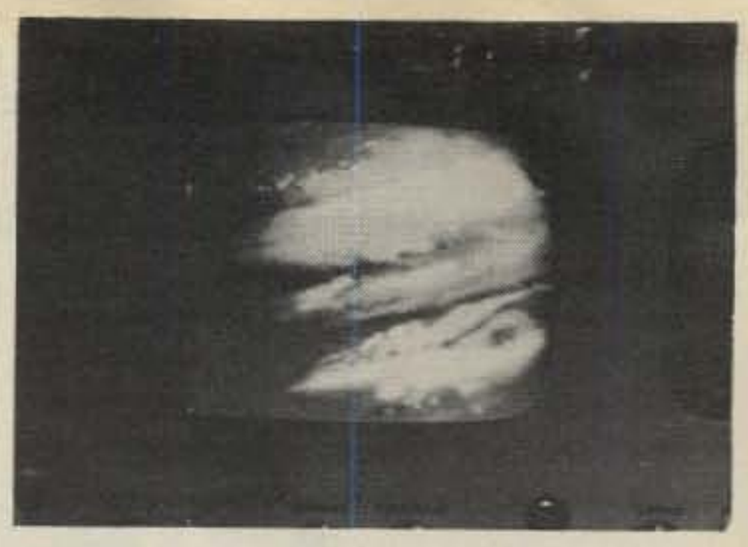
Home life? Since I got on 20 meters

Dazzle them with your graphics to get attention!

the wife has taken an interest in ham radio. Before then she wasn't interested at all! Now she can show pictures of her Arabian horses, harmonica, and herself.

SSTV is a real fun aspect to a great hobby.

You can get more information from regular sources such as *A5 Magazine*, or regular SSTV columns in *CQ*, *World Radio News*, and some sportic coverage in the other magazines. Or, simply join the two SSTV nets on 14,230. The Thursday night net is on 14,230 at 2300Z. Net control is Tom, N7AON, in Layton, Utah, and is basically to help those who have problems or questions about equipment. The Saturday net is at 1800Z on 14,230. Net control is W1JKF, Brooks and WD4DCW, Stan, and is a general news and operating net. These are also good times to snare a new country or state! Lastly, simply call SSTV CQ on 14,230. There



Watch the Jupiter and Saturn pictures sent out by W6VIO at the JPL in Pasadena CA. K6SVP (Dick) and others are on every week with new pictures from outer space, and are usually weeks ahead of other media. Some color SSTV pictures are available to receive them (darn few right now, but it's growing).

is always someone around to answer your questions and lend a hand.

Footnotes

[1]W9NTP, "Color and Motion SSTV Systems - Medium Scan TV", *A5 Magazine*, November, 1978

[2]"Medium Scan TV on 10 Meters", *A5 Magazine*, January, 1979

[3]"Slow Scan TV", *A5 Magazine*, September, 1969

[4]Venus Scientific Corporation

[5]Robot Research, 7391 West Convoy Court, San Diego, CA 92111

[6]James Thomas Industries, P.O. Box 1056, Tucker GA 30084

[7]*Slow Scan Television Handbook*, Miller and Taggert, 73 Publication

[8]Ingram, *The Complete Handbook of Slow-Scan TV*, TAB Books, Number 859

[9]"W0LMD SSTV Keyboard", *CQ*, October, 1972

[10]Takao Yabana, JA0BZC, "Build a Digital Scanconverter for Less Than $100", *A5 Magazine*, March, 1979

[11]"Master Scanner Award", *A5 Magazine*, November, 1978

[12]*Amateur Television* Magazine, Box 1347, Bloomington, IN 47402. $6.50/yr. US/Canada, $9/yr. DX

Here, "ghost" effects of multipath are clearly seen.

Did you know that the world's first integrated circuit was produced in 1926? Over 1,000,000 of these little gems found their way into customers' homes in the form of radios the very first year.

The World's First Integrated Circuit

BY WILLIAM A. GOLD*

Mr. Gold originally described the OE333 in the January 1976 issue of the Australian magazine ***Electronics.*** *- K2EEK*

To most of us, integrated circuits are a fairly modern development. They are the familiar looking "beetles" or "tin hats" which have revolutionised the electronics industry in recent years, and will have an even greater impact in the future.

The modern era of integrated circuits began in 1958 when prototype microcircuits were developed by both Texas instruments Inc., Dallas, Texas, and Westinghouse Electric, Youngwood, Pennsylvania. These prototype ICs were rather crude devices, consisting of separate semiconductor chips carrying transistors, diodes and resistors, all mounted on a common header. Since then manufacturing techniques have improved enormously.

**20 Kingston Mews, 8 Giles Street, Manuka, A.C.T. 2603, Canberra, Australia.*

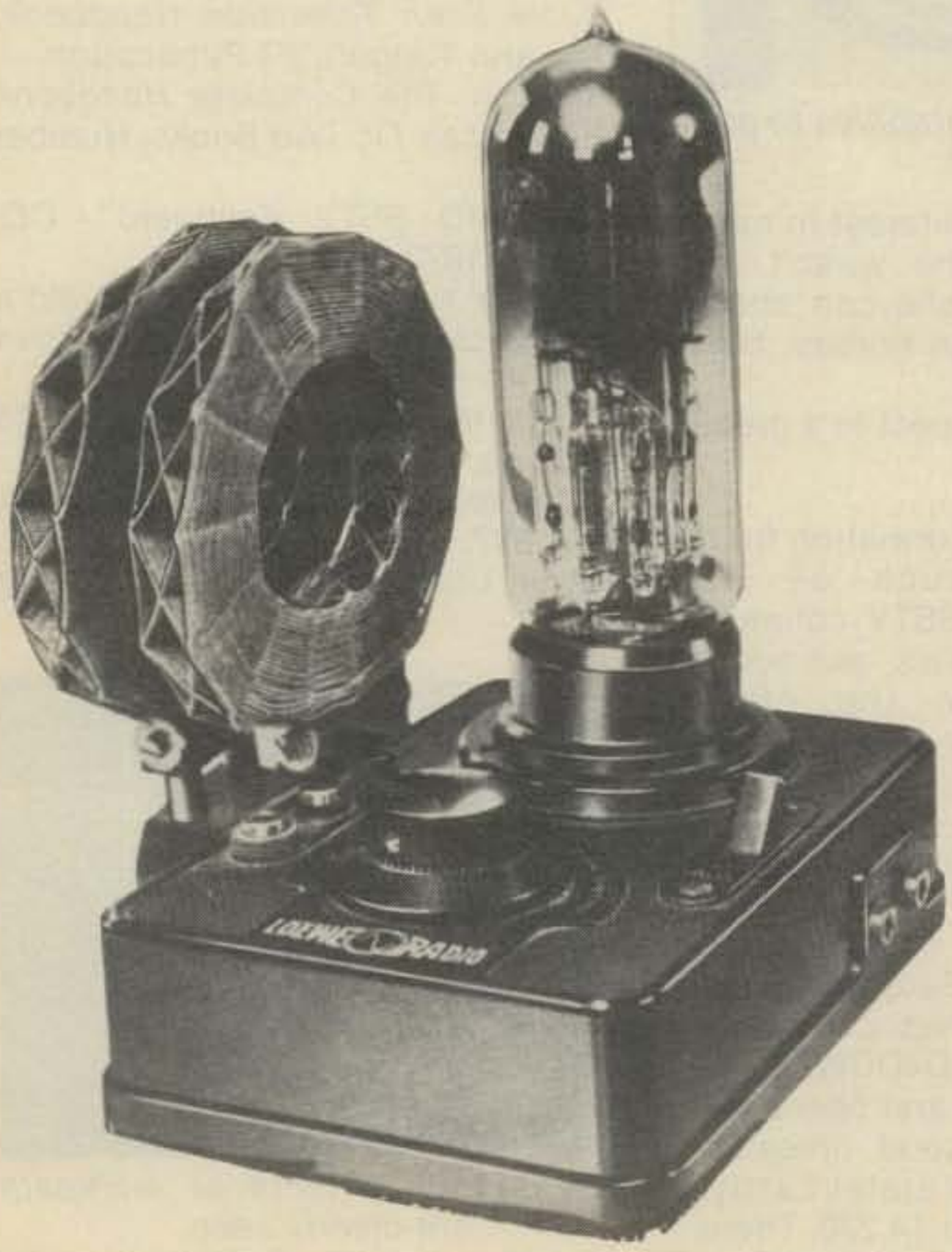


Fig. 1-The Loewe OE333—the world's first million selling radio receiver.

Over the last two years or so, the trend to what is termed large scale integration, or LSI has gathered momentum. More and more complex circuits and subsystems are being crammed into integrated circuit packages, making possible a range of high technology products for everyday use. Witness for example the explosive growth of the calculator industry during the past few years; or the increasing application of minicomputer systems and microprocessor equipment.

Because of this, we associate integrated circuits exclusively with the electronics of today. They range in application through all branches of electronics—radio and TV receivers, hifi equipment, process control systems, digital clocks and watches, computers, communications and broadcasting equipment, and instrumentation, to name just a few.

It may come as something of a shock, then, to learn that the world's first integrated circuit was developed just over fifty years ago. What's more, the IC was mass produced and incorporated into a radio receiver.

Of course, the world's first integrated circuit looked nothing like the IC's of today, although the basic concept was the same. As would be expected, it employed vacuum tube technology, the device essentially consisting of three triode tubes and a number of resistors and capacitors encapsulated in a common glass envelope. By today's standards, the device was quite bulky and somewhat fragile.

The man credited with developing the world's first integrated circuit is Dr. Siegmund Loewe, founder of the Loewe-Opta electronics company of Berlin, Germany, who was granted a

patent for his idea in 1924. The patent application described a vacuum tube device containing two tubes, two coupling capacitors and two resistors within a common glass envelope. External connections were brought out to a polarized pattern of access pins, which could be plugged into, or withdrawn from, a corresponding socket.

By 1926, a device slightly more complex than that described in the patent application had been designed and put into production. This was the triple triode integrated circuit referred to above. It was incorporated into the Loewe OE333 radio receiver, more than one million of which were sold within twelve months of its 1926 launching.

Basically, the triple triode IC used in the OE333 contained virtually a complete radio receiver within a single glass envelope. The only other components required were a tuning coil, a tuning capacitor, a loudspeaker, and the high voltage and low voltage batteries which supplied anode and filament power respectively.

The complete circuit diagram of the Loewe OE333 radio receiver is shown in fig. 2. Battery operated, the receiver simply consisted of a triode anode-bend detector stage, followed by two stages of triode tube amplification.

The anode-bend detector was RC coupled to the first amplifying stage which, in turn, was RC coupled to a loudspeaker, almost certainly of the high impedance moving reed type, although moving coil loudspeakers were in use in high grade equipment at that time.

The receiver was said to provide good loudspeaker performance using an indoor aerial in areas served by effective local and regional broadcast transmitters. An outside aerial was required for more distant station reception.

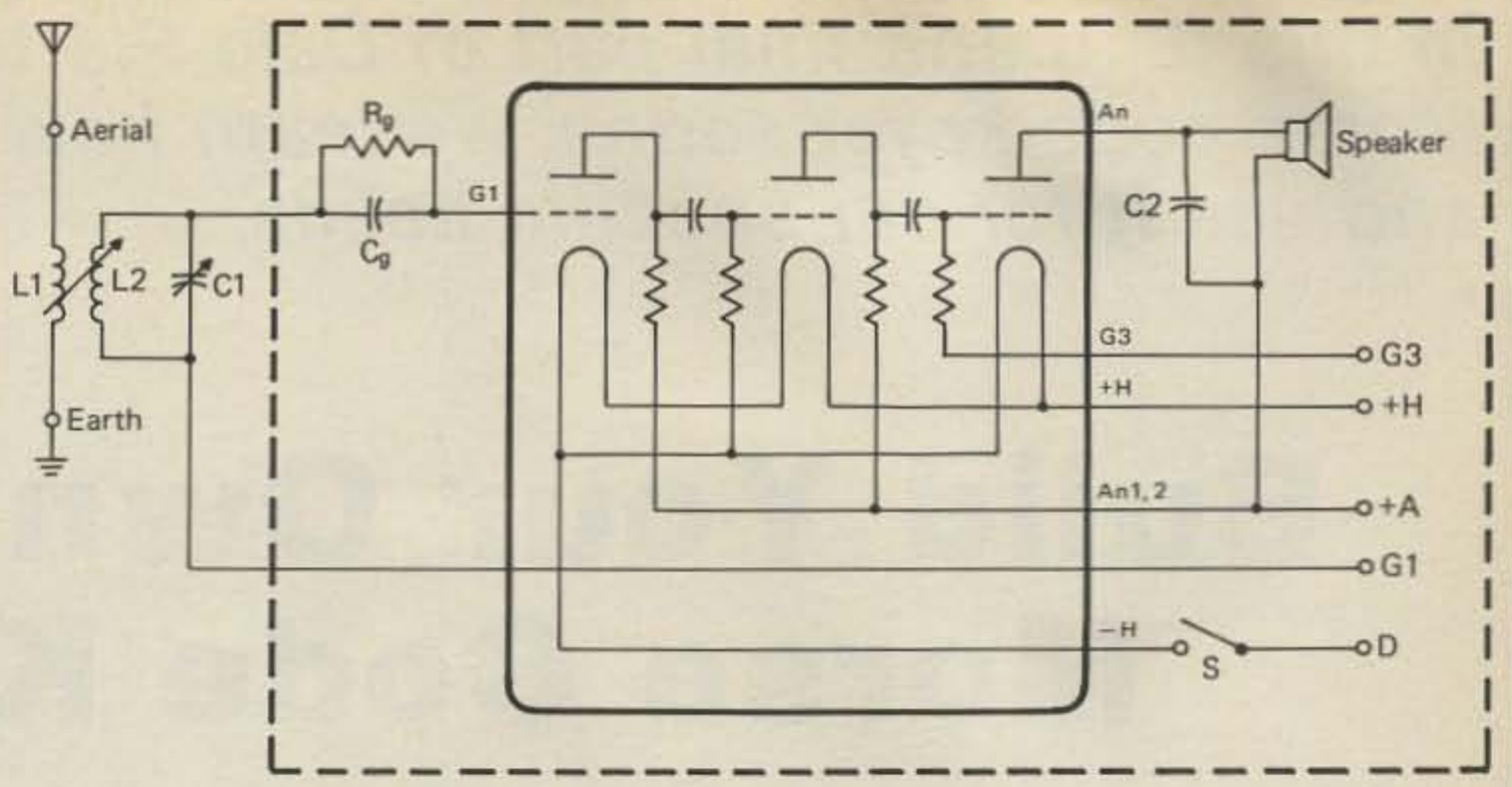


Fig. 2-The circuit diagram of the Loewe OE333 radio receiver. The triple triode IC comprised all those components within the solid dark line.

Fig. 3-The Loewe OE333 IC radio with batteries, frame aerial and speaker.

Fig. 3 may evoke nostalgic memories for some of our older readers. It shows the OE333 receiver surrounded by the now antiquated high-voltage battery, a low-voltage acid-filled battery used for heating the tube filaments, and exponential horn loudspeaker, and the once quite common diagonal frame directional aerial. The latter could be used to replace the more compact pancake-wound aerial and tuning coils, and was of such inductance as to correctly tune across the broadcast band with the aid of a tuning capacitor.

Fig 4. shows the OE333 of 1928 in record player guise. Here the triple stage vacuum tube integrated circuit is being used to amplify the signal from a primitive electromagnetic pick-up head grazing an old 78 rpm gramophone record. A hand-cranked clockwork motor supplied rotational power to the turntable.

It would be a cynical electronic engineer of today who did not concede that Dr. Siegmund Loewe—engineer, inventor and founder of the Loewe Opta Company of Berlin—was the man who gave the world its first cost effective integrated circuit, and successfully mass produced more than one million such ICs half a century ago.

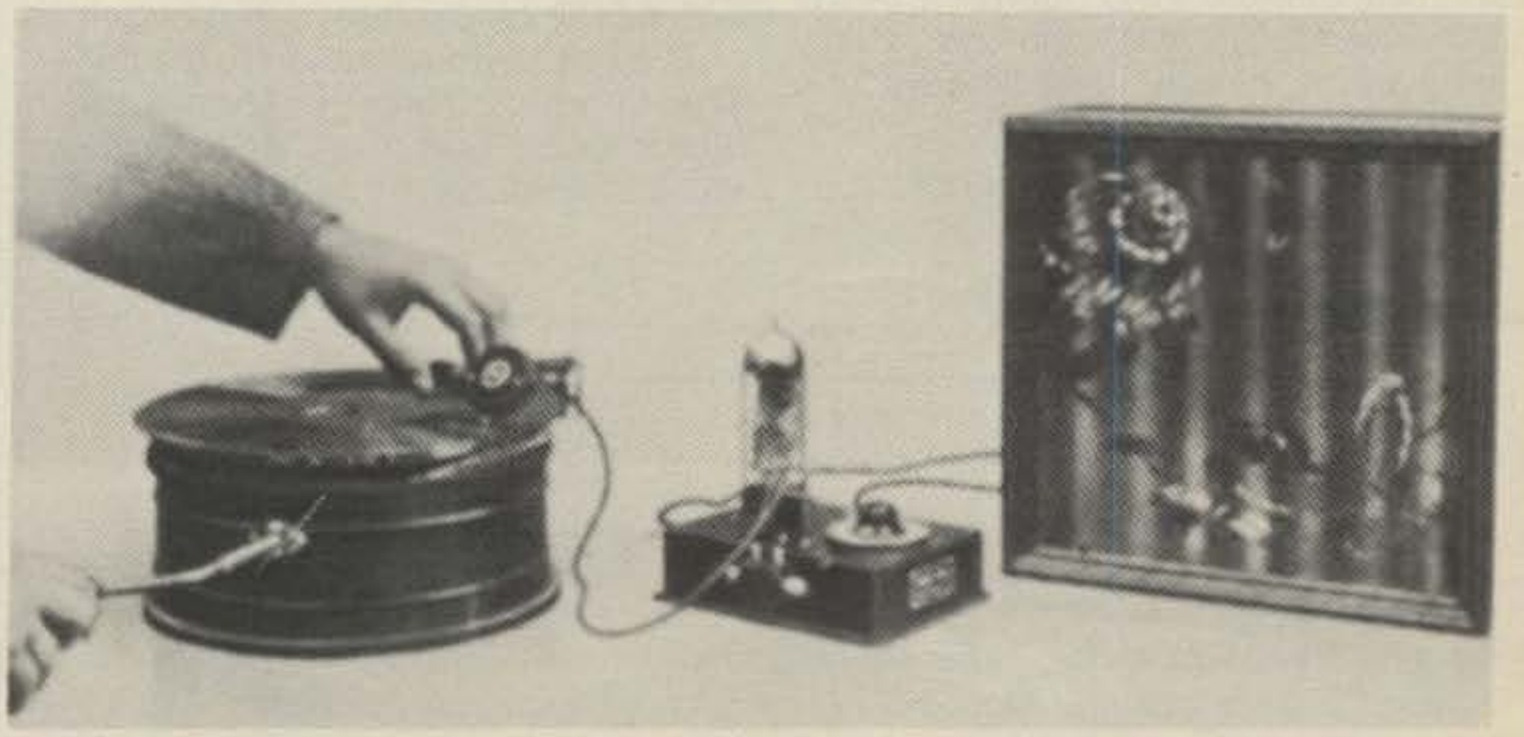


Fig. 4-A 1928 version of the OE333 in use as an amplifier for record playing equipment. Note the hand-cranked turntable.

In this third and final part of Dale Platteter's MP-80 Morse code keyer series, we learn how to program it and use it for our specific needs.

Build Your Own MP-80 Morse Code Keyer

Part III—Programming and Operating

BY DALE PLATTETER*

The 2708 ultraviolet erasable EPROM holds all of the operating instructions and Morse code data. It must be programmed with the data pattern shown in Table I **before** insertion into the p.c. board. Pre-pro-grammed EPROMs are available to help you avoid this laborious task. Commercial EPROM programmers are recommended as the 2708 specification sheet calls for 100 programming loops through all 8192 bits. This is just about impossible to do on the bench without making at least one mistake. The EPROM will hold its data for over 30 years as long as the semiconductor chip is protected from ultraviolet light. Don't worry if a ray of sunlight shines on your EPROM as it takes direct sun exposure for one month to cause the first bit to drop. A small gummed address label masks the quartz lid of the 2708 perfectly and can be easily removed at a later date should you decide to modify the sending speeds or permanently store your call letters in one of its unused areas.

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Selecting A Keyboard

The MP-80 will work nicely with inexpensive ($30 to $60) ASCII keyboards. The P1 connector needs positive logic TTL signals as shown in the timing diagram of fig. 6. To inform the MP-80 that the parallel ASCII data is stable, one 350-800 ns negative going strobe pulse is required each time a key is depressed. As most keyboards provide a strobe level rather than a strobe pulse, the addition of a 74121 one-shot gives the needed strobe timing. Fig. 7 shows this simple modification to a George Risk Industries Model 753 keyboard kit.

The MP-80 is capable of receiving all 128 ASCII characters but recognizes only 59 of them as valid Morse digits. The chart of Table II shows these digits along with their ASCII equivalents in both binary and hexidecimal. Use this chart to check out your keyboard before plugging it into the MP-80's P1 socket.

Wire the connector cable from the keyboard to the P1 socket as illustrated in fig. 7. Power supply voltages are available at the P1 connector for use by the keyboard logic.

The **BREAK** key is a single pole uncommitted switch on the keyboard pad that is wired as the "reset" signal for the MP-80. If your keyboard does not have an unused key labeled **BREAK**, it surely has a **HERE IS, ESC, DEL, CTRL,** or **RETURN** key which can serve as a **BREAK** switch.

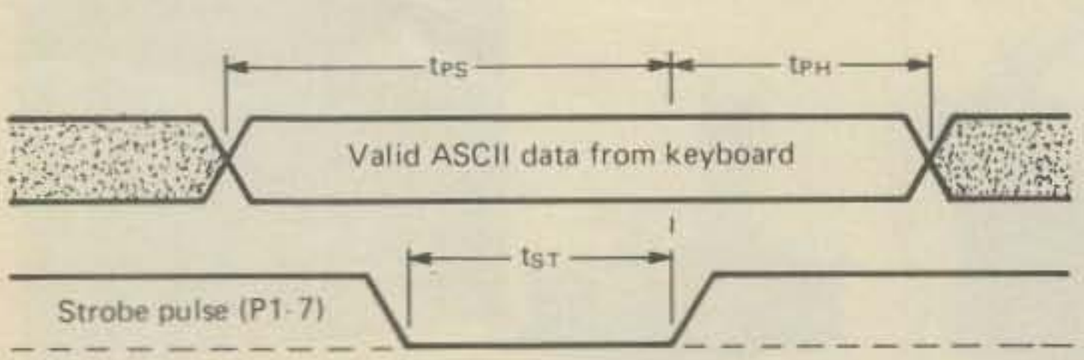


Fig. 6 — Keyboard timing. There are hundreds of ASCII encoded keyboards on the market. Choose the one that is TTL compatible with positive logic. The MP-80 keyer requires one 350-800 ns strobe pulse to indicate that the parallel ASCII data is valid.

Finishing Touches

If your MP-80 keyer is to be used for code practice, no enclosure is necessary. One can mount the MP-80 board directly under the keypad to make a very compact system. In strong r.f. fields (over 100 watts of transmitter output) or on the higher frequency bands, both p.c. boards will pick up noise if they are not housed in a shielded metal enclosure.

The MP-80 coupled with a Model 753 keyboard requires the following regulated d.c. power.

Voltage	Maximum Current	Regulation
+5V (±5%)	900 mA	±3%
+12V (±5%)	200 mA	±3%
−12V (±5%)	200 mA	±3%

Power inputs are clearly labeled on the edge of the p.c. board for convenience.

Do not use unregulated or so called "filtered" power supplies as the a.c. ripple will damage the integrated circuits.

Positive and negative 12 volt supplies can be constructed with μA7812 and μA7912 3-terminal voltage regulator chips. Automobile or motorcycle batteries make ideal supplies. If a 5 volt supply is needed, it can be tapped from a +12 volt (1 amp) source using a μA7805 regulator mounted to a heat sink. Use a 4 ohm (5 watt) series resistor in the +12 volt lead of the 7805 to help reduce its internal power dissipation.

Before any power is applied to the MP-80 board, the entire circuit should be carefully checked. Trouble points include integrated circuits and capacitors with incorrect polarity, solder bridges between p.c. board runs, and cold solder joints. After careful examination of the MP-80 board, the power supplies must be checked out. Measure their d.c. "open circuit" voltages and look for excessive a.c. ripple with an oscilloscope. Next, apply power to the keyboard alone and use a d.c. voltmeter to check its logic outputs. When the letter **C** is held down, a **1000011** should appear on the B7 thru B1 lines. Examine the strobe pulse to be sure it appears for about 500 ns each time a key is depressed.

Apply power to the MP-80 board and recheck to power supplies. The onboard negative voltage regulator can be checked by looking for 5 volts across capacitor C16. Touch all the components. Only A3 thru A6 will rise enough in temperature to be detectable. The remainder of the components should remain very close to room temperature. Connect the keyboard to the powered MP-80. Press the **BREAK** switch while watching pin 1 of A5. The voltage on this pin should rise from about zero to over 3 volts, indicating that the switch is connected properly. Press the letter **C** again and look for the same logic levels as before, but this time on pins 38, 39, 40, 1, 2, 3, and 4 of the 8255 chip. If the strobe line is properly connected, typing the letter **C** again should make the relay chirp out "dahdidahdit."

Use shielded coax from the MP-80 keyer output terminals (marked KY) to your transmitter's key input jack. If r.f. from your transmitter causes multiple letters to be sent, shield the strobe input wire from the keyboard with coax and add a 0.001 μF ceramic capacitor from P1-7 to ground and a 1000 ohm resistor from P1-7 to +5 volts. Extra 0.01 μF ceramic or mica capacitors across the power supplies will bypass any r.f. entering from the power cables.

Table II—ASCII CHARACTER CODE

Character	Binary Code	Hexa-decimal Code
Space Bar	010 0000	20
! (message)	010 0001	21
" (double dash)	010 0010	22
# not used	010 0011	23
$ (bk)	010 0100	24
% not used	010 0101	25
& (cq cq cq)	010 0110	26
. not used	010 0111	27
(	010 1000	28
)	010 1001	29
. (error)	010 1010	2A
+ (ar)	010 1011	2B
, (comma)	010 1100	2C
– (sk)	010 1101	2D
. (period)	010 1110	2E
/	010 1111	2F
0	011 0000	30
1	011 0001	31
2	011 0010	32
3	011 0011	33
4	011 0100	34
5	011 0101	35
6	011 0110	36
7	011 0111	37
8	011 1000	38
9	011 1001	39
:	011 1010	3A
;	011 1011	3B
≐ (as)	011 1100	3C
= (sk)	011 1101	3D
◇ (as)	011 1110	3E
?	011 1111	3F
° (not used)	100 0000	40
A	100 0001	41
B	100 0010	42
C	100 0011	43
D	100 0100	44
E	100 0101	45
F	100 0110	46
G	100 0111	47
H	100 1000	48
I	100 1001	49
J	100 1010	4A
K	100 1011	4B
L	100 1100	4C
M	100 1101	4D
N	100 1110	4E
O	100 1111	4F
P	101 0000	50
Q	101 0001	51
R	101 0010	52
S	101 0011	53
T	101 0100	54
U	101 0101	55
V	101 0110	56
W	101 0111	57
X	101 1000	58
Y	101 1001	59
Z	101 1010	5A

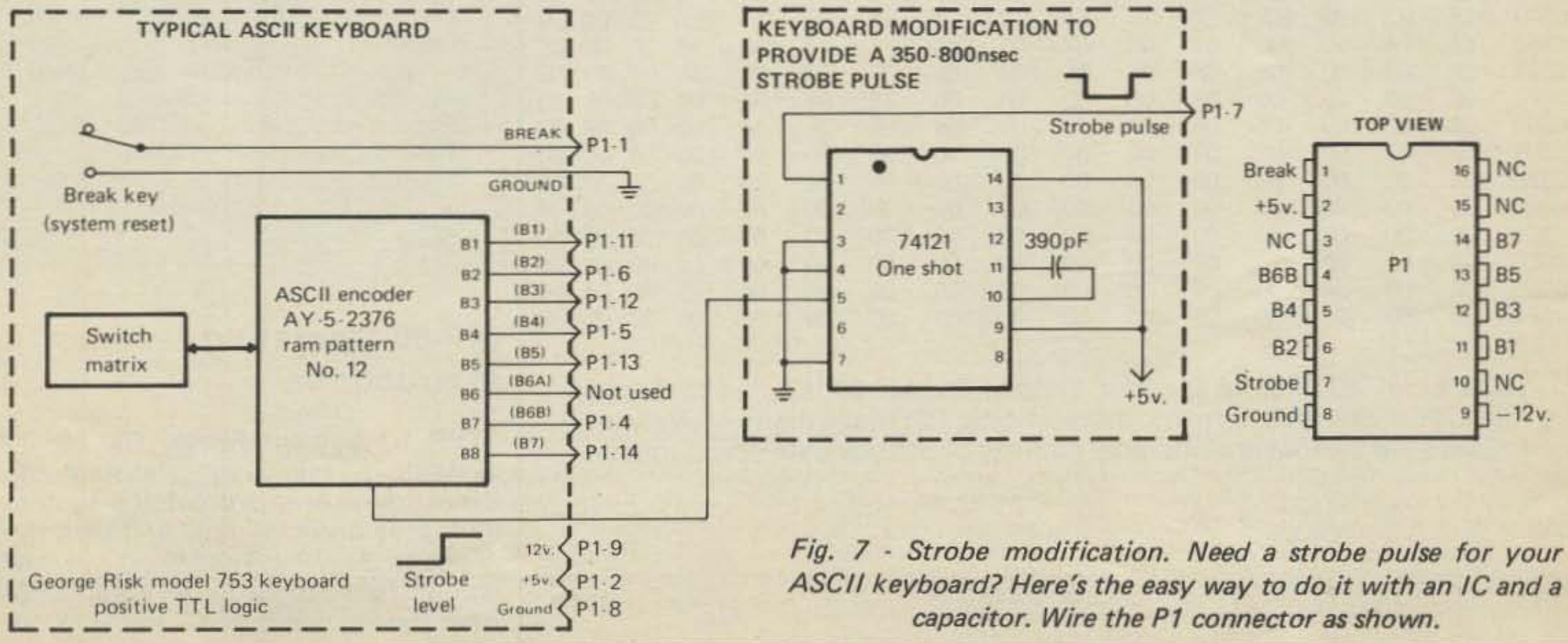
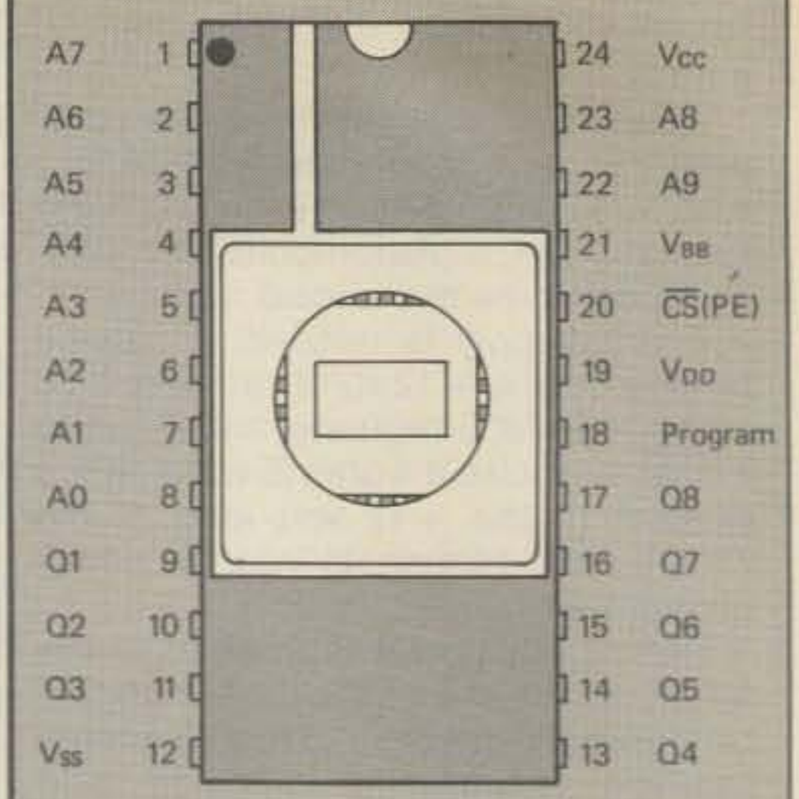


Fig. 7 - Strobe modification. Need a strobe pulse for your ASCII keyboard? Here's the easy way to do it with an IC and a capacitor. Wire the P1 connector as shown.

0000	3E	B7	D3	F7	21	00	10	36	03	2C	36	03	20	36	42	2C
0010	36	00	21	FF	10	F9	CD	8B	05	FE	43	CA	A8	04	FE	53
0020	CA	2D	04	FE	21	CA	5D	04	C3	12	04	00	00	CD	8B	05
0030	47	CD	8B	05	21	02	10	78	FE	33	C2	42	04	36	2C	C3
0040	12	04	FE	31	C2	4C	04	36	68	C3	12	04	FE	30	C2	56
0050	04	36	FF	C3	12	04	36	42	C3	12	04	00	00	11	67	10
0060	CD	8B	05	4F	FE	21	C2	6F	04	EB	36	03	C3	12	04	FE
0070	20	FA	60	04	FE	5B	F2	60	04	26	07	69	46	3E	3B	81
0080	6F	66	68	00	00	3E	F1	BB	C2	90	04	EB	77	C3	12	04
0090	7E	FE	03	C2	9E	04	EB	36	02	23	EB	C3	60	04	23	EB
00A0	77	23	EB	C3	85	04	00	00	CD	8B	05	FE	20	FA	A8	04
00B0	FE	5B	F2	A8	04	4F	26	07	69	46	3E	3B	81	6F	66	68
00C0	7E	FE	00	C2	DA	04	CD	38	05	1E	01	CD	1B	05	CD	33
00D0	05	1E	01	CD	1B	05	23	C3	C0	04	FE	01	C2	F3	04	CD
00E0	38	05	1E	03	CD	1B	05	CD	33	05	1E	01	CD	1B	05	23
00F0	C3	C0	04	FE	02	C2	01	05	1E	02	CD	1B	05	23	03	C0
0100	04	1E	02	CD	1B	05	CD	5F	05	FE	00	CA	A8	04	FE	20
0110	FA	06	05	FE	5B	F2	06	05	C3	B5	04	E5	21	02	10	46
0120	CD	3E	05	16	7A	15	C2	25	05	05	C2	23	05	1D	C2	1C
0130	05	E1	09	3E	7E	D3	F7	C9	3E	7F	D3	F7	C9	00	DB	F6
0140	E6	20	C8	DB	F4	E6	7F	00	21	00	10	6E	77	3E	66	BD
0150	21	00	10	CA	59	05	34	00	C9	36	03	00	C9	00	00	21
0160	01	10	6E	3E	00	BE	C8	66	E5	7D	21	00	10	BE	C2	78
0170	05	6F	36	00	3E	00	E1	C9	FE	66	21	01	10	C2	85	05
0180	36	03	C3	86	05	34	E1	7C	C9	00	00	DB	F6	E6	20	CA
0190	8B	05	DB	F4	E6	7F	C9	00	00	00	00	00	00	00	00	00
01A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
01B0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
01C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
01D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
01E0	00	00	00	00	00	00	00	00	00	00	00	00	00	01	00	01
01F0	00	02	01	01	00	01	02	02	02	01	00	01	00	02	01	01
0200	00	01	02	02	02	01	00	01	00	02	01	01	00	01	02	02
0210	03	01	00	00	00	01	00	01	03	00	00	00	01	00	01	03
0220	03	00	00	01	01	00	00	03	01	00	01	01	00	01	03	00
0230	00	00	00	00	00	00	00	03	00	01	00	01	00	03	01	01
0240	00	00	01	01	03	01	00	00	00	01	03	00	01	00	01	00
0250	01	03	01	00	00	01	00	03	01	01	01	01	01	03	00	01
0260	01	01	01	03	00	00	01	01	01	03	00	00	00	01	01	03
0270	00	00	00	00	01	03	00	00	00	00	00	03	01	00	00	00
0280	00	03	01	01	00	00	00	03	01	01	01	00	00	03	01	01
0290	01	01	00	03	01	01	01	00	00	00	03	01	00	01	00	01
02A0	00	03	00	00	00	01	00	01	03	00	01	00	00	00	03	01
02B0	00	01	03	00	01	03	01	00	00	00	03	01	00	01	00	03
02C0	01	00	00	03	00	03	00	00	01	00	03	01	01	00	03	00
02D0	00	00	00	03	00	00	03	00	01	01	01	03	01	00	01	03
02E0	00	01	00	00	03	01	01	03	01	00	03	01	01	01	03	00
02F0	01	01	00	03	01	01	00	01	03	00	01	00	03	00	00	00
0300	03	01	03	00	00	01	03	00	00	00	01	03	00	01	01	03
0310	01	00	00	01	03	01	00	01	01	03	01	01	00	00	03	00
0320	0E	67	45	2E	11	97	ED	2E	28	28	2F	38	3E	19	4B	52
0330	58	5E	64	6A	70	76	7C	82	88	8E	94	9B	A9	A2	A9	21
0340	2E	B3	B6	BB	C0	C4	C6	CB	CF	D4	D7	DC	E0	E5	E8	EB
0350	EF	F4	F9	FD	01	03	07	0C	10	15	1A	06	10	06	06	06
0360	07	05	06	06	06	06	06	06	06	06	06	06	06	06	06	06
0370	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06
0380	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	07
0390	07	07	07	07	07	07	00	03	00	00	00	00	00	00	00	00
03A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
03B0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
03C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
03D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
03E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
03F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

Table I - MP-80 EPROM Program Listing. The MP-80 is wired to decode this 2708 memory pattern into morse digits. The first 4 digits of every line indicate the hexidecimal memory address of the hex data which follows.

What's An EPROM?



This strange looking 24-pin package houses a tiny n-channel, ultra-violet erasable Electrically Programmable Read-Only Memory (EPROM). Tightly packed on a silicon chip under a transparent quartz window sits 8192 memory cells. Each cell contains an isolated or "floating" polysilicon conductor buried within the gate oxide of a MOS transistor. The floating conductors can be electronically charged or left alone to form logic "1" and logic "0" when addressed. Charging the floating conductor increases the "turn-on" threshold of the MOS transistor to the point where it will not conduct current when addressed. This charge remains on the floating gate for 30 to 100 years, as long as ultraviolet light does not shine on the chip. Erasing the memory is accomplished by exposing the device to 15 W-s/cm² of ultraviolet light. Programming is performed by applying data to the output pins while pulsing the programming pin with 26 volts. Each bit to be programmed is pulsed once. When the entire array has received one pulse, the process is repeated 100 times. Programming takes anywhere from 7 to 13 minutes to complete if run at a 1 kHz rate. EPROMs have been designed for high density, non-volatile storage of data where fast turn-around or program changes are required. EPROMs range in size from 2048 bits all the way up to 32,768 bits. These 8K bit 2708 EPROMs consume less than 800 mW of power and sell for under $9 unprogrammed.

MP-80 Operating Instructions

STEP 1 - System Reset. The MP-80 system is reset by pressing the **BREAK** key. At this point, the system initializes automatically and sets the speed to 20 WPM. The MP-80 will now recognize 3 single letter commands from the keyboard (S, C, and !) "S" is

used to change the code sending speed, "!" is used to start recording the 20 letter message. "C" is used to begin code sending.

STEP 2 - Speed Changes. After system reset, the speed can be changed by typing S05 for 5 WPM, S13 for 13 WPM, S20 for 20 WPM, or S30 for 30 WPM. If 20 WPM speed is desired, no speed information need be entered.

STEP 3 - Message Key Changes. After system reset, to record a 20 letter message, type ! followed by the message. End recording of the message by typing another ! Message example: !W9ABC W9ABC DE W9XYZ! Each time the ! key is depressed during code transmission, the message W9ABC W9ABC DE W9XYZ will be played.

STEP 4 - Sending Morse Code. To start Morse code transmission, type the letter **C.** To stop transmission, type **BREAK** and perform steps 2, 3, and 4 as desired.

The following keyboard letters are used for special morse characters.

Space Bar	= Space Between Words and Sentences
&	= CQ CQ CQ
*	= Error
= or –	= SK (End of Work)
< or >	= AS (Wait)
+	= AR (End of Message)
$	= BK (Break)
"	= Double Dash
!	= User Programmed Message

The internal program which controls these commands is foolproof. The MP-80 will self-initialize after a cold start to 20 w.p.m. with a clear message key. Subsequent resets after power is applied will not destroy the message key and automatically sets the speed to 20 w.p.m. The MP-80 operates as a "stand alone" keying system and can be wired in parallel with a hand key if desired.

a monthly feature by

WILLIAM I. ORR, W6SAI

Antennas

Design, construction, fact, and even some fiction

"Thank goodness, summer is finally under way", said Pendergast as he tossed his sweater in a corner of the room. "Between snow, floods, lightning and a gas shortage, I am just about ready to turn in my DXCC certificate and take up stamp collecting".

"Not to worry", I replied. "We are coming into good weather and that means antenna time is upon us. And the bands sound so good it literally makes me itch to try some antenna experiments. Can I count upon your assistance in this manner?"

Pendergast yawned elaborately. "Certainly", he replied. "Just what do you have in mind?"

"This is the latest issue of *Radio Communication*, The journal of the Radio Society of Great Britian. I'm looking at an article by Bazley, G3HCT on the subject of DX antennas for 40 and 80 meters. Frankly, the high quality of the articles in this magazine amazes me. You should certainly subscribe to it if you want to keep up with modern design techniques.

"The article in question examines the knotty problem of how to get a good DX antenna for the low frequencies on a small lot. And G3HCT painstakingly tried a variety of antennas. He spent about five years in experiments on the air with his designs trying to develop an antenna having gain, a good front-to-back ratio, low angle radiation without requiring a big tower to support it".

"What did he come up with?", asked Pendergast, as he took out his notebook and pencil.

"The first antenna G3HCT tried was the popular inverted-V dipole with the center about 45 feet high. This seemed to work reasonably well to the U.S.A. but was relatively poor on long-haul skip to Australia, particularly on the long path.

"The next antenna tried was a quarter-wave ground plane using 60 radials buried just below the surface of the lawn. The long-haul DX situation was much improved, but short-skip work was considerably poorer than with the inverted-V.

"The third antenna tried was a trapped inverted-V for both 40 and 80 meters. Aside from the advantage of working on two bands the antenna performed similar to the first inverted-V, so it was eventually taken down.

"The next antenna was a combination of a ground plane and a trapped antenna (fig. 1). The wooden support pole is 45 feet high and the top section of the antenna is folded over. This arrangement worked well on both 40 and 80 meters and seemed to be effective on both short-skip and long-haul paths. Unfortunately, the radial system had been removed and the antenna was just working against

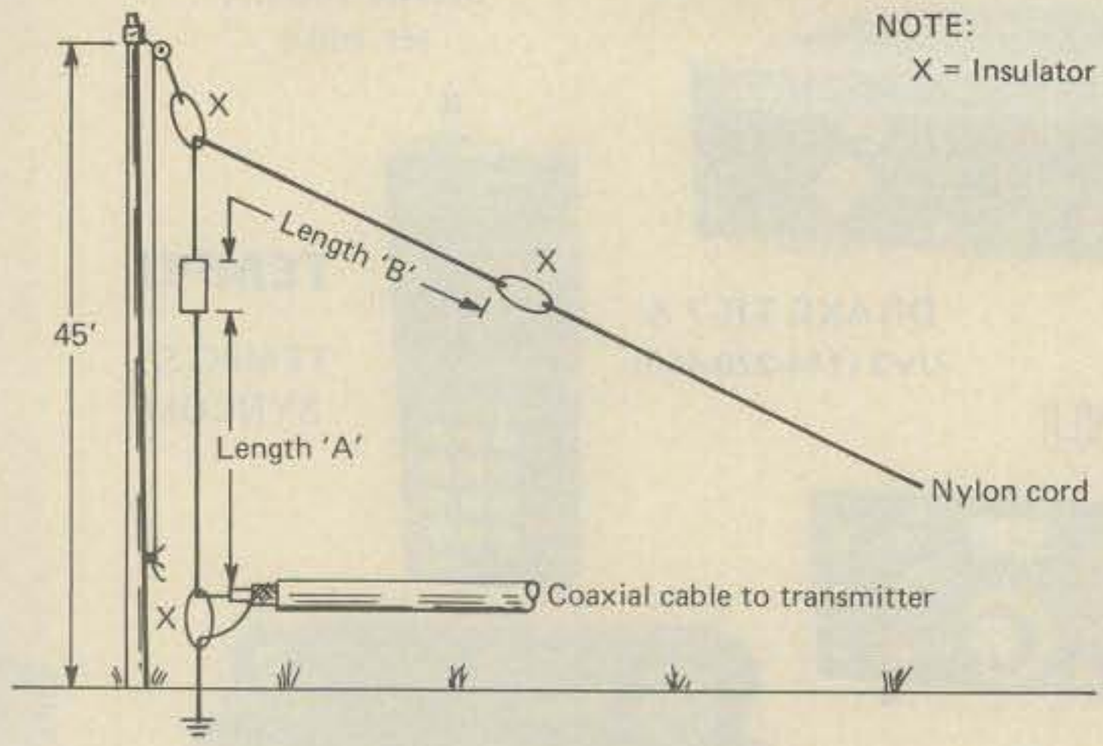


Fig. 1 - The trapped ground plane of G3HCT for 40 and 80 meters. Length A is 33 feet, length B is 29'3". The box represents a parallel tuned trap resonant at 7 MHz.

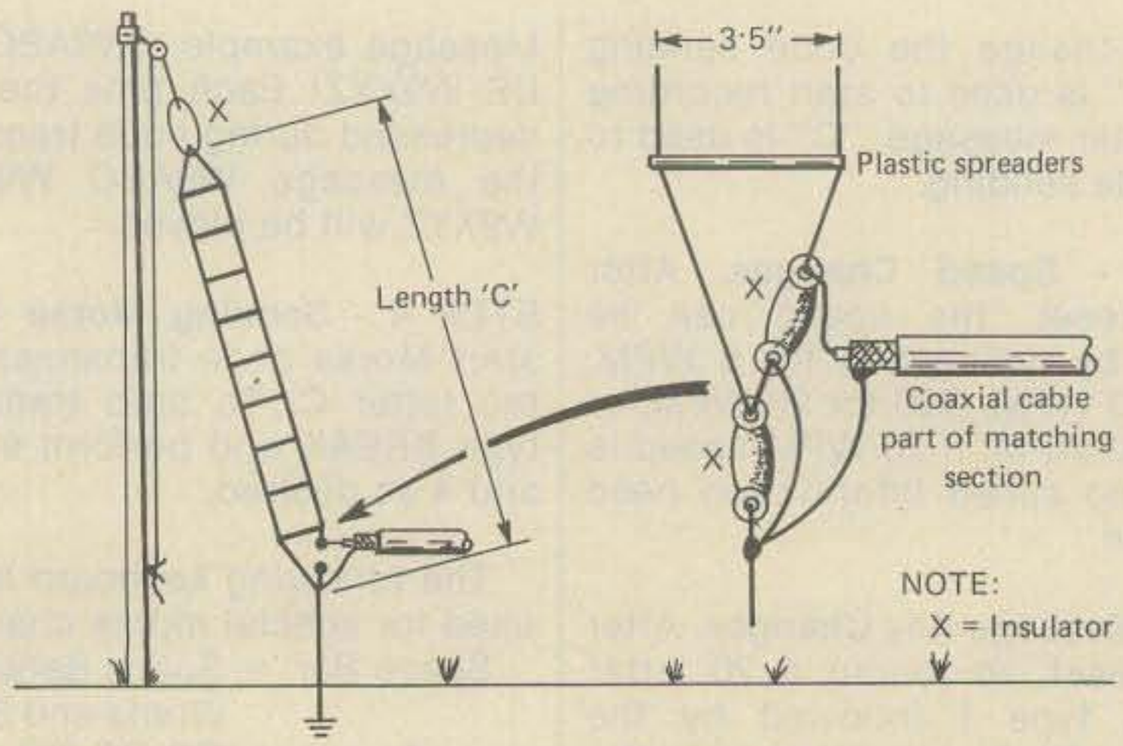


Fig. 2 - The vertical folded monipole at G3HCT. Length C is 34 feet.

48 Campbell Ln., Menlo Park, CA 94025

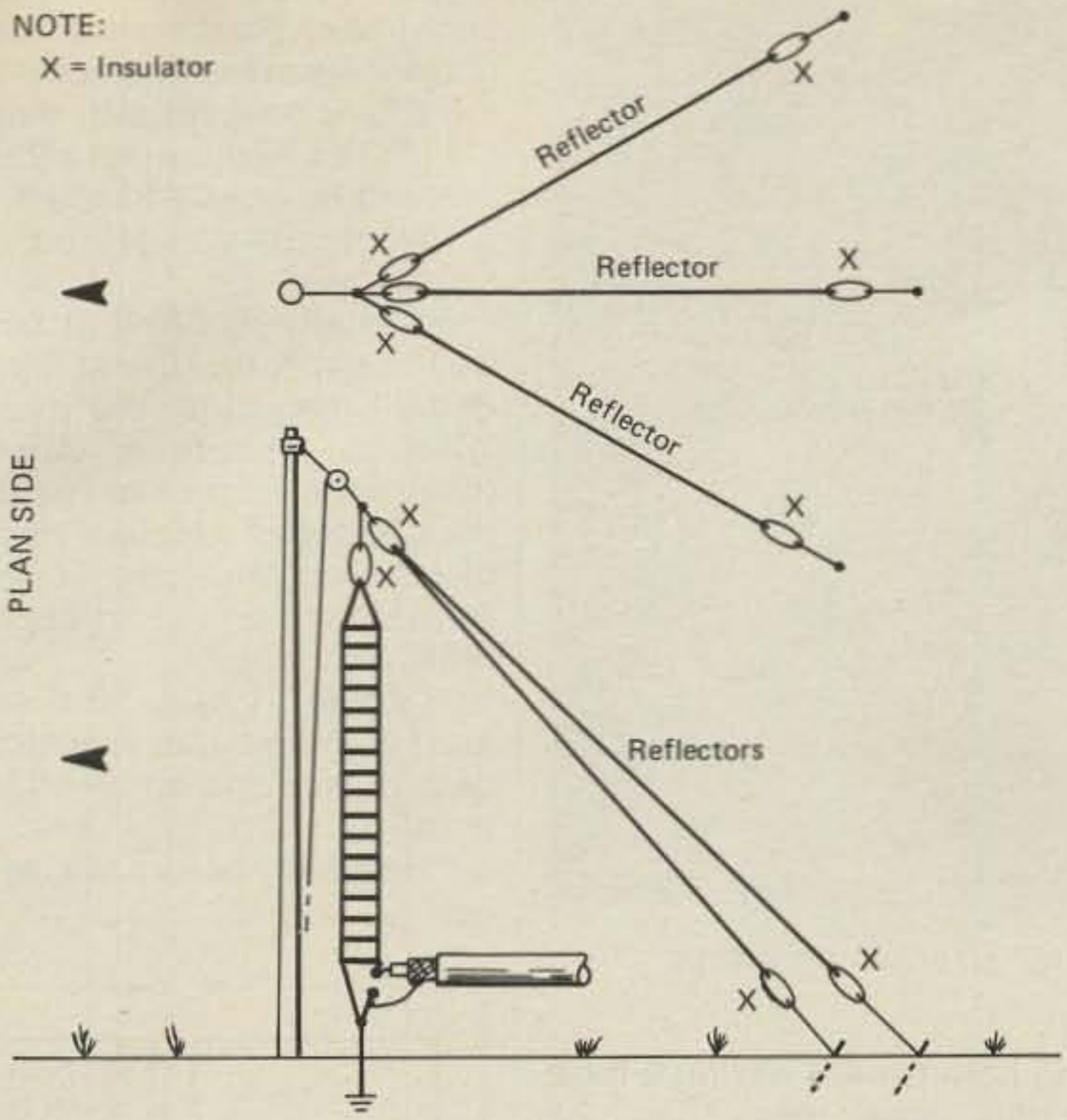


Fig. 3 - The G3HCT 40 meter beam. Length of reflector wires is 71 feet.

ground rods. The ground resistance reduced the antenna efficiency to about 50-percent.

"At this stage of the game G3HCT went back to a vertical antenna composed of half a folded dipole (fig. 2). The folded dipole multiplied the radiation resistance by four, raising it to about 165 ohms. This reduced ground losses to less than 5-percent and a definite improvement in both receiving and transmitting was noted over a period of time".

"Very interesting", commented Pendergast, but this is pretty much old hat. What happened next?"

"The next thing that happened was that a local amateur erected a two element Yagi at 60 feet for 40 meters. That proved to be the goad that spurred G3HCT to a final effort. He tried a phased vertical array which, after a lot of trouble and fussing, worked well and seemed to be competitive with the Yagi. However, the owner of the Yagi raised it to 120 feet above the ground which gave it a 2 to 3 S-unit advantage over the phased verticals.

"The final experiment was to place reflector wires on the vertical folded dipole (fig. 3). Reflector length was 71 feet and the reflectors were installed sloping down from the top of the pole towards the ground, as shown in the drawing. An excellent front-to-back ratio was achieved, and the simple antenna proved to be only a maximum of one S-unit down from the Yagi at 120 feet in the desired direction. G3HCT says, 'Without a doubt this is the best antenna I have used on 7 MHz'. And I say if you can compete with a 2 element Yagi at 120 feet, you must have a good antenna".

"Pendergast peered at the illustrations. "How did G3HCT match the antenna to a 50 ohm transmission line?", he asked.

"He used a stub system (fig. 4) that seemed to do the job quite nicely", I replied. "I like this simple beam antenna. It is inexpensive to build and, while it is not rotatable, it should do a good job in the chosen direction".

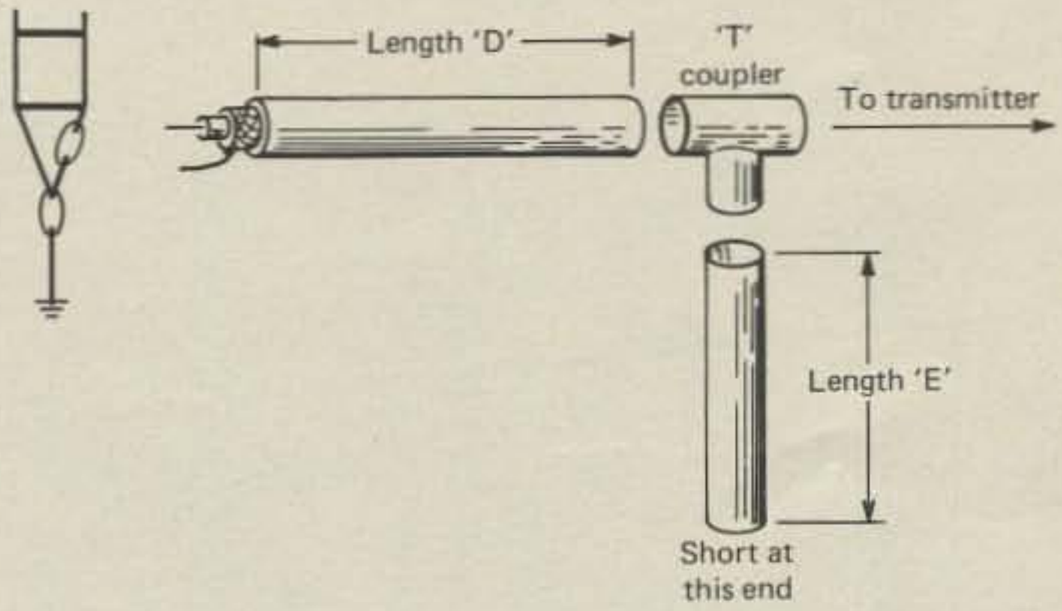
"My friend sighed, "Well, now that the bad weather is behind us, I would certainly like to get started on an antenna project. Maybe this is the one!"

"You are lucky", I replied. "Just look at these pictures of what the winter weather did to the big Quad at WB4JKZ (fig. 5 and 6). Pete has this Monster, 3-band Quad on a 32 foot boom. An ice storm hit it and the weight of the ice bent the bamboo and fiberglass spreaders. But, when the ice melted, it all came back in good shape, as you can see".

Pendergast shuddered. "I would hate to have to rebuild an array that big. Pete was certainly lucky". He reached into his pocket and handed me a letter.

"This came about a week ago and I forgot to give it to you. It is from John, N6JO, and outlines his experiments with the W6TC compact Quad loop discussed in the March column. John feeds the compact loop with a tuner and an open-wire line (fig. 7). The antenna is designed for 20 and 40 meter operation. Note the use of the open stub at the top of the loop. On 20 meters the stub acts as an open circuit and the loop resembles the X-array (expanded Quad). On 20 meters the stub is a quarter wavelength long and acts as a short circuit, closing the loop. There are 142 feet of wire in the loop, exclusive of the stub.

"John mounted the loop in the vertical plane atop his house on 30 foot masts made out of slip-up TV mast sections. The loop height was about 25 feet and the length about 92 feet. John reports good DX results on both



COAXIAL CABLE USED	LENGTH "D"	LENGTH "E"
50Ω RG8U	16'2"	9'3"
75Ω RG11U, solid inner	14'7"	11'10"
75Ω TV cable, semi air-spaced	19'	15'5"

Fig. 4 - The G3HCT network. Figures 1-4 courtesy of Radio Communication, an RSGB publication.

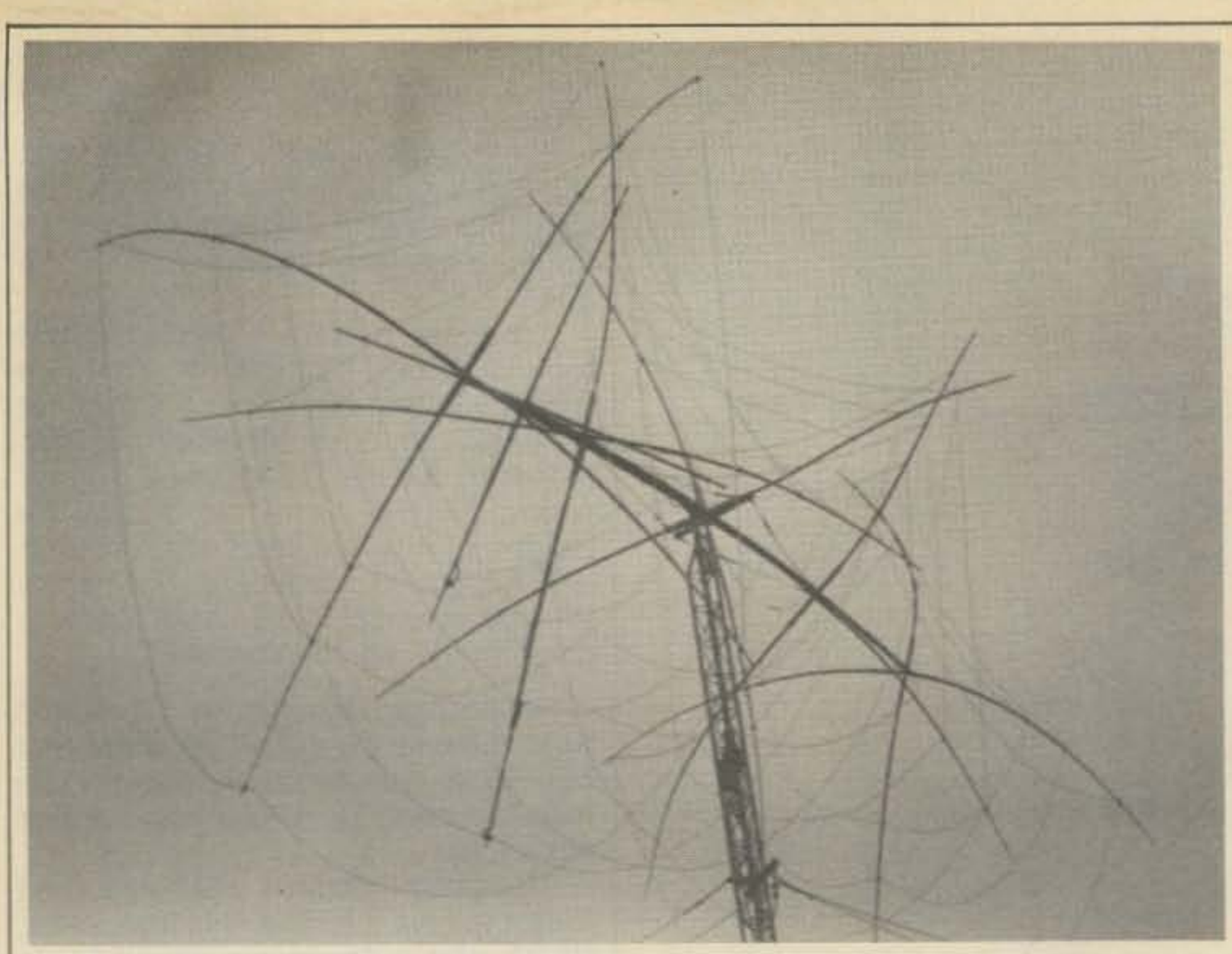


Fig. 5 - The "Monster Quad" at WB4-JKZ after an ice storm.

bands and is now experimenting with two loops driven 180 degrees out of phase, also with one driven element and the other as a parasitic reflector".

"Very interesting", I replied. "It is always nice to see fellows doing experimental work on their own".

"And here's something else", continued Pendergast, pulling a second piece of paper out of his pocket. "Now hear this. The Environmental Protection Agency (EPA) in Washington is considering a regulation to limit the height of all self-supporting ham towers having a base cross-section area less than 2.5 square feet to an overall height of 34 feet".

"Thirty four feet!", I exclaimed. "Why the height restriction?"

Pendergast continued reading, "It seems that free standing towers experience wind shear effects which shake the towers. It also seems that, especially in the late spring and summer, this shaking is transmitted to the surrounding earth. The vibrations disturb earthworms, causing them to come to the surface (often during the hottest part of the day). Exposure of the earthworms to the sun's direct rays causes them to die from sunstroke. Earthworms are very important facets of the ecology—hence the EPA's concern over the problem"

I looked Pendergast straight in the eye and he gently blushed.

"Where did you get that baloney?", I demanded.

He laughed. "Well, it came a long way to get here. I found it in "*Amateur Radio*" magazine, the journal of the *Wireless Insitute of Australia*, and they reprinted it from the bulleting of the *Cascades Amateur Radio Society* of Jackson, Michigan. The caption the Aussies put on the article is "Pull the other leg, Mate".

"I agree", I said. "But some of the stuff coming out of Washington these days makes one wonder if this may be true."

"However, before we wrap up this session, I think you might like to look at the simple antenna tuner that Bill, WD5HOH is using to feed an end-fed wire about 45 feet long. He works on 40 meters with only 15 watts and he needed an "invisible" antenna. He took a tuner from the 1966 *ARRL Handbook* and modified it, as shown in fig. 8. He doesn't have a SWR meter so he made a field strength meter out of a *Simpson 260* analyzer. All he does is tune for maximum voltage on the 260. He uses a four foot ground rod in conjunction with several 40 foot radials buried about 2 inches below the soil. So far, as a new General he's worked over 30 states and Canada with his "invisible" antenna and his tuning network. If you can work that kind of stuff with 15 watts, the antenna must be *good*".

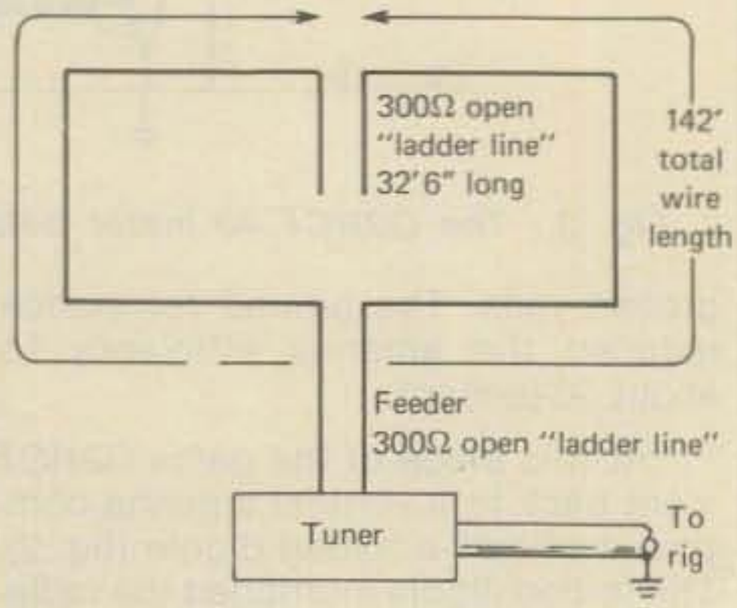


Fig. 7 - The N6JO version of the W6TC compact quad loop. Antenna is designed for 40 and 20 meter operation. John's feedline is about 16 feet long, but other lengths may be used. Loop dimensions are 25 × 92 feet.

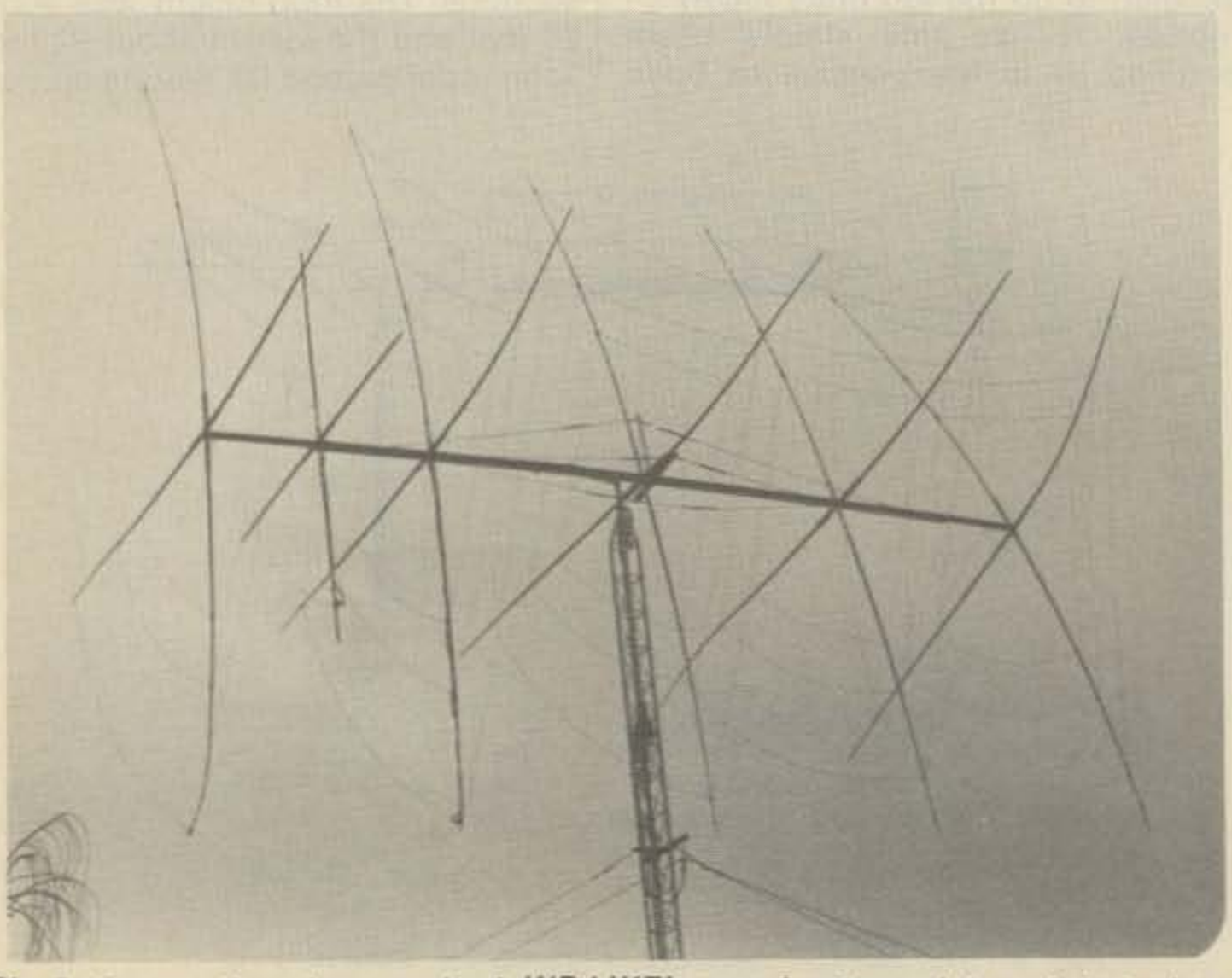


Fig.6 - Once the ice melted, WB4JKZ's quad returned to original shape.

"Very nice", replied Pendergast. "Tell WD5HOH that I can't punch my way out of a paper bag on 40 meters. How does he hear anything through the foreign broadcasters and the jammers?"

"Beats me", I replied. "I think it just proves the old saying that DX is 10% station and 90% operator".

Pendergast prepared to leave. "I have a schedule coming up in a few

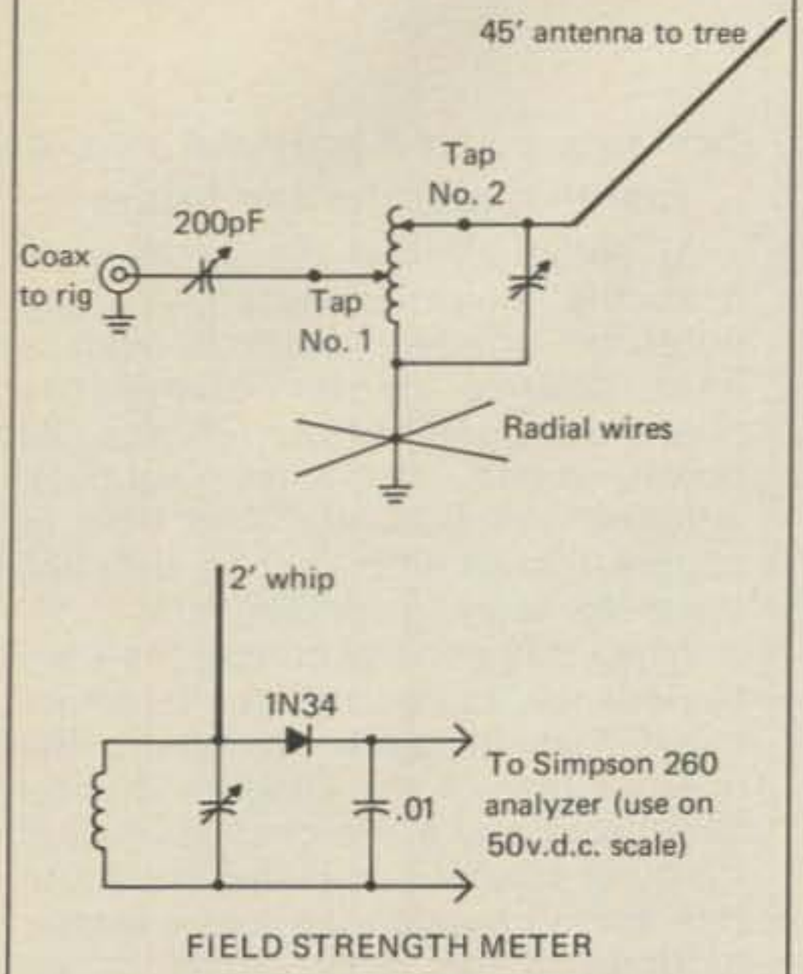


Fig. 8 - The simple antenna and turner at WD5HOH. Coil is 25 turns #16 wire spaced wire diameter on 2" diameter form. Tap 1 is 12-15 turns from ground end, tap 2 is 16-20 turns from ground end. A simple field strength meter is located at operator's desk.

minutes on 10 meters", he said. "So I'd better push off".

"You can work it from here", I offered. Again, Pendergast blushed. "Well, it's with Rosie Radiator. She's working mobile now and I'd just as soon do it from home".

"Suit yourself", I replied. "I'll just listen in!" (Note): W6SAI's new antenna book, "The Radio Amateur Antenna Handbook" is available from Radio Publications, Inc., Box 149, Wilton, CT 06897. This 188 page Handbook covers antennas of all types in simple, understandable language. Price: $6.95 plus 50¢ for shipping and handling.

* * *

The information on the G3HCT beam was taken from "Radio Communication". For more information on this publication, write to the Radio Society of Great Britain, 35 Doughty Street, London, WC1N 2AE England. A highly recommended publication!

a monthly feature by

BILL DEWITT, W2DD

In Focus

Television on the Amateur bands

Slow Scan Station of the Month-XE1HT/XE1AAK

Juanita G. DeMunoz, XE1HT and her husband, Fernando Munoz, XE1AAK, of Leon, GTO, Mexico became SSTV afficionados about a year ago. Located about 240 miles northwest of Mexico City, this husband-wife team of operators are active in several phases of amateur radio including satellite QSOs. Juanita is the first female amateur in Mexico (and probably in all Latin America) to work satellites Oscar 7 and 8 on both modes.

One of the nice experiences associated with amateur radio is the willingness of many amateurs to help others. In a letter to In Focus, Juanita and Fernando said that they are most grateful to N6WQ, K0HT, W4QEB, W2HMQ, WD5GXI, W9WED, W6STC, W3ATV, W4SRZ, and WB0TTR, for their assistance in getting XE1HT/XE1AAK operational on SSTV.

As you can see in fig. 1, the Munozs have a very well equipped station. SSTV gear includes a Sanyo monitor and a Robot 400 scan converter.

Juanita says that she hopes that more YLs/XYLs will become active on SSTV.

Speaking of Husband-Wife Slow Scanners!

Since there aren't too many husband-wife SSTV operator combinations, I think it's appropriate to include pictures of another slow scan duo: Hank and Bobby Hargis, W6WDB and W6WDL, of Glendora, CA. Some time ago In Focus carried a picture and story about Bobby and her paintings. This month we're happy to bring you a new photo of Bobby, see fig. 2. Bobby's talent as an artist is well demonstrated in fig. 3 which includes a painting of W6WDL by W6WDL! Sorry we can't bring you this excellent likeness in color. The distinguished gentleman in fig. 4 is Hank Hargis who spends more time on 2 meter FM than SSTV!

**2112 Turk Hill Rd., Fairport, NY 14450.*

Fig. 1– Juanita G. DeMunoz, XE1HT, at the mike in the beautifully equipped hamshack she shares with her husband, Fernando, XE1AAK.

Puerto Rico Calling-KP4AF

Ernesto Gonzalez Cruz of San Sebastian, P.R. became well-known on the slow scan frequencies as KP4DCY. Since acquiring KP4AF, Ernesto has more room on his TV screen! Congratulations to Ernesto who upgraded his license a few months ago.

In a recent letter, Ernesto reported that he is still very active on SSTV. He works many stations in France, Germany, Italy, Spain, the U.K., and Japan. In fig. 5 you can see that KP4AF's gear includes the famous Robot 70/80 monitor/camera combination. Thank you Ernesto, for the excellent photo of you and your station.

Fig. 2 Bobby Hargis, W6WDL, tries out her SSTV keyboard. If you're looking for SSTV contacts on ten meters, look for W6WDL on 28.680 kHz.

Computers and Amateur Radio, A few thoughts for the future

At some point in the future we'll probably have completely computerized amateur stations with a neat control center giving the operator push-button choice of power, mode, frequency, antenna, antenna direction, etc. And then of course, there's all that good stuff like computer logging for contests!

While this general concept is easy to visualize, its realization will require much design work including the onerous task of providing the control circuits to make the changes called for by computer command. No doubt this will all happen it's just a matter of time! Is this what amateurs are looking for? I can't answer for *all* amateurs however, I think I do have a pretty good idea of what many slow scanners would like in the near future.

What do most Slow Scanners Want?

In my opinion, most slow scanners are sold on video display. They feel that since we have it, we should use it. And I think that most SSTVers would welcome the opportunity to read c.w. and RTTY on the monitors that they now use for SSTV alone. A goodly percentage would enjoy making two-way c.w. and RTTY contacts.

If one could acquire c.w., RTTY,

Fig. 3– Yes, that's the gal you just saw in fig. 2 Bobby, W6WDL, painted by W6WDL!

and SSTV capability all in a single package it sure would be more attractive than buying the various necessary pieces in groups. (Think of the space required, not to mention the cost!)

Computers and SSTV

On a number of occasions yours truly has sounded off in this column with regard to ham use of so-called hobby or personal computers. These comments have been of a somewhat general nature, expressing my feeling that what we'd like is a basic package that would give us send-receive and display capabilities for c.w., RTTY, and SSTV. To this I would now add some other capabilities such as easy graphics (joystick control of line generation), large alpha-numerics, and light pen writing for additions to or alterations of the screen image. These last items might be called mechanical capabilities, but they could help make SSTV contacts more interesting.

In addition to the "basic package" and "mechanical capabilities" just mentioned, signal processing to enhance picture quality is another needed feature. This can be done with a personal computer as already demonstrated by Clayt Abrams, K6AEP. (It is my understanding that Dr. George Steber, WB9LVI, is also working on this problem.)

Encouragement and Frustration!

In my opinion, we are presently faced with an encouraging but somewhat frustrating situation. Encouraging because all of the "wants" mentioned above already exist for some combination of hardware and software-somewhere-but not all together! We have in effect a matrix of hardware, software, and (resulting) applications or capabilities. However, to get it all together—one would have to acquire a few computers, a scan converter, plus some add-on hardware plus cassette programs! Superimposed on this matrix is the design talent of amateurs and computer types who keep adding new capabilities (applications) to the various hardware/software combinations. The need for such a multiplicity of hardware items is indeed frustrating!

A Multi-Mode Communications Center?

Whatever that is! Well, sooner or later, someone will bring all of these desired video goodies together in one box that can be wired up to a conventional transceiver - and then, *voila!* You will have an MMCC (multi-mode communications center)!

Want to work SSB? Grab the mike. Want to go RTTY? Punch the right keyboard buttons and you're into the land of FSK with video display. Like CW? Hit the break button on the keyboard and punch up c.w. - you're ready for video displayed wireless and all that code comes out at the chosen speed as you hunt and peck type! Prefer SSTV? Touch break again and Input SC (for scan conversion—Smile, you're on TV!

Fig. 4— The other half of California's husband-wife slow scan duo, Hank Hargis, W6WDB.

When will it happen?

When we'll have this MMCC box (or whatever you want to call it) I can't predict. What I've outlined is what I think most slow scanners would like. I said above that sooner or later someone will get all the goodies together. Let's hope it's sooner, not later.

How will it happen?

I have a gut feeling that a "start from scratch and design an amateur only device" would be a very expensive approach.

Considering the memory requirements of SSTV (in order of 65,000 bits-RAM) plus control function memory needs of a few K (probably ROM), my guess is that it would be best to start with an off-the shelf personal computer having at least 16K bytes. Then the design could work around that. This approach would save design time and (I think) cut the cost of parts and fabrication. There'd be extra hardware and some software needed for the c.w., RTTY, Large Alpha-numerics, Easy graphics, and light pen functions. I believe that signal processing could turn out to be a software only item. I'm not a designer and don't claim that kind of talent. These comments are all in the "general idea" category that I consider feasible.

Fig. 5— Remember KP4DCY? Ernesto Gonzalez Cruz is now better known as KP4AF. His slow scan pictures cover the world like the Today Show covers Radio City!

Meanwhile, Back at the Ranch

What we have now is some very good things that work, and they're doing a good job. There's the Robot 400 scan converter that will convert fast to slow or slow to fast. DL4RZ makes a scan converter of similar capability. It can also do some titling tricks and has a light pen option. The Digital Group has a hamboard available for their personal computer. This board makes it possible to send, receive, and display c.w. and RTTY. It can produce alpha-numeric SSTV and receive SSTV off the air, but at this writing, I do not believe that it can convert fast scan camera video to SSTV for transmission.

Macrotronics offers a PC board plus software that sends and receives and displays c.w. and RTTY on the Pet and Radio Shack TRS-80 computers. (See further mention in this column.)

As mentioned above, Clayt Abrams, K6AEP has described his image enhancement methods designed for use with a Southwest Technical Products computer.

W3WLO and VE3DVV have designed and built light pens plus other image control items. W3WLO also has a ZOOM feature so that he can "playback" an enlarged portion of a slow scan picture to you.

The James Thomas Industries' SSTV keyboard can be modified to yield double-size alpha-numerics. They are reported to have a scan converter in the mill.

Do you see what I mean about "a matrix of hardware and software with an overlay of design talent"?

Is there a significant market?

If you were to buy one of each of everything mentioned you'd have an enormous investment and a wall of equipment. However, I believe that if someone puts together a package such as I've described it will have ap-

peal to three interest groups—those who like c.w. can add other fascinating phases of amateur radio when they acquire video display and keyboard generation of c.w. and so on for the RTTY and SSTV devotees. Yes, I think that there is a significant market out there in amateur country! If I were going to try to get into this market I would zero in on the TRS-80 computer because it has probably had the biggest sale and broadest distribution of any personal computer on the market.

What are *your* thoughts on this subject? I'd like to hear from anyone who a. agrees with me, or b. does not agree with me!

Attention Computer Owners!

In an up coming issue I'm going to review the Macrotroncis (formerly Microtronics) M-80 hardware/software package for sending, receiving and displaying CW and RTTY via the Radio Shack TRS-80 computer. Macrotronics has a unit for the Pet computer too.

I've already had this little gem out of the box and fired it up. The temptation to discuss it in this column is irresistible! However, there'll be a full story on it soon. Meantime, let me say that if you want to start using your TRS-80 with your amateur gear, here's an inexpensive effective add-on that does a very commendable job.

More Achtung Computer Owners.

If you have developed hardware and or software means for interfacing your personal computer with your amateur station—for *any* purpose, please write and tell me about what you're doing. If what you're doing warrants a full-blown article, *CQ* will be glad to consider it for publication. If you're not interested in writing an article but would like to share the capabilities you've developed with others, you may wish to have it presented in In focus. Photos and a good description are needed for this. In either case, please let us hear from you. Please note that this request is not limited to SSTV items.

New Call Signs Anyone?

With the recent avalanche of call sign changes it's sometimes difficult to know if you're contacting someone on the next block or a brand new exotic country! In Focus would like to help you let your SSTV friends know about your new call sign.

If you have changed your call sign please drop me a note mentioning your old and new call letters for publication in this column. (SSTVers only!) While you're at it, why not send me a photograph of you and your station?

for the experimenter

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CIRCLE 27 ON READER SERVICE CARD

John J. does it again! Here's a very useful piece of test and evaluation equipment that you can build over a weekend.

A Versatile Step Attenuator

BY JOHN J. SCHULTZ*, W4FA

A relatively simple test instrument that can be home-brewed and which has a multitude of uses around a shack is a **step attenuator.** It can be used alone for a variety of interesting tests, particularly on receivers, or in conjunction with other test instruments for more general purpose measurements. Best of all, perhaps, is that it can be constructed inexpensively. Although commercial attenuators can easily cost $60.00 and up, a satisfactory one for use up to the v.h.f. range can be constructed with all new components for under $10.00. Since there are no adjustments to make, building such an attenuator makes a nice project for the newcomer.

Although a number of uses for a step attenuator are described later after the construction of the unit is covered, here is a *sampling* of the uses to which it can be put:

1. Checking the relative sensitivity of different receivers or preamplifiers.
2. Checking the relative (or absolute) noise level at different operating locations.
3. Checking relative antenna gain and front-to-back ratio.
4. Providing a variety of accurate voltages from one known level for receiver alignment, scope calibration, meter calibration, etc.
5. Provide various accurate audio measurements relating to gain, compression levels, etc.

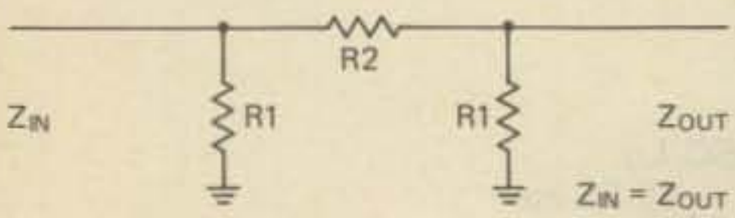
A step attenuator is a **switched series of resistors** which provide known, accurate reductions in the level of an input signal. One does not have to be an expert on the dB scales to appreciate that accurately known reductions in a signal level are the key to comparative measurements of any sort. However, most step attenuators are marked in dB levels for convenience since the dB values for each step of attenuation can be directly added to obtain the total attenuation.

The most convenient form of step attenuator to build is one composed of a number pi-type resistor networks. A single basic **pi section** is shown in fig. 1. The calculation of the resistor values comes from formulas which can be found in standard handbooks. Note, however, that the resistance values can be calculated once one decides on the impedance value at which the attenuator will be used. Equal input and output impedances are assumed. Usually, the impedance value chosen is 50 ohms for normal general purpose r.f. applications. Since the "frequency response" of the attenuator obviously extends down to d.c., even an attenuator designed around 50 ohms will work fine with audio circuits when properly matched to them. However, if one likes to do quite a bit of audio experimenting a step attenuator based on 500 ohm impedances will probably be more handy. It can be matched into a wide variety of circuits using commonly available transistor audio transformers having a 500 ohm winding on one side.

The basic **pi attenuator** of fig. 1 can be built up into a series string of such attenuators. Fig. 2 shows one such string of seven attenuators. Four of the sections have the same attenuation (20 dB) while three sections have different attenuation values. Each attenuator section can be switched in or out of the circuit. The particular combination of attenuation values was chosen because it allows a great combination of total attenuation steps from 3 dB to a total of 99 dB. It becomes virtually impossible for the average home-brewer with common materials, connectors, etc., to build a calibrated attenuator with more than 100 dB attenuation becuase of leakage. 100 dB does represent, for instance, an input voltage of 1.0 volt being dropped down to 10 microvolts.

Some amateurs have built step attenuators with a different grouping of sections to correspond to "S" units.

*c/o CQ Magazine



Attenuation (DB)	V Out (1 Volt In)	R1 Z Equals	R2 Z Equals
1	.891	17.4	0.115
2	.794	8.72	.232
3	.707	5.84	.353
5	.562	3.57	.608
6	.5	3.01	.747
10	.316	1.92	1.42
15	.178	1.43	2.72
20	.1	1.22	4.95

Fig. 1 - Resistor calculation table for a single section pi attenuator.

But, then one has to resolve which approximation to accept for an "S" unit - the older idea of 6 dB per unit or 5 dB per unit as some amateurs now favor. The resistor values shown in fig. 2 are based on a 50 ohm impedance design. Also, they are the nearest *standard* value resistor available to match the exact values one can calculate from the table in fig. 1. The 240 ohm resistors, for example, are used when the calculations would indicate a 247.5 ohm resistor. The error introduced by this order of substitution is very low. 5% tolerance carbon or carbon film resistors are satisfactory and these resistors can be obtained for about 13 cents each. 1% film type resistors can sometimes be obtained at good prices from surplus outlets. In any case, *only* regular carbon composition or film type resistors should be used. The wattage rating of the resistors need be only ½ watt for general test purposes. However, if one wants to use the step attenuator to accurately reduce the power output of a QRP transmitter down into the milliwatt regions, 2 watt resistors should be used.

Besides proper resistors, the real key to building a good step attenuator is keeping lead lengths short and shielding the unit properly. Neither requirement need pose any unusual difficulty. As shown in fig. 3(A), the resistors should be wired directly around the switch with which they are associated. Slide type switches or miniature toggle switches can be used. The ultra-miniature slide switches should be avoided, however, since they are difficult to work with for this application. An aluminum snap-box enclosure (Bud CU-3015 or Radio Shack 270-236) makes a suitable enclosure. If one wants the attenuator to be as accurate as possible, even to the upper v.h.f. range, some further shielding measures are necessary as shown in fig. 3(B). In this case, an enclosure is constructed within an enclosure. The previously mentioned outer enclosure is used but each switch and its resistors are enclosed in separate shielded compartments made from thin sheet copper or from pieces of double sided p.c. board. The base piece of copper or p.c. board on which all the switches mount is first mounted to the outer enclosure by means of the mounting holes (toggle switches) or screws (slide switches) associated with the switches. The resistors are soldered in place around each switch. Then, the pre-cut "walls" between switches are soldered in place and the inter-switch wiring done. Finally, the side "walls" and top of the inside enclosure are soldered in place. The work is tedious but not difficult and will result in a well shielded enclosure.

If one has available an a.f. generator and a suitable a.c. voltmeter, the step attenuator can be checked. The attenuator's input and output should be terminated with a 50 ohm resistor. Then by using the voltage out/in chart of fig. 1, one can check that the output voltage falls correctly for a given input. Note that the 20 dB steps checked individually should reduce the output voltage to 1/10 of the input value and the 6 dB step will halve the output voltage.

The applications for the step attenuator are many and varied. The following paragraphs cover some of the most interesting ones in detail.

Checking Noise Levels at a QTH

The step attenuator is connected between the station antenna and a receiver. The receiver is tuned to a quiet spot on the band of interest with, if possible, a.g.c. and limiter functions turned off. The step attenuator is set for maximum attenuation and the receiver gain controls are set such that one comfortably hears background noise. Attenuation is then switched out in whatever combinations are necessary so the noise background just starts to rise. This gives the ratio between the local, outside noise and the noise generated by the receiver. For instance, if setting the attenuator at 23 dB produces the noise rise, the outside noise is 23 dB greater then the receiver noise. If one knew the actual noise figure of the receiver being used, one could calculate the absolute noise level (just add the attenuator setting in dB and the noise figure of the receiver in dB). But, even without knowing the receiver noise figure, the relative noise level at different QTH's can be checked using the same receiver. For the 23 dB example given, if another location needs only a 16 dB setting, the second location is, of course, a quieter one. This technique can be helpful if a number of locations are being considered for a repeater installation or field station installation.

Checking Relative Sensitivity of Receivers and Preamplifiers

This measurement is just an extension of the idea presented previously. However, the outside noise is con-

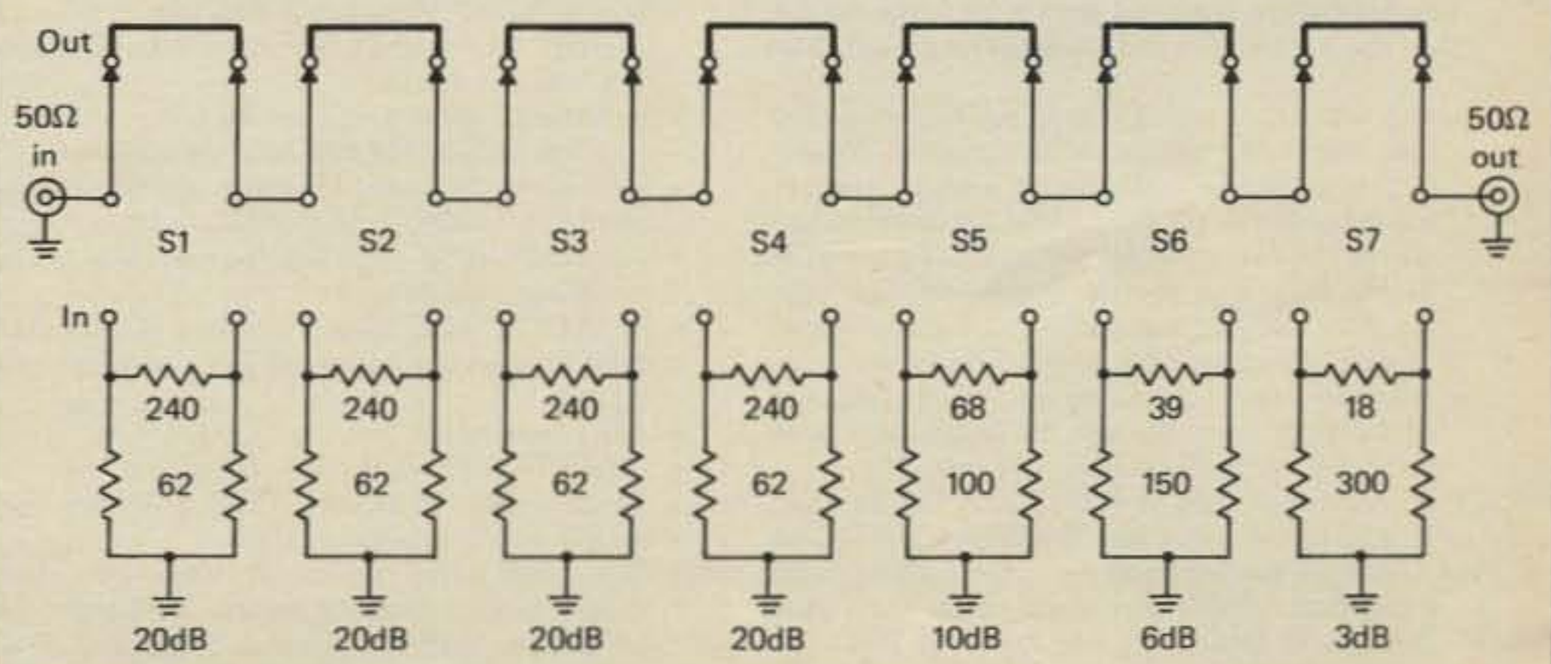


Fig. 2 - Schematic diagram for the complete seven-section step attenuator with a range of from 3 dB to 99 dB.

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Kenwood's TS-180S with DFC is an all solid-state HF tranceiver designed for the DXer, the contest operator, and all other Amateurs who enjoy the 160 through 10-meter bands. The following features prove, beyond doubt, that the TS-180S is the classiest rig available!

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- All solid-state... including the final. No dipping or loading. Just dial up the frequency, peak the drive, and operate!
- High power... 200 W PEP/160 W DC input on 160-15 meters, and 160 W PEP/140 W DC on 10 meters (entire band provided). Also covers more than 50 kHz above and below each band (MARS, WARC, etc.), and receives WWV on 10 MHz.
- Improved dynamic range.
- Adaptable to all three proposed (WARC) bands.
- Single-conversion system with highly advanced PLL circuit, using only one crystal with improved stability and spurious characteristics.
- Built-in microprocessor-controlled large digital display. Shows actual VFO frequency and difference between VFO and "M1" memory frequency. Blinking decimal points indicate "out of band." Monoscale dial, too.
- IF shift... Kenwood's famous passband tuning that reduces QRM.
- Selectable wide and narrow CW bandwidth on receive (500-Hz CW filter is optional).
- Automatic selection of upper and lower sideband (SSB NORM/SSB REV switch).
- Tunable noise blanker (adjustable noise-sampling frequency).
- RF AGC ("RGC"), which activates automatically to prevent overload from strong, local signals.
- AGC (selectable fast/slow/off).
- Dual RIT (VFO and memory/fix).
- Three operating modes... SSB, CW, and FSK.
- Improved RF speech processor.
- Dual SSB filter (optional), with very steep shape factor to reduce out-of-passband noise on receive and to improve operation of RF speech processor on transmit.
- 13.8 VDC operation.
- Also available is the TS-180S without DFC, which still shows VFO frequency and difference between VFO and "hold" frequencies on the digital display.
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Kenwood's TS-820S HF transceiver.

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TR-7600 and TR-7625...one of them is sure to fit the needs of today's Amateur Operator who's looking for optimum versatility in a 2-meter FM transceiver. And, when either rig is combined with the RM-76, a whole new dimension unfolds in channel memory and scanning capability. Here's what you get:

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- Memory channel...with simplex or repeater (±600 kHz transmitter offset) operation.
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- Store frequencies in six memories (simplex/repeater).
- Scan all memory channels.
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- Manually scan up or down in 5-kHz steps (or fast tune).
- Set lower and upper scan frequency limits.
- Clear scan (for transmitting).
- Stop scan (with HOLD button).
- Scan for busy or open channel.
- Select repeater mode (simplex, transmit frequency offset (±600 kHz or ±1 MHz), or one memory transmit frequency).
- Operates on 143.95 MHz simplex (MARS)
- Adaptable to all MARS frequencies.
- Display indicates frequency (even while scanning) and functions (such as auto-scan, lower scan frequency limit, upper scan limit, and error, i.e. transmitting out of band).

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sidered to be a constant noise source or noise "generator" and the attenuator as the output level control for the "generator." If different preamplifiers or receivers are checked through the same antenna, the setting of the step attenuator will indicate their relative sensitivity. For instance, consider fig. 4(A) where a receiver requires 20 dB of attenuation for the previously described QTH noise test. Now, if the receiver is substituted by another one, Fig. 4(B), and, to produce a noise rise, the attenuator has to be set at 18 dB, the second receiver is less sensitive. This is because less attenuation (and hence *more* outside noise) had to be used to overcome the noise base in the receiver and produce a noise rise.

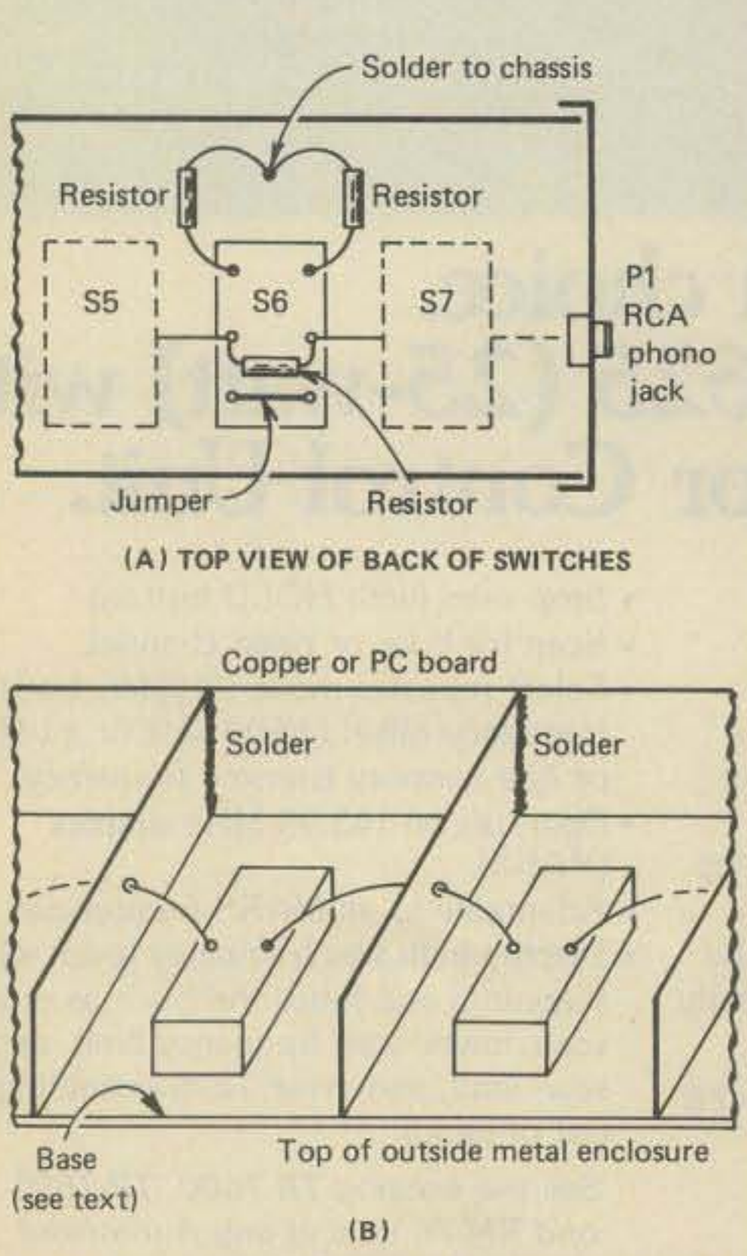


Fig. 3 - For simplified construction, seven switches are simply mounted in line at the top of a suitable enclosure (A). More elaborate sheilding scheme is shown in (B), as discussed in the text.

In fig. 4(C) another receiver which requires an attenuator setting of 23 dB will be more sensitive than the receiver of either fig. 4(A) or 4(B). Preamplifiers can be measured in the same manner by substituting different preamplifiers in front of the same receiver. One can, in fact, check if a preamplifier is really doing any good at all by placing it before a receiver and going through the test described as though the receiver alone were receiver #1 and the preamplifier plus receiver were receiver #2. Remember to look for the *rise* in noise during the test and do not be impressed by simply more noise coming out of the receiver with a preamplifier. This test assumes a few things such as reasonably similar shielding on the receivers used, similar bandwidths, a 50 ohm system and that outside noise remains relatively constant over a short period of time. Nonetheless, the measurement is very useful for someone trying to improve the sensitivity of a receiving system without using elaborate test equipment.

Relative Antenna Gain and Front-to-Back Ratio

The comparative gain of different antennas and the front-to-back ratio of antennas can be checked using the step attenuator and a suitable receiver with its a.g.c./limiter switched off. A reference signal level is set on the receiver's S-meter using one transmitting antenna. Then using the other antenna, the degree to which attenuation has to be switched in or out to produce the same reference level would indicate the relative gain of one antenna over the other. The reference level should not be set too high to avoid overloading the receiver. This measurement can be done off-the-air if signal levels are not fading but it is probably most useful when comparing v.h.f. antenna designs under steady signal conditions. Front-to-back ratios are simply checked in a similar manner by rotating the antenna under test.

Checking Receiver S-Meters

Using some known signal source, such as a signal generator or v.f.o. output, with the step attenuator connected between it and a receiver, one can check the dB required for each S-unit change on the receiver. There is not much one can do about it if the receiver's S-unit changes are erratic but at least it will alert one to suitably modify one's response when asked for comparative on-the-air S-meter reports!

Checking Receiver Spurious Responses

Receivers can have many spurious responses particularly at image and i.f. frequencies. The step attenuator allows a measurement of these responses. Set a reference level using a signal generator and as much attenuation as possible with the receiver tuned to a normal operating frequency. Then tune to the image frequency (or reset the generator to the i.f. frequency when measuring i.f. response) and reduce the attenuation until the reference S-meter reading is obtained. The difference between the attenuator settings is the image of i.f. rejection. This measurement is probably most useful when using an antenna coupler or filter to reject some unwanted signals, image or otherwise. One can check the relative improvement obtained in rejecting undesired signals in the same manner as checking image rejection.

Obtaining Alignment/Calibration Voltages

Two of the main problems when using inexpensive signal generators to align or test a sensitive receiver are that such generators do not have calibrated output attenuators and they are not sufficiently shielded. The step attenuator will allow accurate generator output voltages to be obtained down to the microvolt range. However, one must know the input voltage to the attenuator by means of some independent measurement (meter, scope, etc.). Then by using a standard dB graph or working from the table of fig. 1, one can accurately

calculate the output voltage obtained for various step attenuator settings. Usually, however, the poor shielding of inexpensive generators will confuse matters when working in the microvolt range. Of course, there are all sorts of steps that can be taken to improve generator shielding but that is a subject in itself. If inadequate generator shielding is suspected, try wrapping the whole generator tightly in aluminum foil. If this cures the problem, the direction in which one must make some improvements is obvious.

Oscilloscope and meter calibrators of the professional variety are expensive instruments. But, one can make a calibrator suitable for hobby work using the step atteunuator and one voltage source which has been accurately measured. The source could be an audio generator output, filament transformer or even d.c. source. A 1 volt source, for instance, will provide a variety of calibration points down to the millivolt level. Remember that the step attenuator is designed for 50 ohms in/out. If the voltage source and unit being calibrated do not provide this termination, suitable resistors should be used to simulate such a termination.

Checking Amplifier Gain

When constructing various a.f. or r.f. circuits it is often desirable to measure stage gain. Using a signal source and the step attenuator, set the attenuator to about the estimated stage gain and adjust the signal source level to obtain a reference output reading from the stage under test. Then bypass the stage and decrease the attenuator settings until the same reference output reading is obtained. The stage gain is, of course, the difference between the attenuator settings. The various impedances involved must be correctly matched. This method may seem awkward compared to some others but it depends on the test equipment one has available and how really good such test equipment is at the a.f. or r.f. frequencies involved.

Checking A.F. or R.F. Switches

It is often surprising to find that simple relays or switches, be they rotary, slide or toggle types, can provide excellent performance at inexpensive prices even up to the v.h.f. ranges. The physical appearances of such switches seldom provide any real indication of their effectiveness. Two of the main criteria in looking at a switch are **insertion loss** and **cross-coupling** between switch circuits. The use of a step attenuator cannot help to evaluate the first quality since one is usually dealing with very small losses on the order of a fraction of a dB. However, the step attenuator in series with the output of a suitable signal source (audio generator, signal generator or even QRP transmitter) can certainly help to evaluate the degree of cross-coupling between switch positions.

Assuming a s.p.d.t. switch, connect the *pole* arm to a suitable receiver (r.f. range) or sensitive scope (a.f. range). The signal source is connected to one switch position and a 50 ohm resistor to the other. Suitable shielding up to the switch contacts should be used in the case of an r.f. switch. The pole arm is connected to the switch position having the signal source and the attenuator switched to the maximum attenuation which provides a discernable signal on a receiver or reading on a scope. Then the switch pole arm is oriented to the 50 ohm termination position and the attenuation *decreased* until a similar minimum discernable receiver signal or display on an oscilloscope is obtained. The difference in attenuator settings indicates the degree of cross coupling between switch contacts. The test can be expanded, of course, to any sort of multiple pole or multiple position switch. One will find quite a bit of variation in the isolation between switch contacts, especially at r.f. frequencies. A range of 20 db to 50 db or more is common.

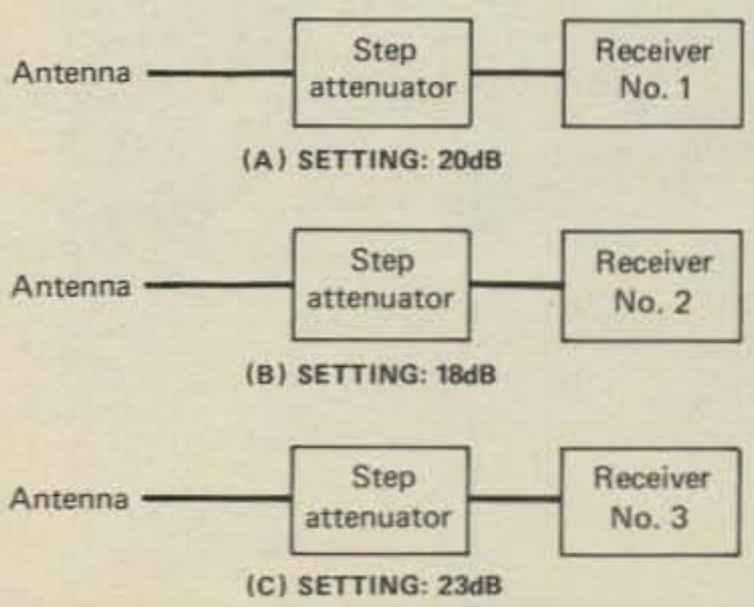


Fig. 4 - Which receiver is the most sensitive? The use of a step attenuator without any other test equipment can provide a good relative indication, as discussed in the text.

The attenuator can be used in the antenna line to a receiver to prevent receiver overload. Even the best of the solid-state receiver designs still have their overload problems when signal levels are very high. Often just a little bit of attenuation will clear up some of the "garbage" one hears while still allowing enough receiver sensitivity to carry on contacts. The main use of the attenuator with a transmitter is to accurately reduce the power output level for QRP transmitters. If one has the transmitter set up for some known output level - say 1 or 2 watts - one can accurately reduce the output level down to the milliwatt range. This approach is usually far better than changing supply voltages since the output tuning is not affected assuming one starts with a matched 50 ohm system.

To obtain meaningful results from the foregoing applications for a step attenuator requires varying degrees of electronic knowledge. But, it can be seen that there are applications practically every amateur can utilize. Still more applications for a step attenuator will suggest themselves as one becomes familiar with this simple but versatile test instrument.

Here are plans for a neat tri-bander.

The LPQ Mk-V

A Low Profile Quad For 10, 15 and 20 Meters

BY JOHN P. TYSKEWICZ*, W1HXU

The LP quad antenna works and offers an improved version of it's 3 bander, as described in the December 1976 issue of *CQ*.

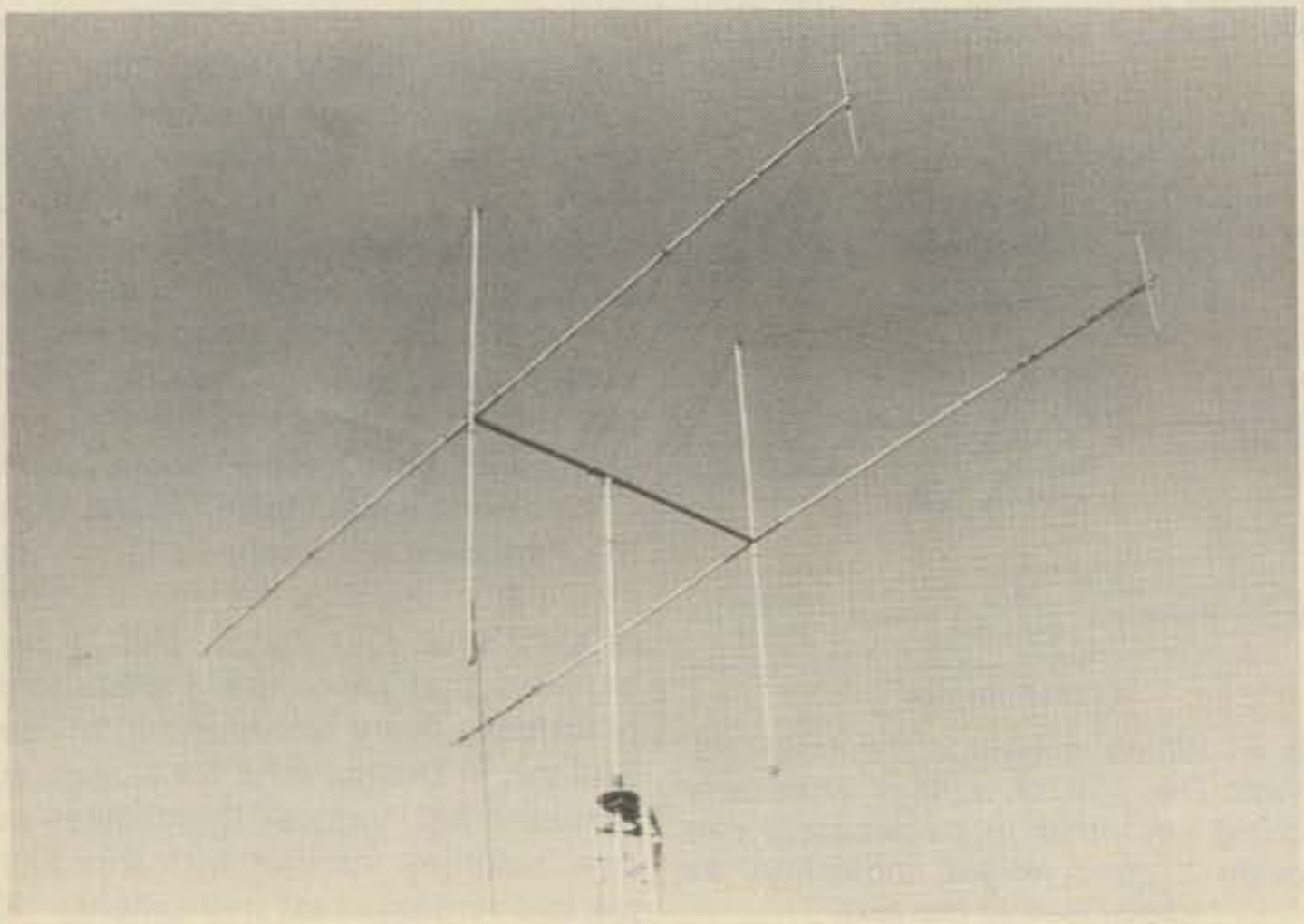
In any mechanically shortened antenna, loading must be inserted to achieve correct operation. The Mk IV relied upon center loading coils, the equivalent of base loading a quarter wave radiator. A loading coil, in the high current part of any antenna is easy to install, tunes up nicely, but radiates poorly. Moving the loading gimmick towards the high voltage portion is better; when capacity end-loading takes over, optimum signal is attained.

In this latest model, the 20 meter section gains the most and the 10-15 meter loops have been extended to one wavelength. A glance at fig. 1, shows the 10 meter element; practically an exact copy of a standard quad. The 15 meter section, takes on the aspect of a LP, while "20" is a 100 per cent LPQ. The short stubs on 15, allows its sloping wire to be centered between the 10 and 20 meter band wires.

To simplify resonating a loop, a bit of center loading was retained and upgraded to a tuning-coil status. In the driven element, these coils appear as mere "bumps on a log."

The most interesting experimental work was to contrive a simple and effective "capacity-leader" for 20 meters, presenting minimal wind and icing surface and capable of shifting the loop's fundamental resonant frequency from 19 MHz to 14.2 MHz. After trying several rather hay-wire arrangements, the scheme chosen can be easily understood from the drawings and photo. Connected at the loop's corner is a vertical stiff wire; also a length of 300 ohm TV twin lead, which runs along the inner side of the horizontal spreader.

*77 W. Euclid St., Hartford CT 06112



Construction

Material on hand or readily available will determine order of construction. Fig. 1 shows the layout and dimensions of the driven and reflector element; also close up detail pertaining to the 20 meter "capacity-loader."

The bamboo pole spreaders are prepared by reinforcing the tips with wood-dowel inserts, approximately 75 mm (3 in.) long and epoxy cement. With a coarse flat file, remove the sharp flashing growth at each bamboo joint. Using paper masking tape, 19 mm (¾ in) wide, spiral wrap the pole, making an overlap of 6.5 mm (¼ in.) or more.

Before applying a non-metallic base paint, set the masking tape by exposing it to the flame of a propane torch. While warm, mold the tape by hand firmly to the spreader and especially around the bamboo joint area. At the plexiglass insulator places, wrap 5 turns of PVC tape over an area 26 mm (1 in.) wide and at the spider-clamp locations, wrap friction tape. Install the vertical bamboo spreader with the smaller and reinforced end, bottom side. Select the stronger looking one for the driven element.

Insulators

Each vertical spreader requires two phenolic or plexiglass connector blocks as shown in fig. 2. The part is fastened to the outer side of spreader with one M3.5 (6-32) screw and banded at two places with No.16 galvanized iron wire. The wire-hole spacing dimension 15 to be 80 per cent of the bamboo diameter, at that point. Wrap two layers of friction tape around the bamboo, insert pre-formed wire through the holes, draw up firmly with

pliers and lock with a twisted joint.

Most of the labeled galvanized iron wire is only flash plated. Therefore it should be tinned with solder or coated with a silicone or front wheel bearing car grease.

The tubular Plexiglass insulators, fig. 2, are fitted to the spreader, by filing a flat spot in the insulator. The cut-out radius is slightly less than the spreader dimension. Drilling the long concentric hole should be done in a lathe, using a soap-water cutting lubricant.

The 10 meter insulators will be attached to the inner side of the beam and the 15 meter set, on the outer side. Two pieces of pre-coated iron wire are used in a criss-cross manner per insulator. As per fig. 2, form one wire diagonally around the insulator and spreader, pull up at the free ends with pliers and start a twist joint. Slip the other coated wire halfway and under the twist joint, then form the other connection at opposite side. Alternate between twist joints in a final twisting operation, while checking for correct alignment of the insulator. The trick is to apply maximum squeeze before reaching the wire's yield point. Cut off excess wire, leaving twisted stubs 7 mm (5/16 in.) long. The 20 meter ceramic, egg or strain type insulators are attached closely to the spreader via a drilled hole, 6.5 mm (1/4 in.) from the reinforced end of the spreader.

Antenna Wire

Rigging starts with the 10 meter section, checking for horizontal and vertical spreader alignment, before installing the 15 and 20 meter wires. Use No.14 enameled or bare copper wire; the heavy plastic covered wire has a different propagation velocity factor.

Capacity-Loader

See fig. 1. This consists of three major pieces per unit. One No.12 Copperweld wire. 152 cm (60 in.) long. One No.14 wire jumper, 30 cm (12 in.) long and a piece of 300 ohm TV twin lead, 130 cm (51 in.) long. The twin lead used has a thin and solid polyethylene web.

The straight piece of Copperweld is skewered through the insulator holes, displacing them to the inner side of the beam. If the correct size of insulated "spaghetti" is unavailable, a wrapping of PVC tape will be adaquate. The jumper wire is hooked over the upper antenna wire, extended and wrapped one turn around the vertical Copperweld wire and carried over to the lower wires. Strip off 25 mm (1 in.) from one end of twin lead, twist the wires together and solder them to the middle of the jumper wire. The twin lead is taped to the inner side of the spreader at five or more places.

The vertical Copperweld wire is given some rigidity by adding a varnished wooden stick, 7 mm (5/16 in.) square by 76 cm (30 in.) long. Lay it along the inner side of the wire, and bind together with light guage wire at the Copperweld and jumper wire soldered joint. Start here and spiral wrap with paper masking tape; then finish the outer end with another wire binding to keep the tape from unraveling.

Tuning Coils

These, as required for the driven and reflector elements, are made with No.14 copper wire. The wire table, see fig. 1, indicates the correct overall length of wire used in making the air wound coils. Wind the 10 and 15 meter set on a 12.7 mm (1/2 in.) diameter rod, using a very coarse pitch. Form hooks at the lead ends, and fit the coil into place by altering it's pitch and diameter. The 15 meter coil extends across the center of the connector block, while the 10 and 20 meter coils, are off the inner and outer edges of the block. The 20 meter coils will be wound on a 19 mm

TUNING COIL WIRE LENGTH

BAND	10	15	20
Driven element	46cm (18")	15.3cm (6")	25.2cm (10")
Reflector 2 coils req'd.	43cm (17")	61cm (24")	76cm (30")

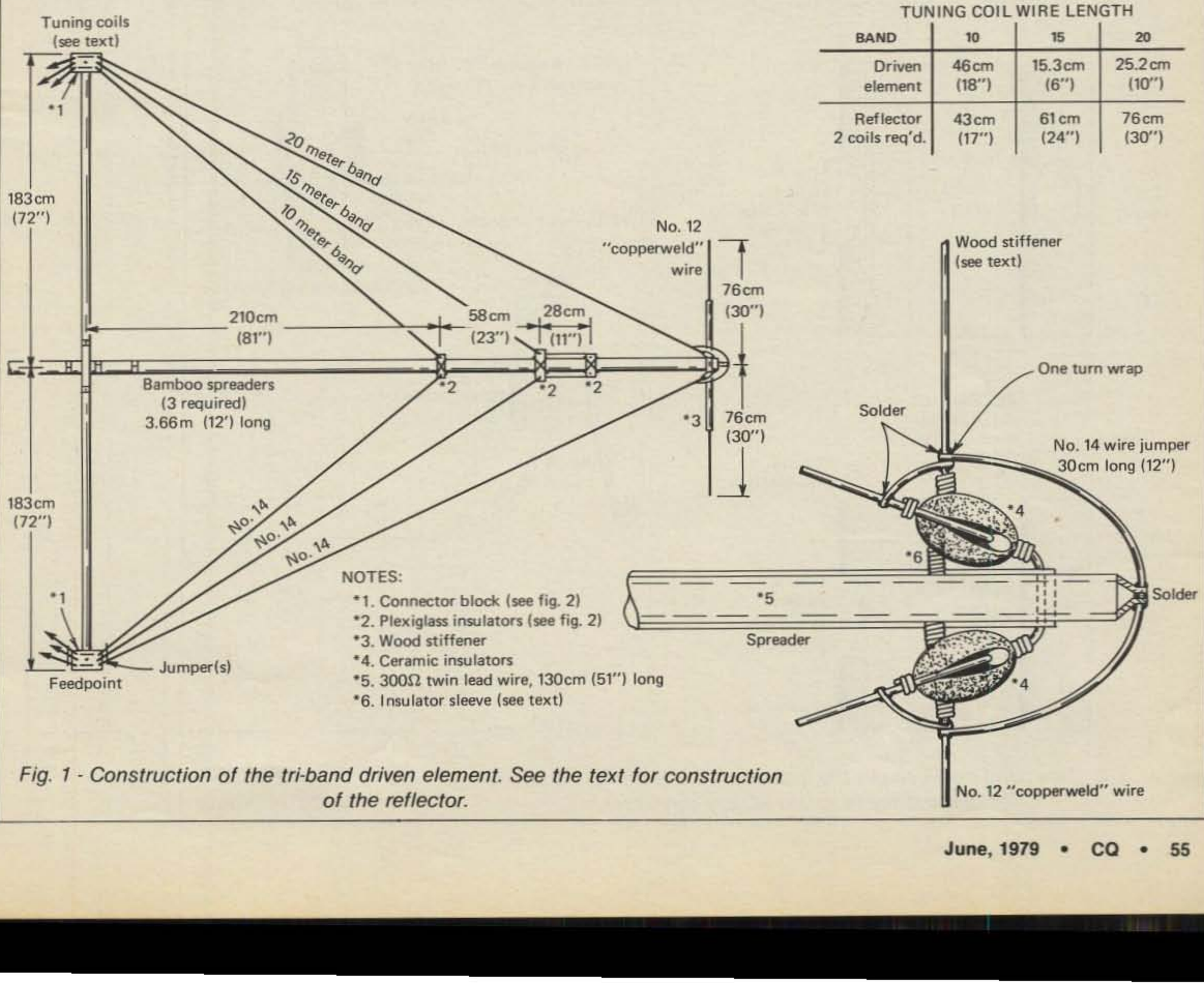


Fig. 1 - Construction of the tri-band driven element. See the text for construction of the reflector.

(3/4 in.) diameter form. The driven element uses one set of coils and the reflector requires coils across the upper and lower connector blocks.

Since the basic wire element are identical, the reflector coil inductance is much larger than the driven element coil leading. I suppose one should extend the reflector 10 and 15 meter loops and use more capacity leading in the 20 meter section for maximum gain. This would put the cap on what we started out to do.

Driven Element

This will be fed by a single RG/8 coaxial cable. The antenna wires on each side of the lower connector block, are connected in parallel with a wire jumper and to a modified SO-239 coax fitting. A photo of my installation shows the coax making a direct drop; actually it is attached a short distance above the connector block and makes a 180 degree loop, with the PL-259 fitting headed downward. To protect the underside of the SO-239 fitting from water and dirt accumulation over the narrow insulated gap, a drip-skirt, see fig. 2, made from a short section of brass tubing or rolled up sheet is soldered on; also the necessary wire leads to join the jumper wire connection.

Spider and related hardware, although finally covered, will probably be the starting point of your LP Quad. I used the same parts left over from the MK IV that were made to fit a 51 mm (2 in.) OD aluminum boom.

A cheaper and more common boom material is steel electrical mettalic tubing or EMT, 25.5 mm (1 in.) size. Fig. 3 shows all of the parts required and construction details. The angle iron can be a lighter gauge, if available. The iron pipe stubs may require some file work for a smooth fit to the EMT. An additional part to the original spreader clamp assembly is a curved sheet metal piece that bridges the open gap and improves clamp tightness.

Feeding And Adjustment

The driven element is fed directly by one RG/8 coaxial line; a balun is not required to equalize current distribution to both sides of antenna. The electrical path between the inner conductor and the outer sheath is via a loss copper wire circuit. A half wave dipole behaves quite differently. As to r.f. line radiation, if there is any, it is at a sub QRP level.

My antenna sections were peaked at 14.15, 21.15 and 28.4 MHz to cover the c.w. and lower end of the phone band. Tune-up for c.w. or phone bands only; this will improve performance. This can be done by altering the length of coil wire. In addition, the 20 meter element capacity-loader can be trimmed. A difference of 25.5 mm (1 in.) in the linear dimension of one twin lead will shift the frequency aproximately 16 kHz. The same change to one vertical Copperweld wire will move the frequency aproximately 18 kHz.

In actual practice, any capacity trimming should be equally divided, however the upper and lower pair of reflector coils can be different; the coil with the greater inductance should be at the top, to favor the driven element.

A transmatch or tuner must be used, in view of the simple feed and triple impedance. Initial testing should be done at low power to determine if antenna is performing as per "great expectations." The s.w.r. meter readings will be affected by the length of coax cable, since it's part of the tuning system. Optimum tune-up requires a simple field strength meter hookup to obtain relative power gain and front-to-back data. To complete our basic instrumentation, an antenna noise bridge can be very useful.

Conclusion

At the moment, I can see one more addition that will enhance the overall

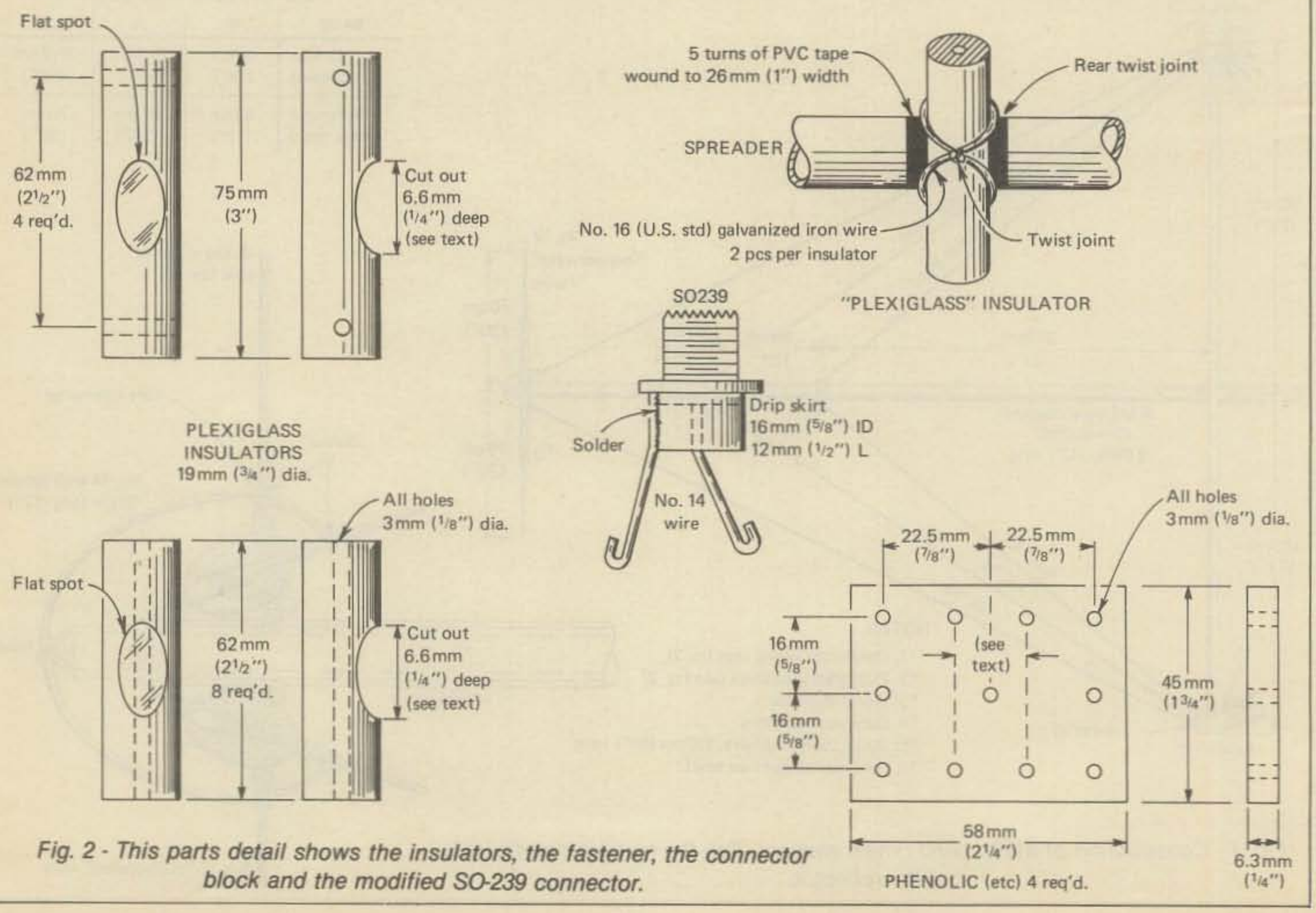


Fig. 2 - This parts detail shows the insulators, the fastener, the connector block and the modified SO-239 connector.

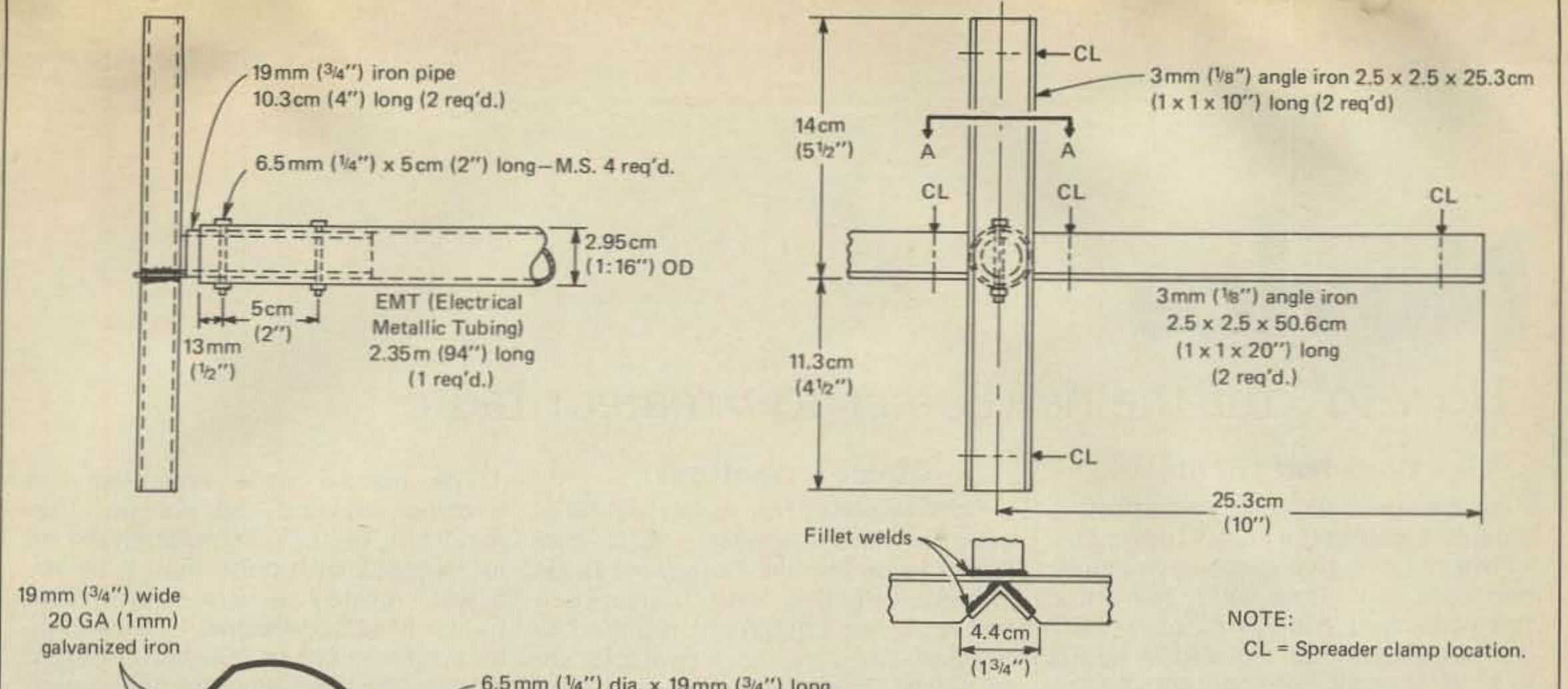


Fig. 3 - The spider spreader clamp and boom construction.

performance. Operation on the 10 meter band has frequently spread above 29 MHz; therefore to extend the antenna bandwidth, another set of loops can be connected in parallel with the present ones. I suggest installing the other set of Plexiglass insulators along the horizontal spreaders at 190 cm (75 in.). Try it. See what happens. Let us know.

a monthly feature by

BILL WELSH, W6DDB

Novice

"How to" for the newcomer to Amateur radio

Code Part I of III

I have worked with many prospective amateurs during the past 30 years and I have noticed that most newcomers seriously doubt their ability to master the code well enough to pass FCC licensing examinations and to use it to hold two-way radio contacts on the air. Despite this predominant early fear, I do not recall any student who was unable to learn the code. Licensing course students sometimes tell me that they have no desire to use code on the air and that they will never touch a key after they pass the FCC code test requirements related to the licenses being sought. I have noticed that some of the people who express the greatest initial dislike for code turn out to be extremely good code operators who predominantly operate by code.

2814 Empire Ave., Burbank CA 91520

This is Eric Jessen (KA8AKY) of Cleveland, Ohio. Eric worked 35 states in his first few months on the air with his Heath HW-16 Transceiver, Heath HG-10B VFO, and Hustler 4-BTV Antenna. Eric is a student at Case Western Reserve University. His shack is 35 yards from a freeway interchange, 70 yards from railroad and rapid transit lines, and 200 yards from the glidepath of airplanes approaching Hopkins Airport. Despite all the interference, this 18 year old amateur does a fine job on the air.

Code Advantages

Code provided the initial method of radio communications and it continues to be popular because it is extremely effective. The transmitting and receiving equipment required to conduct two-way radio contacts are relatively simple, low cost, and easy to operate.

Code transmissions are normally very narrow which means that many stations can simultaneously conduct different contacts using very little frequency spectrum. Simply stated, the width of the transmitted code signal is about five times the code speed sending rate. Consequently, a code transmission at 20 words per minute (w.p.m.) would be about 100 hertz wide. To better understand just how significant this narrow bandwidth is, simply compare it to a typical single sideband (SSB) signal of about 2700 hertz or a typical amplitude modulation (AM) signal of about 6000 hertz width. The indicated relationship is as significant as the preceding figures show. You can hold 25 to 60 (or more) two-way code contacts in the frequency spectrum used by just one SSB or AM voice contact. The extremely narrow bandwidth characteristic of code signals does more than allow several stations to crowd into smaller band segments. The narrow code emission allows receivers to be operated at their maximum selectivity capabilities, which means that just a small segment of frequency has to be listened to by both operators involved in each contact. Atmospherics (natural radio noise), local electrical impulse noise, and other noise is spread out fairly evenly over large frequency segments. Much of this noise can effectively be eliminated by using a narrow receiver selectivity which just allow 80 to 300 hertz of spectrum to be processed thru the receiver. Simply stated, when you use high selectivity with a receiver that includes a code (cw telegraphy) filter, you do not hear noise or interference unless it is within the very narrow frequency spectrum where you are listening.

The narrow code emission has another natural advantage that results in better communications effectiveness with code than with any other mode of emission. The transmitted code signal is packed into a narrow (20 to 300 hertz) output signal, providing an extremely potent transmission that can be received at distances and under adverse conditions where SSB and AM signals would not be heard.

There are other advantages to code when compared to SSB, AM, NBVM (narrow band voice modulation), RTTY (radioteletype), FM (frequency modulation), NBFM (narrow band frequency modulation), ATV (amateur television), or SSTV (slow scan television) emissions but not all code advantages are easy to describe. There is pride of accomplishment in having mastered the code and developed the capability to hold solid two-way contacts with other proficient code operators encountered on the amateur bands. There is a greatly reduced possibility of being bothered by other stations breaking in on your contacts; code operators tend to wait until a contact is finished rather than to make roundtables (3, or more operators) out of contacts. If you become involved in handling messages, you will learn that there is less possibility of error when traffic is handled by code than when it is routed by voice.

What Code Is

There are different types of code emissions. In the crowded high frequency range (3 - 30 megahertz), only A1 code emissions are allowed. An A0 emission is simply a wave being transmitted with no variations of amplitude, frequency, or phase. There is no intelligence on the A0 emission, it is simply a continuous wave (cw). When an A0 (cw) emission is turned on and off in a known sequence, as when code is being transmitted, it becomes A1, which is also known as interrupted cw (icw), cw telegraphy, or code. As previously explained, such

code signals are extremely narrow and they provide extremely efficient long distance communication capability.

Another code system is modulated code which is designated as A2. The advantage of A2 over A1 is that 1t can be received using any receiver that can be turned to the transmission frequency, whereas a communication receiver is needed to receiver A1. A1 reception requires a beat frequency oscillator (BFO) stage to develop an audible beat (difference) frequency that can be heard by the operator. The A2 signal is modulated by a suitable tone (often 400 to 1000 hertz) and that tone will be heard each time a dit or dah is transmitted, with no BFO required. The obvious disadvantage to an A2 signal is that it is much wider than an A1 signal. The wider mcw signals are not permitted in the crowded h.f. amateur bands (80 thru 10 meters), but they are allowed on the v.h.f. (very high frequency, 30 - 300 MHz) and u.h.f. (ultra high frequency (300 3000 MHz) bands. Some amateurs produce mcw emissions by simply keying a code practice oscillator and positioning their microphone where it picks the code to modulate the transmitter output wave.

Although code contacts are generally conducted at the low end of each amateur band, they are legal everywhere on all amateur bands. Naturally, one is not allowed to transmit code in band segments not included in one's operating privileges. However, you are allowed to make code transmissions throughout the amateur spectrum you are authorized to use for any purpose.

If other members of your family normally use the area where your station is set up, it may be very difficult to operate in a voice mode since your microphone could pick up their voices, noise, or commerical radio and TV broadcasts. Conditions which make voice operation impossible will not stop you from operating code.

Word Count System

Each letter of the alphabet has a single unit count. Each numeral, punctuation mark, and work sign (except K) has a two unit count. Each five units are counted as a word. The code speed rate is easy to calculate. Just count the total number of units sent or received in one minute and divide that total by five. As an example, if 25 letters were sent in one minute, the code speed was 5 words per minute. Check a few code practice runs and you will quickly become familiar with determining exact code speed rates in words per minute.

Code Tests

Basic Information. When a volunteer examiner conducts a code test, both receiving and sending tests are administered. When taking a code test at an FCC office, only the code receiving test is administered. The volunteer examiner conducts the receiving test first since an applicant is much more likely to flunk the receiving test than the sending test. Naturally, the sending test is only administered if the applicant successfully passes the sending test.

There are two types of code receiving tests. One type involves a five minute code test run in which the applicant must correctly copy one minute's material without error; this is the long established one minute out of five minutes code requirement. The other type of code receiving test again involves a five minute code test run; however, in this case, the applicant is asked ten questions about the text he/she copied and must correctly answer at least eight of the questions to pass the test.

Novice Code Test. This receiving and sending test is normally conducted by an amateur holding a General (or higher) class license. No numerals, punctuation marks, or work signs can be included in the receiving test; it must be forward reading plain language text. Since the Novice code speed test is at 5 w.p.m., 125 letters are sent during the 5 minute long receiving test. If the applicant correctly copies any 25 consecutive letters during this test, he/she has passed the first part of the code test. The test copy does not have to show proper spacing between words nor do all letters in words have to be correctly grouped together. A passing run can start and end in the middle of words. Since only 125 letters are included in the entire Novice code receiving test, it is impractical for the volunteer examiner to develop a reasonable comprehension test; it would involve one question based on each 2.5 words sent in the test. The Novice sending test is again at the rate of 5 w.p.m.; however all numerals and letters, plus certain punctuation marks and work signs, are included in the sending test. The specific symbols which can be included in amateur code tests are detailed later in this article. If the applicant sends one minute (or more) of forward reading plain language text during a five minute run at 5 (or more) w.p.m., he/she has passed the Novice sending test. The Technician code test requirement is also 5 w.p.m., but Technician examinations are now normally conducted only at FCC offices where no code sending test is performed.

Other Code Tests. The code speed requirement for General and Advanced licenses is 13 w.p.m. and it is 20 w.p.m. for Extra class license applicants. Since all of these license examinations are usually conducted at FCC offices, no sending tests are involved. I was not surprised when the FCC stopped conducting sending tests since my own experience indicated that less than one out of each one thousand applicants failed a sending test after passing a receiving test at the same speed. By eliminating the code sending test and adopting the code receiving comprehension test, the FCC has made it possible for people with no code proficiency to conduct code tests, possibly clearing the way to have amateur and commercial operator's licensing examinations held at all civil service examination offices.

Summary

This concludes the first portion of this three part article on code. Each part contains information that is useful by itself but the entire article should be read to derive maximum benefit.

Andy Chang (KA6AXV) advises that the Mean Teen Net meets at 0030 UTC Monday through Friday on 7103 kHz. The net control station is N6AWU and speeds range between 5 and 20 w.p.m.

The latest revision of the Amateur Radio Service rules and regulations is available at $1.40 per copy from the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402. The revised part 97 can be ordered as stock number 004-000-00357-8.

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:

KA1BBD Patricia @ Shrewsbury, Mass., KA2CMC Greg @ Mattydale, New York, KA3AUE Beverly @ Friendly, Maryland, KA4ANG Frank @ Gainsville, Florida, WB5LVL Richard @ Cleveland, Texas, KA6EAS John @ Citrus Heights, Calif., KA7AHC Ronald @ Glendive, Montana, WD8JUB Brian @ Bellefontaine, Ohio, WD9CYW Helen @ Menasha, Wisconsin, KA0ABQ Andras @ Andover, Minnesota.

73, Bill, W6DDB

W6VIO's SSTV Pictures of JUPITER and its MOONS go around the World

BY DR. NORMAL L. CHALFIN*, K6PGX

Thanks to Norm and the enthusiastic group at JPL we have been pleased to bring you some of the most exciting photos and up to date information possible on our space missions. I am happy to report that we will be publishing on a regular basis more material from Norm and the gang at JPL. The technology of space and the future of amateur radio are closely linked, not only in theoretical terms but on a humanistic level that can be appreciated even today.

-K2EEK

W6VIO's CQ SSTV Card as viewed on the SSTV Monitor. (K6PGX Photo)

Stan Brokl, N2YQ, and Roy Neal, K6DUE, go over a point in the log at W6VIO.

Amid a string of new discoveries about Jupiter and its Moons the Amateur Radio Club of the Jet Propulsion Laboratory in Pasadena, CA, through its club station W6VIO, commemorated the Voyager I flight around the Planet Jupiter and at least four of its moons by making contacts on c.w., s.s.b., f.m./SSTV with a grand total of about 1500 amateurs. Many JPL ARC members participated.

The operation was organized by Dick Piety, K6SVP, who is well-known for his slow-scan TV activity by amateurs around the world. It began on the First of March 1979 and continued through March 11th. The participants worked through their lunch periods, after work and on week-ends during the commemorative period to make contacts on the various bands. A commemorative QSL is being sent to all who contacted V6VIO during the operation, and forward an SASE to the JPL Club*.

Some of the anecdotal experiences during the 12 days of the commemorative are indicative of the extreme interest generated. On the twenty-meter Slow Scan TV operation John Young, WD5JHP, in Wichita Falls, Texas reported that he was recording all of the pitctures being transmitted to show to his class of 14 year-olds at the S.H. Rider High School. Dave Ingram, K4TWJ, of Birmingham Alabama sent a telegram to W6VIO indicating that he was recording images and sending them to the local press as fast as he could copy them. A station in France hearing W6VIO called friends both in France

Dick Piety, K6SVP was the "Honcho" for the W6VIO Voyager I Jupiter Fly-By commemorative operation. Here he is describing one of the IO (one of the moons of Jupiter) images that had just been transmitted via SSTV on 20 meters. The dark bar is synch scan with photo exposure which uses a focal plane shutter.

*JPL Amateur Radio Club W6VI 4800 Oak Grove Dr., Pasadena, CA 91103

During the N6V operation from JPL in 1976 Stan Brokl, left N2YQ (then he was K6YYQ) demonstrated his slow scan TV operation to NBC's Science reporter Roy Neal, K6DUE and the retiring director of the Jet propulsion Lab Dr. William H. Pickering (Ex Z2BL)

and in Germany to make contacts with the JPL Station.

Of course the incentive was enhanced because of the anticipated QSL card which will have a close up view of the great Red Spot on Jupiter and other images obtained by the NASA/JPL spaceprobe.

Many of those receiving the W6VIO signals recalled the event in 1976, when, under the special call N6V, JPL's amateur enthusiasts racked up a total of more than 10,000 contacts when Viking's landers setdown on Mars and returned those remarkable pictures of its surface. Durin that commemorative event many places in the world not otherwise served by other press services were able to publish pictures of the Martian surface because of the JPL Amateur Radio Club's transmissions.

For the Voyager I Commemorative the JPL club station has been completely revamped which should be evident from the pictures accompanying this story. It was a touch-and-go situation. The rigs were still being laid in the trailer which houses the club station when the operation began.

For those who were not able to get in on the March Voyager I Commemorative from W6VIO, there will be another in July during the close encounter of Voyager II with Jupiter. The W6VIO operations during that period will begin July 6th and continue through July 15, 1979.

Participants in the operations at W6VIO include:

Dick Piety,	K6SVP
John Repar	WA6LWD
Stan Sander	N6MP
Ron Zenone	W6TUZ
Warren Apel	K6GPK

Jim Lumsden, WA6MYJ puts out a Voyager image on SSTV of the plan for camera pointing which led to the discovery of the ring around Jupiter's equator. This was part of the W6VIO commemorative activity for the Fly-By of Jupiter and four of its moons by Voyager I. (Photo by Dr. Norm Chalfin, K6PGX)

Merv Mac Medan	N6NO
Jim Longthorne	WA6KPW
Bob Gosline	AE6S
Rich Soikelle	(An Explorer Scout, will get call later)
George Morris	W6ABW
Jim Lumsden	WA6MYJ
Mike Griffin	N6WU
Norm Chalfin	K6PGX

Support Your Local Dealer ~~Sheriff~~

BY RICHARD A. COWAN, WA2LRO
PUBLISHER, CQ MAGAZINE

There's been a lot written in the ham press recently on the pros and cons of buying gear by mail order as opposed to locally through a regular retailer. The basic attraction of the mail-order system is price. And there's something to be said for getting something as cheaply as possible.

But with any product—and even more especially with amateur equipment—there has to be a bigger consideration than price alone. There's service to consider. There's also maintenance and repairs. What's the difference? Well, let's consider the term service to mean the actual optimum effective usage of your station. Your dealer, who in 99 cases out of 100 is also a fellow amateur, provides a service by helping you plan your station for future needs as well as present ones. He's there to advise you what radio or antenna system is best for your location, the size of your shack, the types of operation you're planning. He's there to provide parts, accessories, and any of a thousand little items that you'll need to make hamming more pleasurable.

John Klewer, AA6Q, Service Engineer for Ham Radio Outlet's Anaheim branch at his service lab position shown checking out an in warranty service problem.

One of New England's oldest distributors, Hatry Electronics. Shown above are some of the product lines that they stock and their equipment demonstrational position.

By maintenance and repair we mean the keeping of your equipment in good working order. Sure, there's always a chance that your new transceiver will blow a final. But while you're waiting to get it fixed, your local dealer will probably lend you a replacement rig to keep you on the air. He'll also be of great assistance in getting your pet radio fixed as quickly and as permanently as is humanly possible. The rig might have to go back to the factory; more than likely your local dealer will handle the repairs for you himself.

And there's an intangible service that

every local dealer provides that you simply can't put a value on. That's the opportunity for you to just look at new gear on the market and play with the knobs. Half the fun of buying is checking out all the products on the market and comparing features. Sure, the magazine ads give you a lot of info, but there's nothing like a personal inspection at the local store to get the adrenalin flowing. I've bought a lot of gear by both systems over the years; I can assure you that carrying the brown box out of the store and into the car is a lot more fun than watching it be delivered by the UPS man.

So these pages are a tribute to the unsung hero of ham radio, the local dealer. The guy who listens to all your problems, answers your questions, and guides you to better hamming. He's the guy who smiles, even though it hurts, when you walk in the door to have a rig fixed that you bought through the mail to save a ten dollar bill. He's the guy who'll come over to the house late some evening when the rig just doesn't seem to be working quite right. He's the guy who makes ham radio a lot more fun.

Here are a few photos of some of the better dealers around the country. As you can see, the layouts are a bit different, and so are the service benches. But on the whole, all these shops have one thing in common. They're the backbone of amateur radio. They want your business. And they deserve it.

A portion of Communications Center's warehouse inventory showing all of the "Goodies" for immediate delivery.

Alan, KØBG of CW Electronic Sales Co. located in Denver, CO is shown here demonstrating the features of this new radio to a local customer.

Barry Electronics, a pioneer in serving the needs of the Radio Amateur. Shown here are some of the staff with Mrs. "Kitty" Gensler, WA2BAP. . .

a monthly feature by

ADRIAN WEISS, K8EEG

QRP

The art of very low power operating

1978 Milliwatt Field Day Trophy Results

Well gang, results for the *1978 Milliwatt Field Day Trophy* are finally in and my reaction is a mixture of disappointment and excitement. In the February, 1978 column, I threatened to discontinue the award unless at least 15 entries were received. Alas, only 7 turned up in my mailbox. This puzzles me, since the 1B listing in the *QST* results shows at least 65 entries! I keep trying to figure out why only 7 end up entering our sidekick competition—perhaps poor publicity, perhaps lack of respect for the award, whatever. Disappointment. But, our entries are exciting ones and do show that QRPp can accomplish amazing things, even in the midst of one of the biggest contest frays known to mankind! And that, I guess, is the purpose of the Milliwatt Field Day Trophy— to recognize achievement in QRPp, so its purpose is being fulfilled. Sure would be nice if a lot more guys sent in their results to support QRPp via the award and this column, which is about the only place that QRPp gains official recognition in the amateur world.

At any rate, in last year's story, we tossed out a challenge for someone to better N2AA's performance of 389QSO's at 1 watt and score of 2790 pts, which had bettered the previous high score of W0IYP by a slim margin of 6 points! Well, it's been done, but by a very slim margin again! WA4IAR racked up a total of 442 QSO's for a grand score of 2802, just 12 points higher than N2AA's 1977 performance! Amazing that these top scorers push the upper limit just a little higher each year! The top edges up a few points at a time as efforts increase each year. But I'm disappointed that fellows at the other end of the score range don't send in their stories and results also, because it is the little guy who is out there competing because he loves to operate QRPp and take his chances against the "pros" that really proves that QRPp is effective! That a ordinary, "non-contester" manages to grind out 72 QSO's during FD with a one watt rig and a limited antenna is the real proof that QRPp is effective and enjoyable. So, one more year! Let's have everyone send in his results whether he scores in the 2000's or 200's! Let's hear what the fellows had to say about their FD efforts.

83 Suburban Estates, Vermillion, SD 57069

Winners of the 1978 Milliwatt Field Day Trophy, WA4IAR (l.) and WA4GQJ (r.) standing in front of the operating position in their camper trailer that served as the "shack". The Argonaut 509, which mustered 2 watts output and KrSA keyer provided a simple but very effective station. Antennas included a Vee on 80 meters, an Inverted L on 40, and a 3 element tribander for 20-15-10 meters. Great job, fellas!

One of our "regulars," K6TG (Ben Saylor, Box 2314, Modesto, CA 95351) provides the following rundown: "Just back from a pleasant QRPp Field Day—nice wx and no bugs except the ants that tried to chew up my nylon guy lines and me. Used trees and bushes for anchors for my 40 ft. pole (see photo) this time, but found it much harder to put up than when I drive four stakes into the ground and can figure the right length for the guys. The Century 21 works well on battery, but the two sidebands, with one of them wrong, is worrisome in contest type operating. The power level is easy to adjust with my separate volt and ampere meters. The FT-7 is really great on SSB even when turned down to less than half its capability, but the dial, while good at night, was nearly invisible in the bright daylight. I worked 198 QSO's in 55 sections, plus KG4, ZL, KH and KL. I trust that you had an enjoyable FD, and hope you will keep the *Milliwatt Field Day Trophy* going!"

K0TO(ex-/W0IYP), Tod Olson, 292 Heather Lane, Long Lake, MN 55356, operating W0AA with W0BE, writes: "Here are the results for 1978. A few QSO's down from 1974 (439 vs 417), but the ARRL power multiplier of 5 drives my *QST* score up to 4000 points. My current QRPp associate, W0BE, and I have already begun to plan for next year. This year the Argonaut worked well, but we felt the

1978 Milliwatt Field Day Trophy Results

	QSO's-C.W./SSB	Power Mult.	Battery Mult.	Total
1. WA4IAR/4	442/0	X4	X	2802
2. W0AA/0	385/32	X4	X	2652
3. W2RUI/2	90/148	X4	X	1578
4. K6TG/6	97/101	X4	X	1338
5. AA2U/m	58/71	X4	X	774
6. WD4EBR/4	11/0	X4	X	216
7. WA7ZYQ/7	4/2	X4	X	186

(Scoring: QSO's (1 pt. ea.) X Pwr. Mult. (1 watt X5, 5 watts X4), X Battery Power Mult. (1.5) + 150 portable setup)

need for an antenna that will do better to the west. Next year we will be trying the standard sloping dipole and also a loop of some sort for 40 & 20 meters. Again this year we used my HQ-215 for receiving and the Argonaut for transmitting. I have a battery powered memory keyer so operating was a real pleasure. Also, we built a very sophisticated antenna switching, receiver muting circuit to give operating conditions almost as good as the home station. Next year, I think we will use a homebrew transmitter to avoid some of the Argonaut-to-receiver problems that we met." Paul R. Clinton, WD4EBR, 617 Broad Ave, Seivierville, TN 37862, writes: "I wish to enter your 1978 Milliwatt FD contest. Enclosed is a copy of my log and info on the rig. This was my first FD. I had to work Saturday, so I could not get started that day. I tried the contest Sunday. Left home at 0945Z and arrived at the site 1001Z. Set up the antenna—a dipole at about 20 ft. between two pine trees—by 1040Z and called my first station at 1155Z. I drank tea and smoked cigars and had a great time until it got so hot in my car that I called it quits. I only made 11 contacts, but had a great time! I've been a Novice since April, 1977. The rig is a

Milliwatt Field Day Trophy Winners

		QSO's SCORE
1970	K4OCE	220/1470
1971	WA6ABP	137/1175.5
1972	W7DRA	55/562.5
1973	WA5WYO	79/742.5
1974	W0IYP	439/2784
1975	WB8OSM	220/1470
1976	K6TG	128/918
1977	N2AA	389/2790
1978	WA4IAR	442/2802

gift from a fellow ham. Since TenTec is next door, I had no trouble getting new finals and repair work for the rig. Now it works fine and I'm hooked on QRPp. I don't expect to win but I do want you to know that QRPp is alive in the TenTec area."

WA7ZYQ, David Rogers, 238 10th St., St. Maries, ID 83861, writes: "Things went downhill after the first hour or two—poor planning. Next year we will know better. Hope you keep the contest going. I have operated several FD's, but this was the first on QRPp—it's a whole new ballgame! Will give it another shot next year."

And finally, AA2U, Randy Rand, 8 McDermott Pass, Danville, NJ 07834, writes: "I worked FD on a return trip from West Chester, PA, to Danville, NJ in a 1975 Chevelle station wagon. Upon reaching home in Danville, everything was transferred to a 1967 VW, and then we worked late into Sunday morning and all day Sunday with only a short nap (AA2U & K2RF). The most productive hours were late at night when it was possible to work the 15 & 20 meter phone stations without QRM. The equipment was an Argonaut 509 and ICOM IC22-S for 2 meters. A 5/8 wave vertical was used on 2 meters, and a Hustler mobile whip on 40-10 meters. I found the 40 meter antenna to be very disappointing as only 3 stations were worked with it, and the 75 meter antenna would not raise anyone. The antenna on 20 meters worked great, as I found out Saturday night when I was called by ZL1CO. The 15 meter antenna worked very well, as it accumulated 46 QSO's on c.w. and phone. At any rate, I will return next year and hopefully improve my score.'

Well, gang, that's it for FD 1978! The trophy goes to WA4IAR for his outstanding showing. We'll go ahead with the award for another year in the hopes of collecting a greater number of entries, as well as seeing if someone can establish a new high score. So, let's get planning now for a great time in 1979!

73, Ade, K8EEG/W0RSP

Quick! Which is better, a kilowatt input or five hundred watts output? For the surprising answer read Ade Weiss' two-part article.

R.F. Output Power Measurements

Part I
Input vs. Output Power

BY ADRIAN WEISS*, K8EEG/W0RSP

One of the most baffling phenomena found in an otherwise state-of-the-art situation in amateur radio is the apparent mystery surrounding the rather simple matter of r.f. power measurements. Somewhere along the line, someone convinced radio amateurs in general that the measurements of r.f. output power was a sort of witchcraft or mystical enterprise reserved for the initiates of some secret, Hewlett-Packard-based laboratory sect, and otherwise beyond the capabilities of mere mortals. Or, perhaps, the greatest hoax of modern science has been secretly perpetuated in the enthronement of INPUT POWER as the ultimate standard for determining performance of electronic gear in the amateur realm. The FCC, of course, has been an either willing or unwitting co-conspirator in this hoax, supporting the sacred cow of INPUT POWER by regulating amateur service according to its standards, while all other radio services are regulated in terms of the mystical OUTPUT POWER standard. Whatever the historical explanation of this current phenomenon, the hoax must be exposed so that the masses of amateurs may be freed from the bonds of ignorance and regain aright their lawful inheritance to the truth! That is, to the truth as regards the performance of their transmitting gear.

The INPUT POWER Hoax Exposed

That the amount of power that a transmitter can deliver to the ether via an antenna is the most important concern in the communications situation is reflected in the fact that the FCC refulates all other radio services in terms of *effective radiated power* and, in relevant cases, directionality. In terms of predicting the performance of a signal, it is the *erp*, or power which is actually radiated from the combined transmitter-antenna system, that must be known in order to determine the coverage of the signal in terms of distance and direction. In calculating and predicting communications expectations over a given path, a complex array of factors, including *erp*, atmospheric absorption, frequency, incidence of wave reflection, ground losses, geographical distance, MUF, and others, must be considered and evaluated. Ultimately, these factors attenuate the *erp* passing through the ionospheric medium, and in order to determine how much of a signal is left after propagation, the *erp* must be known.

Now, the measurement of *effective radiated power* is a complicated task beyond the capabilities of most amateurs. However, it is possible to arrive at a reasonably accurate estimation of *erp* if the actual output power of the transmitter can be determined. Then the loss components of the remainder of the transmitting system can be measured, such as feedline loss and antenna gain, and the *erp* calculated. That *erp* figure can then be plugged into the propagation path prediction formula, and an estimation of performance made.

However, an input power figure does not provide meaningful data for such calculations because the relationship between input power and output power is very ambiguous and varies in almost all specific cases. In fact, there is no way of calculating output power, given the input power. It ultimately must be measured empirically. A rather unscientific practice has been followed due to this ambiguous input *vs* output power relationship, namely, applying the "rule of thumb" assumption that output will be about 50% of the input power. Anyone who has empirically measured input *vs* output powers in a number of transmitters can attest to the total undependability of this "rule of thumb," and indeed, attest to the great variation in the input-output ratio that can be observed in actual units. This writer has measured ratios ranging from about 9% to about 72%! The implication is that, given a certain input power, the output power can be just about anything between zero and one hundred percent—with a little exaggeration of limits, of course! But the point is that this is not too much of an exaggeration. Furthermore, one cannot assume that identical units will exhibit identical input *vs* output ratios, as I will note below. In short, input power provides no meaningful data with respect to path predictions based upon *erp*.

Now, few amateurs ever sit down and calculate the amount of power that is needed to produce a readable signal at station XX0XX over a path of 4752 miles of 21 MHz at a given time of day during a specific point in a sunspot cycle, etc. However, all amateurs confront this question every time they reach for the key or mike to call a station. And oftentimes, someone is surprised because

*83 Suburban Estates, Vermillion SD 57069

of a wide difference in signal reports exchanged. For example, K2ZZ, running 5 watts r.f. output to a three element yagi with a gain of 5.1 dB receives a solid 589 from W6YY who is running 180 watts input to a two element yagi with a gain of 3.1 dB, but only receives a 599 in return. We assume a hypothetical accuracy of RST reports here. Now, just looking at the two stations, it seems that W6YY should get a much better report than he gives K2ZZ, since he's running 180 watts *input* compared to 5 watts *output*. Even if K2ZZ's rig is 50% efficient, and is running 10 watts input, W6YY should get a much better report because he's running 10 times as much power. The catch obviously is that W6YY's 180 watts *input* does not tell us what power he is delivering to the antenna. Now, suppose his transmitter exhibits a typical 42% efficiency (output power/input power ratio), in which case his output is only 75.6 watts. If we then figure in the respective antenna gains, K2ZZ's *erp* is about 15.82 watts, while W6YY's is about 150.8 watts. So the power ratio is about 9.5:1, or about 8 dB. Now, assuming that an S-unit is a 6 dB step, W6YY's 599 report is just about right! Bet your bottom dollar, though, that W6YY will sit there and scratch his head in disbelief, amazed at what a few watts can do. If he approached the situation by basing his expectations on the output power from his 180 watt rig rather than the input power, he'd realize he was getting the performance to be expected. Similarly, emphasis upon output power would save a lot of money and headaches among the QRO boys who fret because there is little noticeable differences in signal reports when they "kick in the big burner" kW linear which amplifies 160 watts output from their "barefoot" rig to a whopping 510 watts output to the antenna. A simple knowledge of output power and power ratios would save alot of guys alot of kilobucks once they realized that $950 cash on the counter will net them about one S-unit gain in signal strength. Can't really "clear the frequency" with that kind of firepower.

Input Power Unreliable As Index of Circuit Performance

The second major area of concern in which input power provides nebulous informantion is with regard to the internal performance of a given transmitter circuit irrespective of its effectiveness over a communications path. In fact, with regard to measuring internal performance, input power can be downright deceptive. *Efficiency* is the key factor here. In one context, efficiency can be defined as the ratio between input and output power. Restated in more appropriate terms, *efficiency* is the capability of a tube or transistor device to transform d.c. input power to r.f. output power, or, it measures a given component's loss factor when placed in a circuit which generates r.f. power. In the most general terms, input power is useless as an index of circuit performance because it provides information *only* about the d.c. dimension, and the basic purpose of the circuit is in the a.c. or r.f. dimension. As noted earlier, the relationship between input and output power is ambiguous and different in nearly every case. Let us consider the reasons for this ambiguity.

First off, there are inherent variations in both tubes and transistors with regard to the actual efficiency of each device. Production quality control is good, but permits fairly significant variations from device to device. It is for this reason that manufacturers rank devices according to reliability and tightness of quality control, with space projects and other such crucial projects receiving highest grade devices, the military next, and so on down the line until mere mortal radio amateurs get what is left. Manufacturers recognize this variation by indicating on specification sheets a spread from "minimum" through "typical" to "maximum" performance to be expected of a given device. The result is that devices from a given production group may exhibit markedly different performance. Anyone who has substituted several examples of the same transistor type in a single circuit can attest to the variation in performance that is actually found in practice.

Now, in addition, transistors and tubes exhibit frequency consciousness, usually becoming less effcient as frequency increases. The gain factor, or *beta*, of a transistor decreases with increase in frequency, with the upper frequency limit where the gain is 1 or unity designated f_T. Manufacturers include in spec sheets graphs indicating the gain of a device across a portion of the spectrum, given specific drive powers. The gain of a specific device can be generally estimated by dividing the f_T by the frequency of operation. What is clear from these charts is that, assuming a given drive power, a given device will produce less output at 28 MHz than at 3.5 MHz. However, the input power, established by the d.c. dimension of the circuit, will not show a similar decrease. Furthermore, the internal structure of transistors include capacitive and inductive components that exhibit reactance *vs* frequency variations and affect the performance of the device across the spectrum.

When the r.f. generating device is considered in terms of its operation in a circuit, several other factors enter into the input power unreliability picture, in regard to both the d.c. and the a.c. dimension of circuit operation. For example, when r.f. drive power is applied to a final amplifier operating in Class C, which is the typical case, that drive power is not "lost" or dissipated in the base-emitter resistive component of the transistor, but a percentage of it is fed through to the r.f. output from the stage. Now, this feedthrough power is not reflected in the d.c. input at all. Of course, it won't be a significant amount of power that is fed through—at best 1 dB or so—but it becomes part of the numerous gains and losses which are occuring in a complex circuit.

But even the d.c. components in a circuit can influence performance in such a way as to make input power deceptive as a standard. Consider, for example, how an r.f. choke in the B+ lead of the final stage collector has such an effect. Assume that the final transistor draws 200 mA at 12 v.d.c. for an input of 2.4 watts, and that the r.f. choke is a frequently used J.W. Miller 100 μH exhibiting a resistance of about 3.0 ohms. Ohm's Law tells us that the choke will produce a voltage drop of about 0.6 V and dissipate about 120 mW in the process, with the result that the actual power dissipated in the transistor is 2.4 - .12 w = 2.28 W. Now, this represents only 5% of the total power. But this is just one part. Suppose that the circuit includes a 2.7 ohm resistor for emitter degeneration and stability purposes. That's another 108 mW and we're up to about 9.5% total input power that is lost. It represents d.c. input not available for transformation to r.f. power output. Then, the efficiencies of all components at the r.f. frequency of operation can be taken into account, and the loss figure rises even more. Now, if the actual transistor used in the circuit shows a 39% efficiency factor, or the circuit itself is highly inefficient as in the case of a single-stage crystal oscillator, the overall efficiency ratio of the unit becomes rather dismal, starting out with the device's 39%, subtracting the 9.5% for just two parts, and after figuring in the remaining losses, it is easy to see how an overall efficiency of 10-20% can result. What does this mean in terms of our discussion? If the input to the final stage is 2.4 watts as per the above example, the r.f. output from the unit will be from 240-480 milliwatts. In reference to the lower

figure, the power ratio exhibits a 10 dB difference!

Practical Cases

Variations in efficiency which can be discerned through attention to output power can be important both in regard to the communications situation and in regard to the internal performance of a transmitter. In regard to the latter category, for example, a dropoff of 18% in the efficiency of a commerical transmitter will probably not affect the effectiveness of the unit in communications, that is, the power ratio variation will not be of such magnitude that it will affect contacts. But it can be an important indication that the unit is malfunctioning in some area of importance that will produce interference in the form of splatter or spurious radiations. The drop in efficiency is the warning signal in this case.

Similarly, variations from one unit to the next of the same type can alert one to possible circuit problems. I have been fascinated over the years with letters and comments from readers which report significant variations in r.f. output powers from units such as the *HW-8* and *Argonaut*. One recent letter noted that the measured r.f. output from his HW-8 unit on 21 MHz was only 0.6 watts, 50% below the 1.2 watts r.f. output I reported from my unit in a review of the transceiver. This represents a 3 dB difference, quite significant in QRPp and DX work. Likewise, my reported figures for the *Argonaut* drew comments similar to the above, but not quite of the same magnitude of difference. However, when returned and peaked for the c.w. portions of the bands, my old 505 did produce r.f. output about 3 dB greater than available with the factory alignment! When we consider variations in units which are identical copies of a circuit published in a magazine, variations are sometimes even greater than 3dB. So, the point should be clear: *One can measure the actual performance of a circuit or unit only if he includes r.f. output in the calculations.*

Another area where the use of the input power standard is senseless is in regard to QRPp awards and power multiplier limits in contests such as the QSO parties sponsored by the QRP ARC I and the ARRL FD. What achievment is actually indicated by the use of the input power standard as a basis of comparison? Consider the QRP ARC I's KM/W, or "1000 miles per watt," award. Suppose the KM/W award specifies that K0XXX worked a distance of 800 miles while running 300 mW *input*, for a KM/W of 2666 miles per watt. But, K0XXX's single stage crystal oscillator rig exhibits an efficiency of only 18% (typical for this type of circuit) and the actual r.f. output was around 54 milliwatts. If we measure the achievement in terms of 54 mW r.f. output, his KM/W is 14814 miles per watt. Quite a different achievement! Further, what if W2XXX worked the same distance with the same input power, except that he was using a three stage transmitter whose final exhibited a 67% efficiency, producing an output of 201 milliwatts. Based upon the input standard, the achievement is exactly the same—2666 KM/W. But based upon the output standard, his KM/W is only 3980 vs K0XXX's 14814! Now, which figure is more indicative of the achievement that the KM/W award is supposed to recognize? Obviously. Clearly, the input power standard masks achievement and provides false comparative conclusions. The similar rationale can be applied to the power multiplier as measured by input power in contests. W2XXX and K0XXX are in the same power multiplier class based upon input power, but W2XXX actually has about a 5.7 dB advantage—that's a whole S-unit! We're talking about matching a 155 pounder against a 210 pounder—some fight. It appears that only *The Milliwatt's* coveted *DXCC QRPp* and *DXCC QRPp* and DXCC Milliwatt awards use output power as a standard and provide an equal comparison, and more recently, *CQ's* adopted of a QRPp section into the DX contests uses the output power standard. Hopefully, the rest of the amateur world will drag itself into the twentieth century and follow suit. The following excerpt from *The Milliwatt* (April, 1970) will add some food for thought regarding the importance of the few dB that may be lost through inefficiency and the like.

Weak Signal Reception at Threshold Levels—Yardley Beers, W0JF

In a previous article, W0BE observes that if one replaces a high powered signal source with a QRPp source, the comparative strength of the received signals seem to decrease more than one expects from the change in power ratio. W0BE has attributed this to greater losses: when one builds a QRPp transmitter, he is likely to use more lossy componenets than when he is building a QRO rig. There is considerable truth in his observation, but I wish to point out that there is another more fundamental but subtle reason which may explain some of the effects which he describes.

When QRPp signals are received, often the signal-to-noise ratio is low. Under these conditions, a receiver, which is linear according to conventional reasoning, can for all practical purposes become a non-linear device, and the noise can suppress the signal. A simplified explanation is as follows. We first observe the noise, then we observe the signal-plus-noise and look for a difference, and this difference is less than the output which the signal would produce in the absence of noise. For example, suppose that the noise produces a detector output of one volt, and further, suppose that the signal, in the absence of the noise, would also produce an output of one volt. Then, because there is a random phase relationship between signal and noise, the signal-plus-noise output corresponds to the sum of their powers, and not to the sum of their voltages. And, therefore, the actual detector output due to signal-plus-noise is the square root of two volts (1.41) rather than two volts. The difference between the signal-plus-noise output is then only 0.41 volt which we recognize as readable signal, and the signal has in effect been "suppressed" in the ratio of 1:0.41 or about 4 dB by the presence of the noise. As the signal is increased however, the effective signal output increases a) by the direct increase in signal power and b) by a reduction of the suppression ratio. Thus, the receiver is in effect a non-linear device at the threshold level. It can be demonstrated mathematically that near the signal-to-noise threshold an otherwise linear receiver becomes a square-law device. Hence, because receivers operate in a non-linear manner near their thresholds, it is important to eliminate every bit of loss in the transmitting system.

What a Difference a dB Makes

W0JF's note makes clear that, when in a low signal-to-noise ratio situation, a dB or two will make a significant difference. An extra 2 dB can bring a signal up to the readable level at the receiving end of the path. QRPp operators often encounter such situations and realize that just a little more power output would turn a very difficult and partially successful attempt at contact into a successful contact.

In the next installment of the this article, we'll continue with a description of the construction and application of three output power measurement instruments—a wattmeter, an r.f. probe, and an in-line wattmeter.

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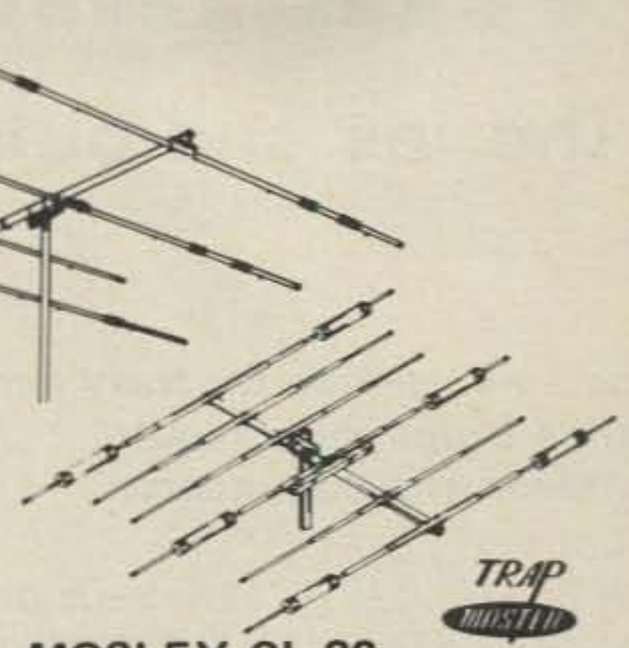

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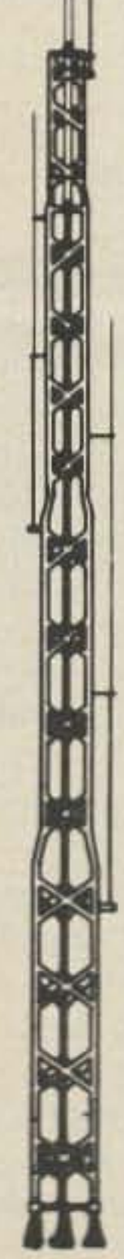

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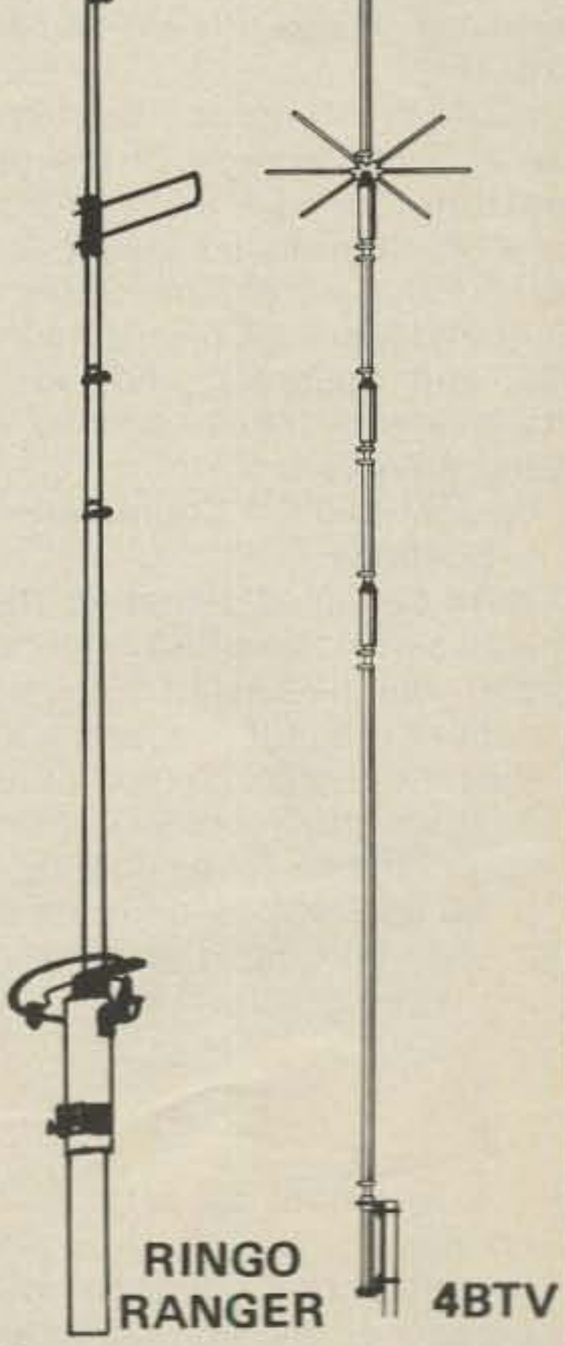

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The ins and outs of the Washington scene

Amateurs working for Navy and Marine Corps must report contacts with communist countries

In the January 26, 1979 issue of *hr Report*, it was noted that Amateurs working for the Navy (and the Marine Corps), who contact Russian Amateurs or Amateurs in other Communist countries, must report such contacts to the Naval Investigative Service. The requirement to report such contacts is imposed by OPNAV Instruction 5510.1F.

Your Washington correspondent has obtained a copy of the pertinent sections of OPNAV Instruction 5510.1F; reproduced below are those paragraphs which are applicable to Navy and Marine Corps personnel (active and reserve) and to civilian employees of these services who are Radio Amateurs:

Paragraph 3-104 **Counterintelligence Briefings**

1. All personnel, whether they have access to classified information or not, shall be alerted to the nature of hostile intelligence operations and the requirement to report suspected hostile intelligence contacts... A counterintelligence briefing shall be given annually to instruct personnel to report promptly any of the following types of information:

a....

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•

•

e. Attempts by persons living in communist countries to obtain information of intelligence value from personnel by correspondence (including "Pen Pal" correspondence), questionnaires, "ham" radio activity, naval cachets (requests to service postal covers), or other forms of communications.

Paragraph 4-202 **Contacts with Citizens of Communist Controlled Countries**

1. Any form of contact, intentional or otherwise, with any citizen of a communist controlled country shall be reported to the Naval Investigative Service. The term "contact" means any form of encounter, association, or communication with any citizen of a communist controlled country, including contacts in person or by radio, telephone or letter, or other forms of communication for social, official, private or any other reason. Also included as reportable contacts are visits to any embassy, consulate, trade or press office, or other official establishment of a communist controlled country, for any reason.

2....

3. Contacts and other associations with citizens of communist controlled countries are not, in themselves, wrong, against regulations or illegal. Such contacts or associations must, however, be reported to the Naval Investigative Service immediately after they occur so the Naval Investigative Service can establish, to the extent necessary, all pertinent facts to protect the Department of the Navy from hostile intelligence activities. When contacts occur routinely or with great frequency, the Naval Investigative Service will advise the individual as to any future reporting requirements.

The spirit and intent of OPNAV Instruction 5510.1F is to identify unusual or suspicious behavior; that is, to identify "questionable contacts" with personnel in communist countries. As such, Navy and Marine Corps personnel should be aware of the counterintelligence responsibilities of the Naval Investigative Service, and to whom they should report suspicious contacts.

Finally, it should be noted that the other military services are guided by similar directives, and each has its own reporting requirements. In addition, civilians who are not employees of the Department of Defense should report any suspicious contacts of an intelligence nature to the Federal Bureau of Investigation.

CCIR Study Group 8E begins preparation of papers

Mr. John J. (Jack) Kelleher (W4ZC), Convenor of CCIR Study Group 8E in the United States, recently announced suggested topics for papers on the Amateur service (vice the Amateur Satellite service). The papers are to be considered during the next "round" of the CCIR, and will provide the technical bases for future, specialized administrative conferences which will follow the 1979 World Administrative Radio Conference (WARC).

Candidate topics for future work include:

1. Documentation on the use of bands above 40 GHz (work must be done to demonstrate Amateur contributions before advancing technology preempts our options);

2. Standardization (international) of digital communication formats, especially those which pertain to automated means of communications;

3. Enhancement of the Amateur service's image, capabilities and needs;

4. Determination of the optimum bandwidths and transmission modes for digital format communications;

5. Development of special procedural signals in the Amateur service to facilitate emergency communications;

*8603 Conover Place, Alexandria, VA 22308.

6. Investigation of advanced modulation methods and their impact on frequency utilization.

Study Group 8E solicits papers on these and other topics of interest.

For more information on Study Group 8E, and on the work of the CCIR (a technical arm of the International Telecommunications Union), contact:

Mr. John J. Kelleher
W4ZC
3717 King Arthur Road
Annandale, Virginia 22003

Britain...Did it bungle on WARC?

In a recent comment, *THE ECONOMIST* (Business: Science and Technology; January 27, 1979) noted that the British public will not be told of that country's submissions to Geneve for the WARC until sometime in the spring. What worries people in broadcasting and telecommunications in Britain is that if the home office has got its priorities wrong, there will be little time to change them. The WARC, as you know, will convene for ten weeks of meetings beginning in September of this year.

The editorial went on to note that "unlike Britain, the United States has been preparing for WARC-79 as for the Olympic games. The Federal Communications Commission's official report is already published."

In short, *THE ECONOMIST* recognized what we already knew... namely, that the Federal Communications Commission (FCC) has prepared well for the WARC, and that it deserves plaudits from the Amateur and Amateur-Satellite services.

FCC drafts new procedures for notices of violation

At this writing, according to Mr. Jeffrey Young, Chief, Investigations Branch, FCC, the Commission is drafting a new procedure which completely changes the procedure for issuing notices of violation. The new form will use less pre-printed material, and will put greater emphasis on case particulars. Notices of violation will also serve as notices of apparent liability (NAL) to monetary forfeiture (that is, as "fines"). Under the new procedure, fines will be scaled according to the severity of the violation.

In addition to developing a new procedure for issuing notices of violation, the Commission will also give high priority to resolving the problem of out-of-band transmissions by unlicensed operators (e.g., the HFers who operate between the 27 MHz, Citizens Band and the 28 MHz. Amateur band). This problem has for some time evaded direct action on the part of the FCC because the Commission lacked the authority to fine unlicensed operators. Now, however, the Commission is able to take direct action in such matters, yielding much more equitable treatment of licensed as well as unlicensed operators who violate the Communications Act of 1934, as amended.

Need questioned for licensing of CB operators

Now that the FCC has been given the right to fine unlicensed operators, the need to license CB operators has been questioned. Chairman Ferris and Commissioner Robert E. Lee, in particular, have gone on record in favor of no longer issuing CB licenses. However, given that the 27 MHz. Citizens Band supports worldwide propagation, and given the ITU's requirements for identification, it would be very difficult, from a regulatory standpoint, to eliminate licensing for 27 MHz. operations.

Such is not the case, however, if a new Citizens Band is created in the 900 MHz. region of the spectrum. Since propagation is limited to line-of-sight paths, and since transmitters could easily be built with automatic IDers, it is entirely feasible to eliminate licensing of CB operations in this band. Whether a new Citizens Band will be created in the 900 MHz. region, however, will not be known until after the WARC.

Safety and Special Radio Services Bureau reorganized, managers named

As mentioned in a previous column, the FCC has reorganized the Safety and Special Radio Services Bureau into a new bureau which will be known as the Private Radio Bureau. The new organization is intended to facilitate the four key regulatory activities performed by the staff, and so, the Private Radio Bureau has separate divisions for policy formulation, rulemaking, licensing, and compliance.

The Policy Development Division will be responsible for performing all long-range planning, and evaluating policy alternatives for the Commission. The Rules Division will carry out the entire rulemaking process, and assess the feasibility of various policy alternatives. The Licensing Division will perform all authorization of service activities, including license application processing. The Compliance Division will develop and carry out programs to promote compliance with the rules and good operating practices. Finally, the Office of the Bureau Chief will have a management and administration staff to help identify potential problem areas in the bureau's operations and to perform routine administrative functions.

The new Private Radio Bureau managers are listed below, together with their titles:

Private Radio Bureau	
Chief	**Carlos Roberts**
Deputy Chief	**Arlan van Doran**
Assistant Chief for Policy	**Vacant***
Assistant Chief for Management	**Vacant***
Special Assistant to the Chief	**Gordon Hempton**
Rules Division	
Chief	George Petrutsas
Deputy Chief	Vernon Spring
Mobile and Fixed Branch Chief	Donald Precure
Personal Radio Branch Chief	John Johnston
Aviation & Marine Branch Chief	Charles Fisher
Compliance Division	
Chief	Gerald Zuckerman
Deputy Chief	Michael Fitch
Enforcement Branch Chief	Mary Fitzgerald
Hearing Branch Chief	Raymond Kowalski
Education Branch Chief	Vacant*
Licensing Division	
Chief	Richard Everett
Deputy Chief	Joseph Brumbaugh
Systems Design Group Chief	Alfred Franz
Land Mobile Branch Chief	Charles Turner
Aviation & Marine Licensing Branch Chief	Robert Mickley
Microwave Branch Chief	Thomas Johnson
Gettysburg Branch Chief	Anna Deatrick
Policy Development Division	
Chief	Vacant*
Deputy Chief	Morgan O'Brien

*The four positions marked "Vacant" will be filled at a later date.

It is interesting to note, as an aside, that all of the division chiefs have strong administrative and legal backgrounds.

We wish Carlos Roberts and the Private Radio Bureau well as they undertake their new responsibilities.

Your Editor thanks Messrs. Jack Kelleher, W4ZC, and Steve Jarrett, K4FJ, for their contributions to this month's column.

No -71-72

a monthly feature by

JOHN A. ATTAWAY, K4IIF

DX

News of communications around the world

Will Dick Spenceley, KV4AA, make the *Guiness Book of World Records*?

After a year-end drive on Dec. 30 and 31, which netted 540 QSO's, Dick ended 1978 with a total of 48,100 contacts. This was an average of 131 per day or one QSO every 11 minutes. His achievement has been submitted to Guiness for certification as a new record by Frank Anzalone, W1WY, *CQ*'s Contest Editor. If accepted it will open up a new challenge for amateur radio's super operators.

About 65% of Dick's contacts were on c.w. and the balance on s.s.b. A total of 199 countries were worked, of which only a couple were chased. Assorted equipment held up nicely as did the verteran operator's health. At age 73, he was slowed somewhat by an attack of the shingles in May 1978, but otherwise it was full speed ahead for the entire year.

Dick cites steady calling by European c.w. stations, cooperation by U.S. s.s.b. stations and contest operations as major factors contributing to his record total. KV4AA took part in almost every contest during the year, including a few whose sponsor is still unknown. Otherwise, his contacts, while short were not of the contest or DXpedition variety.

The KV4AA odyssey started in 1976 when Dick's bicentennial call, AJ3AA, resulted in 35,335 QSO's, an average of 96 per day seeking the elusive one-time prefix. A goal of 36,500 contacts was set for 1978, 100 per day. When King Victor four Able Able passed this mark on Oct. 19, a new goal of 45,000 was set, only to be passed on Dec. 14, after which another 3100 were worked.

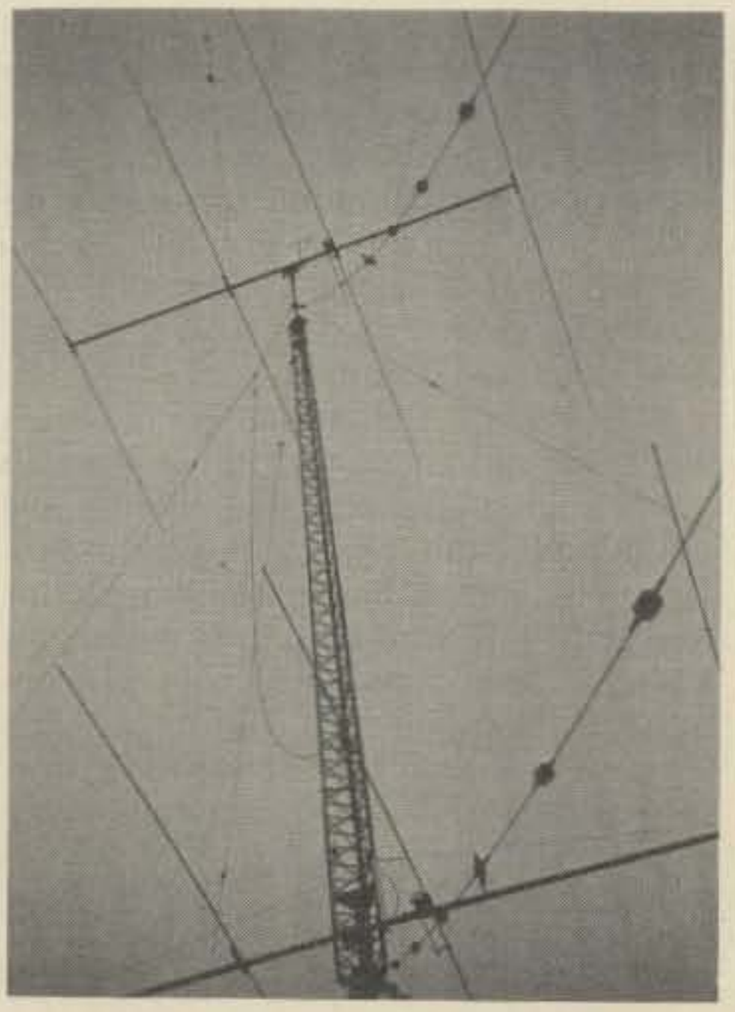
Obviously, certain factors are necessary to achieve such a total. One should have a fairly rare call and plenty of time, which will limit most amateurs. However, KV4AA was not on the air continuously as he works daily until 1 PM, and was seldom in the shack after 7 PM except during the latter part of the year. In addition, stations contacted 2 or more times on the same day were counted only once unless the band and mode were different. In going for a high total, Dick found that a QSO with a WB4 was just as satisfying as a VU2. His 3-year total now stands at 115,280 contacts, and he says it couldn't have been done satisfactorily without the help of WA6AHF and other YASME hams who handled the KV4AA QSLing chores.

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

Guest Column - DXing in Canada - by VE3CXL

Following the success of last year's columns on DXing from Europe by PA0TO and DXing from Japan by K7JA, this month's feature is an article by John Gilbert, VE3CXL, on DXing in Canada. While Canada is a close neighbor, DXing conditions in the far north can be quite different from what we are accustomed to here in W/K land. We think you will find John's article to be quite interesting.

John Gilbert, VE3CXL returned to DXing a few years ago after being away from the hobby for several years attending to studies and raising a family. Previously he had been an avid contester and DXer as VE3BOH and VE8OW where he gave out many a Zone 2 contact in the 50's. He has WAZ, DXCC, CW DXCC and is within sight of 5 Band DXCC. John has operated from every Canadian province, several states, including Hawaii and from 8J3ITU in Japan. His current passion is Grey Line DXing on 80 meters where he is hoping for a miraculous opening to Asia. Take it away, John!



Worm's eye view of VE2GK's 4 over 4 20 meter antenna, Ottawa, Ont. Canada.

The huge area of Canada, 3.8 million square miles, leads to vastly different DX conditions across the country. In the Eastern provinces, VO and VE1, DX hunting has an almost European quality about it. Those of us further West look with envy, for example, at the exotic UI8's and UL7's that VE1ZZ manages to pull through on the low end of 80 meters. Conditions in the heavily populated Quebec-Windsor corridor, by contrast are not too much different from those experienced in the neighboring states South of the border. Further West, in VE7 land, one is more likely to find logs heavily spiced with Asia, Oceania and the Pacific while in the far North, the VE8's share conditions more akin to those faced by the UA0s in Siberia than those of their fellow VEs to the South. Yet, even with the apparent variety in conditions, Canadian DXers have a great deal in common.

In years gone by, Canadian DXing was a somewhat fragmented activity, in part because of the large distances separating those with the DX bug. However, some 14 years ago all of that changed with the formation of the Canadian DX Association (Canad-X) which is administered by the Toronto DX Club. Canad-X now boasts a membership of greater than five hundred and has many members from outside of Canada. It issues a monthly bulletin, *Long Skip*, provides an outgoing QSL service to its members and has sponsored or donated equipment to a number of DXpeditions. The Association pro-

vides several incentives to DXing.

It has, for example, generated a competitive spirit with an annual DX Ladder showing the relative progress of DXers over the years. Leading DX-ers, as well as beginners, find a listing on the "ladder" with, in 1977, VE3WT leading the pack with 312 confirmed countries in the Mixed category and VE3QA leading with 313 confirmed on Phone. (Deleted countries do not count in these listings). The competitive spirit has also been fanned by the annual Can-Am Contest, held in late Summer.

Although not primarily a DX oriented organization, the Canadian Amateur Radio Federation has also helped to encourage interest in DX communications both by their outgoing QSL Bureau and by the "Canawards". The basic "Canaward" is a certificate for confirming two-way contact with all Canadian provinces and territories. The award is granted separately for each band, with a special plaque being awarded for confirmed two-way contacts on each of five separate bands.

Canadian amateurs have been fortunate in the allocation of the radio frequency spectrum. Not only do we have access to the same Phone bands as our friends to the South, but we also have access to most of the DX Phone bands. The most notable exception to this is the 40 meter band where our Phone allocation is identical to that in the United States, meaning that we have to transmit above 7150 and work split frequency to contact that elusive DX below 7100 kHz. There is no doubt that there are great advantages to being able to work in the DX Phone bands, not the least of which is being able to compete in the relatively smaller DX pileups rather than in the many layered pileups in the U.S. Phone Bands.

It is, however, not an unmixed blessing. A great many DX stations, often including the DXpeditions, do not differentiate between VEs and Ws. Not only do they not want to be called by VEs in the DX phone band (and often say so) but frequently their beams are pointed away from North America when the DX station is operating in the DX portion of the band, placing the VE at a distinct disadvantage. The net result is that the serious DXer, one with a score of 200 or more countries often finds it to his advantage to move up and compete in the U.S. bands to snag that rare one.

In addition to our phone advantages, there is also an advantage in our c.w. privileges. Newcomers to the hobby can, as soon as they are licensed, have immediate access to all of

Hal Parsons, VE3QA, is Canada's top Phone DXer. He is also an avid sport's car buff.

the c.w. bands. We have basically only two classes of H.F. License, Amateur Class, which grants c.w. privileges and Advanced Amateur Class which permits both phone and c.w. In addition, a special arrangement whereby amateurs can operate phone on 28 MHz after only six months of c.w. operation has done much to give a budding DXer the incentive to go for the Advanced license.

As if to offset the advantages of our frequency allocations, we are faced with a particularly frustrating situation in our attempts to access DX nets or to be included in a DXers "List". The problem is simply that the net control or list taker is usually in the U.S. and organizes his calling schedule according to American call areas. A W0 or W6, for example, taking a list for the third call area, naturally points his beam at Maryland, Delaware and Pennsylvania. The third Canadian call area, VE3, is well off to the side of the beam, and those without large beams or high power do not often make it on the list. The situation is even worse for VE4's, 5's and 6's who are likely to find themselves trying to catch the attention of a Master of Ceremonies whose beam is pointed at the U.S. 4th, 5th, or 6th call areas - often 180 degrees away from the VE.

There are some nets however where the problem is not so serious,

Standing left to right are Lloyd, W6KG, and Iris, W6QL, Colvin at their Jamaican station W6QL/6Y5. Seated are Lloyd Alberga, 6Y5LA, and his wife Juanita. 6Y5LA is President of the Jamaica Amateur Radio Association. The Colvins made 10,000 QSO's with amateurs in 129 countries during their stay in Jamaica. They also made 6,000 contacts with 123 countries from Costa Rica and 9,000 contacts with 126 countries from Grand Cayman. At their home QTH Lloyd and Iris have a file of over 250,000 QSLs which have resulted from 500,000 QSO's made during their travels to 134 different countries. They are members of the CQ DX Hall of Fame.

A top Canadian DXer, J. Ravenscroft, VE2NV.

The WPX Honor Roll

The WPX Honor Roll is based on the current confirmed prefixes which are submitted by separate application in strict conformance with CQ Master prefix list. Scores are based on the current prefix total regardless of an operator's all-time count. Honor Roll must be up-dated annually by addition to, or to confirm present total. If no up-date, file will be placed into "inactive" until next up-date.

Mixed

1745 W4WV	1428 N4MM	1150 W0AUB	1023 YU1ODS	830 W0IUB
1737 K6JG	1415 DJ7CX	1139 N6JV	1016 SM7TV	811 W9WHM
1701 F9RM	1401 PA0SNG	1123 I2PHN	1015 W0SFU	811 YU3EY
1606 YU2DX	1400 W4BQY	1120 YU2OB	1008 WA1JMP	803 N6JM
1512 VE3GCO	1400 K2VV	1120 N4NO	1000 SM6DHU	782 YU4EBL
1485 W7LLC	1368 W8LY	1109 I6SF	949 WA6TAX	755 YU2CBK
1477 YU1BCD	1318 K5UR	1100 YU1AG	925 I3ANE	749 CT1LN
1477 W3PVZ	1269 N6CW	1095 K6ZDL	902 K7NHG	605 I4BFY
1476 ON4QX	1254 W9FD	1095 I0JX	902 K6DT	600 WB9CGL
1475 W2NUT	1229 AA4A	1094 WA0KDI	860 PY4OD	
1451 N4UU	1225 N6AV	1065 K5DB	855 WA2AUB	
1445 W2NC	1205 N2AC	1063 W8CNL	848 W6ANB	
1433 W9DWQ	1200 N9AF	1062 DL1MD	831 JA1AG	

S.S.B.

1600 F9RM	1193 PA0SNG	1017 F2MO	908 I0MBX	710 N2AC
1555 W4UG	1182 YU1BCD	975 WA6TAX	900 WB4KZG	702 N4NO
1505 I0AMU	1158 I4ZSQ	967 I2PHN	896 DJ7CX	666 PA2TMS
1465 K6JG	1142 W9DWQ	957 W6RKP	825 YU1ODS	654 ZP5RS
1374 I0ZV	1107 ZL3NS	952 N4UU	808 OZ5EV	628 WA2AUB
1339 I8KDB	1101 K5UR	950 N2SS	801 YU1AG	626 WA2FKF
1300 I8YRK	1100 K2VV	948 DL1MD	765 W2NC	
1282 K2POA	1059 WB4SIJ	938 OE2EGL	755 W4BQY	
1250 N4MM	1051 WB2NYM	909 PY3BXW	750 JH1VRQ	

C.W.

1427 W8KPL	1192 N4UU	1030 W3ARK	902 YU1AG	668 LZ1XL
1350 W8LY	1158 W9FD	1012 VO1AW	877 I6SF	660 DL1MD
1341 K6JG	1101 N6JV	1001 K5UR	788 YU1ODS	649 KH6HC
1328 DL1QT	1087 W4BQY	1000 K2VV	729 PY4OD	647 W9OYZ
1297 ON4QX	1059 G2GM	986 N4NO	728 I5IZ	623 JE1JKL
1274 W2NC	1056 WA2HZR	976 WA0KDI	700 WB4KZG	
1251 K6XP	1056 N2AC	973 K6ZDL	698 OK2BLG	
1202 YU1BCD	1031 DJ7CX	905 N4MM	676 SM0GMG	

primarily because the "M.C." does not use the list method exclusively. Bill, W7PHO has a special place in the hearts of eastern VEs, not only because he is able to arrange a QSO with the most difficult areas to work from eastern Canada, but also because of his almost uncanny ability to hear the weakest signals and to give everyone a chance. The other favorite net for Canadians is the Caribbean Net where Allan, 8P6AH has been most sympathetic to VE stations, despite the fact that his net is aimed at linking the Caribbean and the Pacific. The list method, incidentally, has waned in popularity in Canada, although nobody seems to have many suggestions for dealing with the ever growing number of people who want to work the rare DX station. There is a growing feeling that the list problem poses a threat to DXing as bad, if not worse, than the crisis which faced the hobby some years ago with the "green stamp" requirement for a QSL card.

Like DXers the world over, Canadians enjoy being DX as much as they do chasing it. Many Canadians have been on the DX end of a pile-up, with perhaps the best known being Dr. George Collins, VE3FXT (ex-VE1PV) whose activity from such exotic calls as A2CAZ, VE3FXT/S8/3D6, 7P8BE, 7Q7PV, 9G1HE and 9J2PV has become a legend in Canada. To these earlier exploits, George added H5FXT (Bophuthatswana) in 1978 and has also activited S8FXT in Transkei. Another well known area of Canadian DX activity has been as a result of the United Nations Peace Keeping. The recent activity began in late 1972 with VE3AII/SU followed by a host of others including VE3BWK/4U which counts as YK. More recently stations such as VE3HYU/SU (1977) and VE7CQX/SU (1978) continue to provide many with a rare QSO with Egypt.

Thuji Yonten, A5ITY (on right) receiving a remote VFO for the Amateur Station at Thimphu, Bhutan from the Southeastern DX Club President, Stew Woodward, K4SMX. "Yonten" is Bhutan's Director of Wireless Communications and was one of his country's delegates to the U.N. in 1978. Stew will be remembered for Kingman Reef and Palmyra DX'peditions and the most recent 1S1DX, Spratly Island DX'pedition. (photo via Jack, W2LZX)

Over the years the Caribbean has been an attractive area for vacationing Canadian amateurs, but in recent years there has been as great an interest in two "countries" closer to home. Late in 1975, Jack, VE3GMT, Truus, VE3IAA, Mort VE3MJ and Martin, VE3MR carried out two DXpeditions.[1] The first, VX9A was to Sable Island and the second, VY0A was to St. Paul Island. These unique DXpeditions (the first time that one letter calls had ever been permitted in Canada) resulted in two new countries appearing on the DX lists. Sable Island is located in the Atlantic, some 100 miles Southeast of Nova Scotia. Once known to sailors as the "graveyard of the Atlantic", it is the site of 500 shipwrecks. Over the years there has been some regular activity from Sable, such as VE1AST in 1973 and more recently VE1BFV in 1977. Unfortunately, it is next to impossible to obtain permission to operate from the island as a visitor, so activity is normally limited to those on duty or hams assigned to the weather station. The second "country", St. Paul Island, is located at 47°14N, 60°08W, off Cape Breton Island, Nova Scotia. Since the original 1975 DXpedition, there have been two others. The first in May, 1976 when VE3BMV, VE3BBH, VE3DU and VE3KZ made 4300 contacts from XJ3ZZ/1. The second was the May, 1978 activity by VE1AI, VE1AIH, VE1AJP, VE1AMC and VE1MX from VY0CA.

From the point of view of the Worked All Zones awards (and the CQ World Wide Contests) Canada has another rare area, Zone 2. This covers a large part of the Northwest Territories (VE8), Labrador (VO2), and part of Northern Quebec (VE2). Zone 2 is not easy to activate, not only because of its inhospitable climate, but also because of the very high cost of travel and accommodation in the

1. "Sable Saga" by Truus Rosenthal, VE3IAA, in *The Ontario Amateur* Vol. 11, Issue 2, 1976. P. 5. and "XJ3ZZ/1, St. Paul Isl" by Yuri Blanarovich, VE3BMV, in *The Ontario Amateur,* Vol. 11, Issue 4, 1976.

North. There has, however been continuous activity from the zone over the years. There was even a DXpedition in 1977 when VE1AI, VE1MX and VO2AM piled up an excellent score in the CQ WW CW Contest from VO2EPA (CK2EPA). The problem with Zone 2, particularly in VE8 land, is the uncertainty of the propagation conditions. The constant chance of auroral disturbances, which are very prevalent in the far North makes it very hazardous to plan DX operations. As far as DX contests are concerned, one may be able to achieve a very high score or just as likely to have to face the disappointment of no score at all when the bands become subject to a radio "blackout". Nothing is quite as frustrating as listening to 40 hours of the hissing of an auroral storm in the knowledge that under more favorable conditions one would be handling masses of stations all seeking that elusive Zone 2 multiplier!

The auroral problem, irritating though it can be, is offset by an advantage which is shared by Canadians far to the South. This is the fact that the winter months give us very long nights and even weeks of total darkness in the far north, with the result that the 40 meter and lower bands are open to DX for long periods of time. This advantage can be particularly exploited on 80 meters by Grey Line DXing, an art which has been well described by John Devoldere, ON4UN and *CQ*'s Assistant DX Editor Rod Linkous, W7OM.[2] Even as far south as Ottawa, Greylining can be very interesting. For example, as the sun starts to descend early in December, January and February, the Europeans start to break through on 80 as early as 1630 local time. When the sun starts to rise in Europe, around midnight to 0200 Canadian time, there is often a strong path to Europe (shared with many others on the American continent who are also

Receiving his hard-earned "Bermuda 100 Club" Award is John Bazley, G3HCT (Right). The award was presented on behalf of the Radio Society of Bermuda by Allan Davidson, VP9AD. This is only the fifth such award to be presented and the first outside of North America. It is awarded on submission of confirmations for 100 or more contacts with Bermuda Amateur Stations.

in darkness). Then again in the early morning hours, a DX path to Australia and New Zealand often appears. Rod Linkous points out in his article that one only becomes interested in the phenomena when chasing those last elusive 80 meter contacts for 5 Band DXCC, but perhaps with the recent announcement of the 5 Band WAZ award more Canadians will become interested in exploiting this natural advantage and put our longer nights to good use.

A somewhat mixed blessing to the Canadian DXer has been the use of special prefixes. Since the introduction of the special 3B and 3C prefixes in 1967, Canada's Centennial Year, the Department of Communications (which licenses and regulates Canadian amateurs) has been most cooperative in granting special calls. In 1976, to commemorate the XXI Olympiad the prefixes XJ and XN were activated followed by CY (CK for VO stations) to celebrate the Queen Elizabeth Silver Jubilee in 1977 and CG calls in 1978 to commemorate the Commonwealth Games. Special calls have also been granted for special events and anniversaries such as the VB calls on the occasion of the 60th anniversary of the Canadian National Institute for the Blind, the CJ calls in 1977 commemorating the arrival of the first Japanese immigrants to Canada and the VF calls commemorating the 25th anniversary of the Stratford Shakespearean Festival. The year 1978 saw a continuation of the special prefix trend with VC7 used by VE7's to celebrate the bicentennial

2. Navigating to 80 Meter DX, *CQ*, Jan 1978. Rod Linkous, W7OM. 80 Meter DXing, by John Devoldere, ON4UN, Communications Technology, Inc., Greenville, N.H., 1977.

The WPX Program

Mixed

718...F6DCQ
719...F6DHB
720...JA1KJW
721...K3DH
722...JA7HMZ
723...YU1NZW
724...K4FYM
725...N4VA
726...SP5GOR
727...SP9PDF
728...YU2RTW

S.S.B.

1134...EA3KW
1135...WB2RLK/VE1
1136...GW3SLA
1137...WA4NQG
1138...DK2WU
1139...SP9PDF
1140...WB3HAZ
1141...YU2RTW

C.W.

1797...JA6PWN
1798...YU1EC
1799...VE2BP
1800...W9JR/m
1801...JH3XCU
1802...OK3KJF
1803...WB2FFY
1804...WB5UWF
1805...DM2FWL
1806...DM2FBL
1807...SP7AW
1808...HB9BCY
1809...YU2RTW

WPNX

137...WB2LQI
138...KA8BAV
139...WN7UMU
140...WB3KRV
141...WB7UVB
142...WD4DJC
143...WD9GPC
144...VK4NEN
145...WD4MXR
146...WD9HWW

VPX

158...DM-2652/M
159...DM-7729/I

Endorsements

Mixed: 400 F6DHB, K3DH, JA7HMZ, K4FYM, SP5GOR, SP9PDF. 500 AF5M, JA1KJW, YU1NZW. 550 WA4QMQ, N4VA, OE1KJW. 650 F6DCQ, WA4QMQ. 750 K9GM, W9NO. 800 W2KE, 850 PY4OD, 1000 YU1ODS, K0JN YU2RTW. 1050 K5DB, SP9AI. 1'00 I0JX. 1300 K5UR 1400 K2VV.

SSB: 300 GWSLA, WA4NQG, WB3HAZ. 400 EA3KW, SP9PDF. 500 YU2RTW. 550 WB2RLK/VE1. 600 PY4OD. 800 YU1ODS. 900 I6SF. 1050 WB2NYM.

CW: 300 JA6PWN, YU1EC, W9JR/m, JH3XCU, OK3KJF, WB2FFY, WB5UWF, DM2FWL, SP7AW, VE2BP. 350 HB9BCY. 400 DM2FBL. 500 OE1KJW, SP6FER, YU2RTW. 600 VE7CNE, K9UQN. 700 K9WA. 750 YU1ODS, PY4OD, ZL1AGO. 900 K7ABV. 1000 K2VV, K5UR, OK3JW.

10 meters: K0JN, OK1IQ.
15 meters: K0JN, OK1IQ.
20 meters: DM2FBL.
40 meters: DJ8WD.
80 meters: SP5GOR.
Asia: N4WX, K2VV, I2DMK, YU5FAM, JA7HMZ, SP6FER.
Europe: DL1VW, DM2FWL, DM2FBL, SP5GOR.
No. Amer.: OE1KJW.
Oceania: JH3XCU, JA7HMZ.

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

The WAZ Program

Single Band WAZ

20 Meter Phone

206...W7YEM
207...VE7JY
208...WA4PYF
209...EP2LI

15 Meter C.W.

9...YU2RTW
10...JF1COE

20 Meter C.W.

70...I3HDH
71...VE7AVC
72...W0SR

All Band WAZ S.S.B.

1599...JA2UYS
1600...K7JXR
1601...W3YFV
1602...I8RFD
1603...W6MFC
1604...N3RL
1605...I1FNX
1606...K6BMX
1607...WB0SNG
1608...W2YTO
1609...WB3HAZ
1610...K4QPR

C.W./Phone Mixed

4465...JA7HMZ
4466...SM6CYU
4467...YU1DZ
4468...W5ZPA
4469...JA1SGU
4470...JA2DTE
4471...W5LFK
4472...N4RR
4473...JG1HND
4474...WB9SLV
4475...WA2FIJ
4476...WB0SNG
4477...W4DM
4478...K7NG
4479...W4BD
4480...WB8UIA
4481...W6MJP
4482...AB1U
4483...VE4IU
4484...W6CQ
4485...G3HCV
4486...WB0YUI
4487...I1ANP
4488...VE2YM
4489...F5NW
4490...F8PM
4491...N5FW
4492...JA1PMN

All Phone

548...N7SW
549...EA7IR
550...W2IZS

The complete rules for WAZ are found in the May 1976 issue of CQ Magazine application blanks and reprints of the rules may be obtained by sending a self addressed stamped envelope, to the WAZ Manager, Leo Haijsman 1044 S.E. 43 Street, Cape Coral, Florida 33904. Applicants forwarding QSL cards direct to the QSL Manager should include sufficient postage for the safe return of the QSL cards. Please note that effective January 1, 1979, the processing fee for CQ DX certificates was raised to $2.00.

VE3IPR has installed a Wilson beam and a Henry linear and plans to go all out for DX awards. Mr Sklepkowcyz was first licensed in 1977 and worked most of his first 200 using a ground plane antenna.

of Captain Cook's Vancouver Island explorations and, from July 1st to December 31st, CF and CY calls were used by members of the armed forces (active and reserve or former) to commemorate 75 years of Canadian Armed Forces communications.

Many diehards have stuck with their VE or VO prefixes through the years, but others have managed to use the unusual prefixes to increase their DX scores. For the lowly VE3, a special call can give a bit of an edge in a DX pile-up (the DX station responds out of curiosity), and the special events have done much to stimulate activity on the h.f. bands. In particular, prefixes have provided an extra boost for VE's in certain contests such as *CQ* WPX festivities. The recent North American record for multi-multi in the 1978 WPX Contest by VC7WJ, The Fraser Valley DX Club, second worldwide only to UK9AAN, is the latest example. The same contest netted CG3BMV the top single band score on 21 MHz, CGIXE the high score on 7 MHz and VE3BBN the high score on "Top Band".

Many Canadians have made their

Dick Spenceley, KV4AA, completed 48,100 contacts during 1978. This is believed to be a world high and has been submitted to the **Guiness Book of World Records.** *KV4AA is a member of the CQ DX Hall of Fame.*

The CQ DX Awards Program

S.S.B.

659	WB4KSQ	664	JA1SGU
660	W3KHQ	665	W7DAZ
661	WB4HOK	666	K0SVX
662	W2VHJ	667	W0SR
663	G3JMH		

C.W.

354	WB3EPC	356	K3NS
355	CT4BD	357	W0SR

S.S.B. Endorsements

310	W4UG/317	275	WA4JTI/276
310	W4DPS/312	275	W0SR/275
310	VE2WY/311	250	K0SVX/275
300	EA4LH/309	200	WB4HOK/234
300	K5OVC/307	200	KG6SW/224
300	ZL1AGO/306	200	WA6TOO/203
300	W0SD/305	150	WA2SRM/150
300	K6XP/302	3.5/7 MHz	AA4A/103
275	K8LJG/295	28 MHz	K0SVX/101
275	AA4A/276		

C.W. Endorsements

310	ON4QX/317	200	W0SR/223
310	N4PN/313	150	JA1SGU/154
275	K4CEB/293	150	K3NS/152

Complete rules and applications 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 S.W., Seattle, Washington 98136 U.S.A.

mark on DXing in other ways. Several are among the leaders in the DXCC Honor Roll with (March, 1978) VE2NV (352) and VE5RU (343) topping the Mixed and VE3QA (346) and VE3MR (333) the Phone listings for Canada.

VE3QA, although retired continues to be well known for his activity on the DX Advisory Committee and for his work with the Canadian Radio Technical Planning Board. He also, on occasion, gives a most entertaining and informative talk on DXing. Not content with just amateur radio as a hobby, Hal is also well known in the sports car field and both he and his wife made the front pages of the *Ottawa Citizen* last year with their sports cars (complete with the VE3-QA call letter license plates).

Canada is also fortunate, as in other countries, in having a very efficient incoming QSL bureau system staffed by many unpaid volunteers who help us all keep the financing of QSLing within reason.

Finally, we also have our technical leaders in DXing, particularly in the antenna field where several remote antenna projects are now underway. Gerry King, VE3GK is very active in the field and has already established an enviable reputation with his classic four-over-four 20 meter antenna. This antenna is a landmark both on the air and in the City of Ottawa and Gerry has provided copies of his findings to many interested DXers.[3] Gerry's contributions to ham radio have extended will beyond antennas. In the past seven years over 400

3. The 20 Meter Gain Game, Gerry King, VE3GK. Presented to the Radio Society of Ontario 1975 Convention, Ottawa, Ontario.

would-be amateurs have graduated from his Amateur Radio courses, and many an active Canadian DXer first caught the bug from being exposed to Gerry's enthusiasm for our hobby.

Here and There

New CQ DX Committeeman - Art Westneat, W1AM, has moved away from the Southern New England DX Club area and has resigned from the *CQ* DX Awards Advisory Committee. We thank Art for his past services, and are pleased to announce that his slot on the committee has been filled by veteran DXer George Hitz, W1DA. George was first licensed in 1955 as KN4GPI and has held the calls W1DAL and G5BFH. He holds 40 meter c.w. Single Band WAZ # 2 (first in north america), c.w. DXCC # 2 and has a DXCC score of 310 confirmed. He is QSL Manager for PY0RO and PW0PP.

Do You Remember??? - Barry, VK5BS, would like to confirm some very old contacts. Can you direct him to KJ6AP, QSO'ed Feb. 7, 1951; VP5AY for Sept. 4, 1949; PK6VK worked Sept. 13, 1950 or PK2ZZ for March 6, 1950. If so, please write Barry directly to 18 Cornish St., Glenelg North, S.A., 5045 Australia.

Beata Island, Dominican Republic -The DXpedition to Beata made 3,000 contacts with 53 countries during 52 hours of operation. The Dominican Republic has issued a special commemorative stamp. QSL to Box 2191, Santo Domingo, D.R.

Isle of Man - The Warrington and District Amateur Radio Society is organizing a charity DXpedition to the Isle of Man during the period July 1 -4, 1979 using the call GT4CDA. The objective is to raise funds for mentally handicapped children through sponsored QSL lists and OSL distribution. To our knowledge, this is the first DX-pedition organized for charitable purposes. It is quite serious and an audit will be available Jan. 1, 1980 for doubting Thomas's. Further information can be obtained from Jeff Maynard, G4EJA.

The Liverpool and District Amateur Radio Society also has an Isle of Man DXpedition scheduled for June 29 -July 8, 1979 to celebrate 1,000 years of the island's parliament, Tynwald. QSL to G4GHS.

Stefan Luckhaus, DF7FH, advises that his group will also be QRV from the Isle of Man during July, 1979 and hopes to make several thousand contacts using the calls GT5CGV

(DL7FH), GT5AVQ (DK5FJ), GT5MIR (DC1FP) and GT5CID (DJ3BG).

The GT prefix will be very busy this summer.

Largest Local DX Club? - With over 400 members, the Western Washington DX Club in Seattle may be the world's largest local DX club. Do you know of one larger?

QSL Information

The following wish to volunteer their services as QSL Manager for any interested DX station: Harry, W6TPC; Dean, WA0TKJ and Bill WB7BFK.

A helpful QSL Manager listing is published under the title *QSL Report* by the QSL Management Association in Japan. For complete details contact the editor, Hiromichi Katsurashima, JH1HWN, 5-2236-33 Iriya, Zama-city, Kanagawa, Japan.

A6XB - Via K1DRN
A7XAH - To DJ9ZB
A35RB c/o Box 844, Nuku'Alofa, Tonga, South Pacific
A51PN - Via N.H. Pradhan, Headquarters Royal Bhutan Wireless, Thimpu, Bhutan
BV2B - To Tim Chen, Box 101, Taipei, Taiwan
DA2QE - c/o Robert L. Chilcote, Box 14, APO New York, NY 09742
FB8XU - Via F6FLZ
FB8XV - To F5VU
FK8CR - c/o W7OK
FM7WO - Via JH3XCU
FW8AC - To F6BWX
FW0TT - c/o 4Z4TT, P.O. Box 22572, Tel Aviv, Israel
GT4CDA - P.O. Box 59, Isle of Man, United Kingdom
H5COA & H5FXT - Via VE3DPD
HH2EL - To K6KII
HR1LP - c/o K1RAW
JW9WT - Via LA9WT
KA1IW - To K8DYZ
KA1MI - c/o W7GXU
KA1NC - (Minami Torishima) - Via K4JEX
KC6GF - Box 419, Ponape, E. Carolines 96941
KC6MJ - To W7PHO
KH3AA - (Johnston Island) - Box 60, APO San Francisco, CA 96305
KH6JHJ/KH4 - c/o KM6BI
KH6XX - To W5HNK
KM6FC - Via K5OA
KP4AM/Desecheo - To Northern California DX Foundation, Box 717, Oakland, CA 94604
KX6BU - c/o Box 444, APO San Francisco, CA 96555

LU3ZY - Via LU2CN
PJ9CG - To WA1AHQ
S8FXT - c/o VE3DPD
ST0HF - Via G4GFI
T20 (-ex-VR80) - Box 3429, Wellington, New Zealand
T2T - To W5RBO
TF3CW c/o K1RH
TI2AZ - Via W4ZD (ex-W4CKB, W8CKB, K4VW, ZF1VW), Box 1083, Lake Placid, FL 33852
TI2BEV - To W4ZD
VK9XW - c/o VK6RU
VK0PK - Via VK3OT
VO6ONT - To VO1HP
VP1RX - c/o W4SME
VP2MBH (February, 1979) - Via W0SH, Box 73, Des Moines, IA 50301
VQ9JJ - To W5RU
VQ9MR - N5GW
VR1AE - Box 239, Bikenibeu, Tarawa, Gilbert Islands
VR1BD - c/o W5RBO
VR3AH - Via WB4PRU
VR6TC (April 19, 1979) - To W0PAH
VU4ARC c/o VU2TS
WB5LBJ/4D6 - Via K7LAY
WH2ABB - To Tom Gates, AB5G, Rt. 1, Box 288, Deville, LA 71328
XT2AV - c/o VE2ATS or VE2DFR
YI1BGD - P.O. Box 5864, Baghdad, Iraq
YJ8KW - Via K6KII
ZK2AB - To N6EG
ZL1BIQ/K c/o D.H. Pratt, Raoul Island, New Zealand
3D2BH - Via Box 735, Sua, Fiji
3D6AF - To K6KII
3V8AA - c/o IS0LYN
3Y1DQ - Via LA5DQ
3Y1VC - To LA5NM
4N0D - c/o YU2CQ
5N2AKY - Via W4BUW
5W1AU - To W6KNH
5W1AX - c/o KH6LW
6O1FG - Via I0DUD
8R1X - To VE3IXE
9A1VU - c/o DL1VU
9J2BO - Via W6ORD
9M8HG - To Horace Grey, Box 2242, Kuching, Sarawak, Borneo
9N1MM - c/o Edward Blaszczyk, N7EB (ex-W3KVQ), 12802 Sun Valley Dr., Sun City, AZ 85351
9V1TE - Via WA0TKJ

73, John, K4IIF

a monthly feature by

A. EDWARD HOPPER, W2GT

Awards

News of certificate and award collecting

The "Story of the Month" for June, as told by Manny is:

Manuel B. Greco, K2LFG
All Counties #204, 11-21-78

"I was licensed in 1955 and ran QRP power on c.w. and because of the low power, decided to look for counties, instead of countries. This was long before I had heard of the USA-CA Program. When I did learn about the Award, I beame a member of the CW County Hunter Net and worked the first thousand counties on c.w. Then I became corrupted (hi) when someone sold me a s.s.b. rig and I quickly discovered that phone is where the action is.

I never ran high power or any other antenna beside a long wire, but with the help of many many relay stations, my Award started to fill up: April '68 USA-CA-500, August '72 1000, December 1500, May '73 2000, February '74 2500, April '77 3000 and November 1978 the whole ball of wax!

Met some good people in person and spoke to many good people on the Net. Blessed be the harried net control stations and my gratitude to the mobiles, who despite gas shortages and sometimes chaotic band conditions, were still out there on the county lines.

I began the chase with a S-38C receiver and AT-1 transmitter and made the last one with a Swan 270. The last county was given to me by Fred, W5FS who detoured "slightly" to finish up my last two counties in the last two states. The net controls were Karl, WA6MAR and Arnie, K9DCJ, two fine gentlemen who have always been there to help the County Hunters.

The electric bill has been paid from my pay checks as a letter carrier. And my son, Michael (age 14) has been there to see me log the contacts and then tell his peers with their CB radios that his father also has a radio.

It has been fun, if frustrating, hi. What is the next goal? I have been known to use the phonetics *L*ooking *F*or *G*irls, so who is to say I can't find a YL QSO in each of the 3075 Counties for the second go-round?".

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


SAVEZ RADIO - AMATERA JUGOSLAVIJE
RADIO KLUB GOSPIC

DIPLOMU

TO RADIO
VE7CNE ALEXA IVSIC

Nikola Tesla Award

Fine set-up of equipment at DL1QT. Feb. 1979

Awards Issued

Fred Seifert, W5FS (exW9EFX, W9ETK, W8WWA, W2RVU, W5QJO, K6CCD, W4JTV, W5MHQ) waited until he had them all to receive USA-CA-500 through 3000 endorsed all SSB, all 14, all mobiles, and all counties, Mixed.

Chuck Secrest, AD8W (ex WA8ASV) added to his collection, USA-CA-2500 and 3000 endorsed all 2XSSB, all mobiles, and all counties, Mixed.

George Readman, WB6VRR also waited until he had them all to catch USA-CA-500 through 3000 endorsed all SSB, all 20, all mobiles, and all counties, Mixed.

Lyn Welliver, WB4RVW applied for USA-CA-2500 and USA-CA-3000.

Jack Johnson, WD9AXF gained USA-CA-3000.

Harold DeVoe, KL7MF who had received USA-CA-500-#1K back in 1961 acquired USA-CA-1500 through USA-CA-3000.

George Challenger, K6GC (ex W5HTM, W5HTM/KP6, VR3P) was issued USA-CA-500 through USA-CA-2500.

Jim Roberts, WB0MIX picked up USA-CA-2500.

Bruce Roberts, WB9AAJ obtained USA-CA-2500 endorsed all SSB.

Dan Broadbooks, WA9WIF won USA-CA-1500, 2000 and 2500 endorsed all 2XCW.

John Kroll, K8LJG (exWA8TDY) qualified for USA-CA-2500.

Douglas Hall, WA4UNS claimed USA-CA-500 through 2500, endorsed all SSB.

Bob Robertson, N5QQ (exWA5TPO) collected USA-CA-2500.

Dave Bishop, WB9QNX gained USA-CA-2500.

Bert Pinto, CT1QZ was sent USA-CA-2000, endorsed all SSB (#4 to Portugal).

Ruel Samuels, 6Y5RS won USA-CA-500 and 1000 endorsed all SSB, all 20; and USA-CA-1500 endorsed all SSB; and USA-CA-2000. #1 Award to Jamaica.

Harry Daley, VE1AIG added to his collection, USA-CA-1500 endorsed all SSB, all 20.

Special Honor Roll
All Counties

#215 Fred F. Seifert, W5FS 2-12-79
#216 Charles S. Secrest, AD8W 2-20-79
#217 George S. Readman, WB6VRR 3-9-79

Martin Luther, VK4VU had me send him USA-CA-1000 endorsed all SSB, #1 to Australia. He wants to thank his QSL manager, Bob, WB5HGS. Martin manages to get into the 14336 Net, but it is often 3AM his time and it is not unusual to find him rather sleepy -Hi!

Dave Christensen, WA9WGJ asked for USA-CA-1000 endorsed all SSB.

Arthur Labahn, WB0GRN worked hard for his USA-CA-500 and 1000 endorsed mobile to mobiles, all SSB, and all QRPp.

Maurice Mead, W9FBC added USA-CA-1000.

Lars Berg, SM0CCM was happy to get USA-CA-500 endorsed all A-1.

Mark Stidam, WD9FPQ collected USA-CA-500.

Alvaro Robledo, EA2OP wanted to be #1 for Spain and made #1 with the unusual endorsement of all c.w., all fixed stations, all 50 states. Of course, a Mixed 500 went to Inaki, EA2IA and one all c.w. went to Santos, EA4CR.

Awards

CQ Awards & Custodians: As I continue to get requests for this data, I repeat.

Worked All Zones (WAZ): Leo Haijsman, W4KA, 1044 Southwest 43rd Street, Cape Coral, Florida 33904. (Cost is now $2.00)

Helmut Baumert, DL1QT USA-CA-500-#42, Dec. 1961

Prefix Awards: WPX, VPX, WPNX: Robert Huntington, K6XP, 5014 Mindora Drive, Torrance, California 90505.

CQ DX Awards: Rod Linkous, W7OM, 5632 47th Avenue S.W., Seattle, Washington 98136.

United States of America Counties Award: USA-CA: Ed. Hopper, W2GT, P.O. Box 73, Rochelle Park, N.J. 07662.

Note: For full details on these *CQ Awards,* send s.a.s.e. to the Custodian.

Jefferson Davis Monument Award: Sponsored by the Pennyroyal Amateur Radio Society, in memory of Jefferson Davis, the only President of the Confederacy. President Davis was born June 3, 1808. This award may be obtained by working any ten (10) Kentucky Amateurs during the year *or* by working any Pennyroyal ARS member during the special QSO period 0001Z to 2359Z June 3, 1979. At this time, the Pennyroyal ARS will be operating portable from The Jefferson Davis Memorial Park. Frequencies to be used are: Novice - 3.740, 21.140, 28.140. General - 3.970, 7.270, 14.310, 21.370, 28.610. Send the required QSL or QSLs and $2.00 to: P.A.R.S., Box 1077, Hopkinsville, Kentucky 42240.

Thanks to Billy Loyd, WD4HCC for this information.

Silver Jubilee Award: To celebrate 25 years of the Queen's reign, from June 4 to June 12, 1977, English Amateurs used prefix GE. To obtain this beautiful award, check your logs for that period in 1977, you must have worked GE3VGG and 24 other GE stations, and you must apply before the end of 1979. Send full log data and $1.00 or 4 IRCs to John Harvey, G8KLO, 38 Bodenham Road, Northfield, Birmingham B31 5DS, England. The proper name of the award is Bromsgrove Silver Jubilee Award. This data via telephone from G8KLO.

Nikola Tesla Award: This award issued by the Gospic Amateur Radio Club, YU2EAB to commemorate the birth of Nickola Tesla, the world renowned inventor and visionary of present day technology who was born in Gospic. To obtain this award you must work special station YU0NT for 5 points, plus any other Gospic station for one point. Six points are required. There are no band or mode restrictions. YU0NT will operate from July 7 to July 17 from the house where Nickola Tesla was born. Some other stations to look for in Gospic are: YU2CET, 2CGE, 2CGF, 2CGG, 2CPJ, 2CUĐ, 2EAB, 2RWI, 2RWY and 2VE. Send full log data and 5 IRCs or $2.00 to: YU2EAB, Box 55, 48000 Gospic, Yugoslavia. Additional stickers are awarded each year. Thanks to Alex, VE7CNE ex-operator from YU2AKL.

Worked All South East: This WASE Award is sponsored by the Southeast Amateur Radio Club of Cleveland, Ohio. Requirements are: Work at least three members of the club on any band below six meters. Members of the club will be on 14.300 every Wednesday evening starting at 0130 UTC and on 28.700 at 0130 UTC each Sunday evening. Send self addressed stamped envelope along with the call sign of, and date of QSO with at least

USA-CA Honor Roll

3000		2000		1000	
WB4RVW	238	K5GC	349	K5GC	521
W5FS	239	WA9WIF	350	VK4VU	522
AD8W	240	W5FS	351	W5FS	523
WD9AXF	241	WA4UNS	352	WA9WGJ	524
KL7MF	242	CT1QZ	353	WB0GRN	525
WB6VRR	243	KL7MF	354	WA4UNS	526
2500		6Y5RS	355	W9FBC	527
K5GC	297	WB6VRR	356	6Y5RS	528
WB0MIX	298	1500		WB6VRR	529
WB9AAJ	299	K6GC	401	500	
WB4RVW	300	WA9WIF	402	K5GC	1321
WA9WIF	301	W5FS	403	W5FS	1322
W5FS	302	WA4UNS	404	WB0GRN	1323
AD8W	303	VE1AIG	405	SM0CCM	1324
K8LJG	304	KL7MF	406	WD9FPQ	1325
WA4UNS	305	6Y5RS	407	WA4UNS	1326
N5QQ	306	WB6VRR	408	EA2OP	1327
WB9QNX	307			6Y5RS	1328
KL7MF	308			WB6VRR	1329
WB6VRR	309				

Islands of the World DX Award

Jefferson Davis Monument Award

three club members to: WASE c/o WD8KIS, 2196 South Overlook Road, Cleveland Heights, Ohio 44106.

Islands of the World DX Award: Sponsored by Amateurs residing on Whidbey Island, Washington. All amateurs and SWLs throughout the world are elgible. Special band and mode endorsements are available. Applicants must have QSL confirmations with:

(1) 50 Islands of the World, including Whidbey Island.

(2) 100 Islands of the Workd, including Whidbey Island.

(3) 150 Islands of the World, including Whidbey Island.

(4) 162 Islands of the World, including Whidbey Island.

Not all islands are qualified contacts for this award. Applicants will find it necessary to have a special Island Listing and a copy of the IDX Award Program rules. Both may be obtained by enclosing a large business size SASE to: Bill Gosney, WB7BFK, 2665 N. 1250 East, Whidbey Island, Oak Harbor, Washington 98277 USA. Foreign inquiries must include 5 IRCs.

As an added incentive, a Special IDX Wall Plaque will be awarded to the first recorded applicant to obtain the maximum number of 162 Island confirmed. There is a fine DX Profile in Bill, WB7BFK, page 10 March 1979 73. This award is *not* to be confused with Islands-On The-Air Award by Geoff Watts, 62 Belmore Road, Norwich NR7 OPU, England. 73, Ed., W2GT

Worked All South East Award

a monthly feature by

GEORGE JACOBS, W3ASK

Propagation

The science of predicting radio conditions

The present sunspot cycle continues to zoom upwards, bringing with it a corresponding improvement in propagation conditions on the shortwave bands.

The Swiss Federal Observatory, the world's official keeper of sunspot records, reports a monthly mean number of 138 for February, 1979. Daily activity ranged from a low of 88 on February 25th to a high of 171, which was recorded on the 21st.

This results in a 12-month running *smoothed* number of 104 centered on August, 1978. A sunspot cycle's progress is measured by the magnitude of smoothed sunspot number. A smoothed number in the range of 150 is forecast for this month, as the present cycle reached a degree of intensity only rarely surpassed in the more than 200 years that sunspot records have been kept.

The following are the official smoothed sunspot numbers reported to date for Cycle 21. The experts continue to disagree whether the new cycle began during March or June, 1976.

June Forecast

The exceptionally high level of solar activity expected during June should produce some pleasant surprises on the shortwave bands, particularly on *10*, *15* and *20* meters.

**11307 Clara St., Silver Spring, MD 20902.*

Sunspot Cycle 21
Smoothed Sunspot Numbers

Month	1976	1977	1978
Jan.	—	17	61
Feb.	—	18	65
March	12	20	70
April	13	22	77
May	13	24	83
June	12	26	89
July	13	29	97
Aug.	14	33	104
Sept.	14	39	
Oct.	14	46	
Nov.	14	52	
Dec.	15	57	

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for June 1979

Propagation Index	Expected Signal Quality (4)	(3)	(2)	(1)
Above Normal: 3, 28, 30	A	A	B	B-C
High Normal: 1-2, 4-5, 7 17, 19, 24-25	A	B	C	C-D
Low Normal: 6, 8-10, 12-13, 16, 18, 23, 27	A-B	B-C	C-D	D-E
Below Normal: 11, 14-15, 20 22, 26	C-E	D-E	E	E
Disturbed: 7	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 good (B) on June 1st, and 2nd; excellent (A) on the third; good (B) on the 4th and 5th; fair to good (B-C) on the 6th, etc. Subscribe to bi-weekly MAIL-A-PROP, P.O. Box 1714, Silver Spring, MD 20902.

Although normally dead for DX during the summer months, expect considerable DX on the *10* meter band this June, and throughout the summer months of 1979. True, there will be fewer east-west openings than took place during the winter and spring months, but there should be plenty of good openings to more southerly and tropical areas. DX conditions are expected to be best during the late afternoon, and the band should remain open until shortly after sundown.

Look for some nice surprises on *15* meters. Expect the band to open for DX shortly after sunrise, and to remain open well into the evening hours. This should be the best DX band during the hours of daylight, with openings possible to just about all areas of the world. Peak conditions should occur during the late afternoon hours, and to many parts of the world expect the band to remain open to Midnight! It's been a long time since *15* meters has been a *nighttime* DX band, but expect it to be this June, and during the summer months as well.

What's the surprise on *20* meters? Well, while this band is often thought as *the* daytime DX band, this June it will provide the best in *nighttime* DX. While the band will open for DX shortly after sunrise, conditions are expected to be spotty until the late afternoon. Then, like a switch being thrown on, the band should come to life, with signal levels becoming louder and louder as sundown approaches. Expect conditions to peak an hour or two after sundown, and to remain excellent to most parts of the world to Midnight, and beyond. From sundown to well past Midnight you are likely to hear DX signals on *20* meters like you haven't heard in nearly 20 years!

Fewer hours of darkness and an expected sharp seasonal increase in static levels will mask any improvement on *40*, *80* and *160* meter DX propagation conditions. Yet, some excellent openings can be expected this month on *40* meters to many parts of the world during the hours of darkness. The band won't sound as good as it did during the spring months, but signals will often be exceptionally strong. DX openings to many areas of the world are forecast for *80* meters this June, during the hours of darkness, but signals will often be weak and noisy. Not much DX is expected on *160* meters until the fall, but an occasional opening may be possible during the hours of darkness, with chances best just before sunrise on the *eastern* terminal of a path.

Expect plenty of *short-skip* openings on the shortwave bands this

month. For distances less than 250 miles, try *40* and *80* meters during the day and *80* and *160* meters at night. For openings between 250 and 750 miles, *40* meters should be best during the day, with *20* meters a close second. Try *80* meters at night, with *40* meters a second choice. *Twenty* meters should be best for daytime openings between 750 and 1300 miles, with *40* meters best at night, backed up by *80* meters. Between distances of 1300 and 2300 miles, use *20* meters during th day, with *15* as a second choice, with *40* meters expected to be best for this distance range at night. Frequent short-skip openings, resulting from an expected seasonal increase in sporadic-E ionization, should also be possible on *10* and *15* meters, over distances ranging between approximately 450 and 1300 miles. As its name implies, sporadic-E ionization can occur at any time, but it is usually most prevalent between 10 a.m. and 2 p.m. and again between 6 and 10 p.m., local daylight time.

This month's *CQ* Propagation Charts contain DX predictions for the period June 15 through August 15, 1979. Short-skip Charts for June, for openings between 50 and 2300 miles, and from Hawaii and Alaska, appeared in last month's column.

V.h.f. Ionospheric Openings

Sporadic-E ionization is also expected to result in some fairly frequent *6* meter short-skip openings over a range from 1000 to 1400 miles. During intense and widespread sporadic-E ionization, two-hop openings well beyond 1300 miles may also be possible at times. An occasional sporadic-E opening on *2* meters can occur, particularly when ionization is very intense, over distances between approximately 1200 and 1400 miles.

Two minor meteor showers are expected during June, the *Herculids* and *Scorpiids*. They may produce enough meteor ionization between June 3 and 5 to permit some meteor-type openings on the v.h.f. bands.

There is usually a seasonal decline in T.E. propagation during the summer months, but some *6* meter openings may still be possible during June. T.E. openings must cross the geomagnetic equator at or near a right angle, and the best time for such openings is between 8 and 11 p.m., local daylight time. Conditions favor openings deep into South America from the Central American and Caribbean areas in this hemisphere, as well as from the southern tier states in the USA. Openings can, however, extend at times into more northern states as well. Similar north-south T.E. openings are posible in other areas of the world.

Propagation Handbook

There are still available a very limited number of *The Shortwave Propagation Handbook* personally signed by the authors, George Jacobs, W3ASK and T.J. Cohen, N4XX. This book explains the many 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 the shortwave bands, as well as forecasting 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. Personalized copies can be obtained directly from the authors by sending $7.50 (postpaid) to:

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

When ordering for delivery outside the USA, please remit $8.50 in US funds for surface deliver, $10 for air-mail delivery.

HOW TO USE THE DX PROPAGATION CHARTS

1. Use Chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8 KP4, KG4 and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9 and 0 areas; the Western USA Chart in the 6 and 7 areas, and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts. An * indicates the best time to listen for 160 meter openings.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of *days* during the month on which the opening is expected to take place as follows:

(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur 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.

4. 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. Appropriate *daylight* time is used, *not* GMT. To convert to GMT, add to the times shown in the appropriate chart 7 hours in PDT Zone, 6 hours in MDT Zone, 5 hours in CDT Zone, and 4 hours in EDT Zone. For example, 14 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 03 GMT, etc.

5. The charts are based upon a transmitted power of 250 watts c.w., or 1 kw. p.e.p. on sideband, into a dipole antenna quarter-wavelength above ground on 160 and 80 meters, and a half-wavelength above ground on 40 and 20 meters, and a wavelength 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.

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

June 15—August 15, 1979
Time Zone: EDT
EASTERN USA TO:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Central Europe & North Africa	16-18 (1)	08-09 (1) 09-12 (2) 12-15 (1) 15-17 (2) 17-18 (3) 18-19 (2) 19-21 (1)	09-15 (1) 15-16 (2) 16-18 (3) 18-00 (4) 00-03 (3) 03-05 (2) 05-07 (3) 07-09 (2)	20-21 (1) 21-22 (2) 22-23 (3) 23-01 (4) 01-02 (3) 02-03 (2) 03-04 (1) 21-22 (1)* 22-23 (2)* 23-00 (3)* 00-01 (2)* 01-02 (1)*
Northern Europe & European USSR	15-17 (1)	11-15 (1) 15-18 (2) 18-19 (1)	09-15 (1) 15-17 (2) 17-19 (3) 19-22 (4) 22-01 (3) 01-03 (2) 03-06 (1) 06-09 (2)	21-22 (1) 22-23 (2) 23-00 (3) 00-01 (2) 01-02 (1) 22-01 (1)*
Eastern Mediter-ranean & Middle East	16-18 (1)	11-13 (1) 13-17 (2) 17-18 (3) 18-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	12-16 (1) 16-18 (2) 18-20 (3) 20-00 (4) 00-01 (3) 01-03 (2) 03-06 (1) 06-08 (2) 08-09 (1)	20-22 (1) 22-00 (2) 00-01 (1) 22-00 (1)*
Western Africa	11-13 (1) 15-17 (1) 17-19 (2) 19-21 (1)	10-12 (1) 12-15 (2) 15-17 (3) 17-23 (4) 23-03 (3) 03-04 (2) 04-05 (1)	14-16 (1) 16-17 (2) 17-18 (3) 18-03 (4) 03-04 (3) 04-05 (2) 05-07 (1)	20-22 (1) 22-00 (2) 00-02 (1) 22-00 (1)*
Eastern & Central Africa	17-19 (1)	09-12 (1) 12-14 (2) 14-17 (3) 17-19 (4) 19-22 (3) 22-23 (2) 23-00 (1)	14-16 (1) 16-18 (2) 18-20 (3) 20-00 (4) 00-02 (3) 02-03 (2) 03-05 (1)	21-00 (1)

Southern Africa	10-13 (1)	08-10 (1) 10-11 (2) 11-12 (3) 12-13 (4) 13-14 (3) 14-15 (2) 15-16 (1) 01-03 (1)	23-01 (1) 01-03 (3) 03-05 (2) 05-08 (1) 14-15 (1) 15-16 (2) 16-18 (3) 18-19 (2) 19-20 (1)	21-22 (1) 22-00 (2) 00-02 (1) 23-01 (1)*
Central & South Asia	NIL	09-10 (1) 10-12 (2) 12-13 (1) 17-19 (1) 19-22 (2) 22-23 (1)	17-20 (1) 20-23 (2) 23-03 (1) 03-06 (2) 06-08 (1)	19-21 (1) 04-06 (1)
Southeast Asia	NIL	10-14 (1) 14-16 (2) 16-19 (1) 19-21 (2) 21-22 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-19 (1) 19-21 (2) 21-23 (1) 23-02 (2) 02-03 (1)	04-06 (1)
Far East	NIL	09-10 (1) 10-12 (2) 12-18 (1) 18-20 (2) 20-22 (1)	06-07 (2) 07-09 (3) 09-10 (2) 10-12 (1) 18-21 (1) 21-23 (2) 23-02)3) 02-04 (2) 04-06 (1)	04-06 (1)
South Pacific & New Zealand	16-18 (1) 18-20 (2) 20-22 (1)	09-11 (1) 14-16 (1) 16-18 (2) 18-19 (3) 19-21 (4) 21-22 (3) 22-00 (2) 00-01 (1)	18-20 (1) 20-23 (2) 23-01 (3) 01-04 (4) 04-05 (3) 05-06 (2) 06-09 (3) 09-10 (2) 10-12 (1)	01-03 (1) 03-05 (2) 05-06 (3) 06-07 (2) 07-08 (1) 04-06 (1)*
Australasia	18-19 (1) 19-21 (2) 21-22 (1)	10-12 (1) 17-18 (1) 18-20 (2) 20-22 (3) 22-23 (2) 23-00 (1)	21-23 (1) 23-01 (2) 01-03 (3) 03-05 (4) 05-07 (2) 07-09 (3) 09-10 (2) 10-11 (1) 16-18 (1)	03-04 (1) 04-06 (2) 06-07 (1) 04-06 (1)*
Caribbean, Central America & Northern Countries of South America	09-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	08-09 (2) 09-12 (4) 12-14 (3) 14-21 (4) 21-01 (3) 01-03 (2) 03-08 (1)	06-07 (3) 07-10 (4) 10-11 (3) 11-15 (2) 15-17 (3) 17-03 (4) 03-05 (3) 05-06 (2)	19-20 (1) 20-21 (2) 21-23 (3) 23-03 (4) 03-04 (3) 04-05 (2) 05-06 (1) 22-23 (1)* 23-04 (2)* 04-05 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	10-14 (1) 14-16 (2) 16-17 (3) 17-18 (4) 18-19 (3) 19-21 (2) 21-22 (1)	07-08 (1) 08-11 (2) 11-15 (1) 15-16 (2) 16-17 (3) 17-23 (4) 23-01 (3) 01-02 (2) 02-03 (1)	10-16 (1) 16-18 (2) 18-19 (3) 19-02 (4) 02-04 (3) 04-07 (2) 07-09 (3) 09-10 (2)	20-21 (1) 21-22 (2) 22-02 (3) 02-04 (2) 04-05 (1) 22-03 (1)*
McMurdo Sound, Antarctica	15-17 (1)	16-18 (1) 18-21 (2) 21-22 (1)	17-19 (1) 19-22 (2) 22-03 (3) 03-05 (2) 05-06 (1) 07-09 (1)	02-05 (1)

Time Zones: CDT & MDT (24-Hour Time) CENTRAL USA TO:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Southern Europe & North Africa	NIL	11-15 (1) 15-17 (2) 17-18 (3) 18-19 (2) 19-20 (1) 23-01 (1)	05-08 (2) 08-15 (1) 15-17 (2) 17-18 (3) 18-22 (4) 22-02 (3) 02-03 (2) 03-05 (1)	20-23 (1) 23-01 (2) 01-02 (1) 22-00 (1)*
Northern & Central Europe & European USSR	Nil	10-15 (1) 15-17 (2) 17-18 (1)	02-06 (1) 06-09 (2) 09-15 (1) 15-18 (2) 18-19 (3) 19-21 (4) 21-00 (3) 00-02 (2)	20-21 (1) 21-23 (2) 23-00 (1) 21-23 (1)*
Eastern Mediter-ranean & Middle East	15-17 (1)	11-16 (1) 16-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	13-16 (1) 16-18 (2) 18-20 (3) 20-22 (4) 22-23 (3) 23-00 (2) 00-02 (1) 07-09 (1)	21-23 (1)
Western Africa	10-12 (1) 15-16 (1) 16-18 (2) 18-20 (1)	10-12 (1) 12-15 (2) 15-17 (3) 17-21 (4) 21-00 (3) 00-02 (2) 02-03 (1)	14-15 (1) 15-16 (2) 16-18 (3) 18-00 (4) 00-02 (3) 02-04 (2) 04-06 (1)	20-00 (1) 22-00 (1)*
Eastern & Central Africa	16-18 (1)	10-14 (1) 14-16 (2) 16-17 (3) 17-18 (4) 18-19 (3) 19-20 (2) 20-22 (1)	15-17 (1) 17-18 (2) 18-19 (3) 19-22 (4) 22-00 (3) 00-02 (2) 02-04 (1)	21-23 (1)
Southern Africa	09-12 (1)	08-10 (1) 10-11 (2) 11-12 (4) 12-13 (3) 13-14 (2) 14-15 (1) 00-02 (1)	23-00 (1) 00-02 (3) 02-04 (2) 04-06 (1) 12-14 (1) 14-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	21-22 (1) 22-00 (2) 00-01 (1) 22-00 (1)*
Central & South Asia	NIL	09-11 (1) 11-12 (2) 12-13 (1) 15-18 (1) 18-21 (2) 21-23 (1)	17-19 (1) 19-22 (2) 22-02 (1) 02-06 (2) 06-08 (3) 08-09 (2) 09-10 (1)	19-21 (1) 05-07 (1)
Southeast Asia	NIL	10-11 (1) 11-14 (2) 14-19 (1) 19-22 (2) 22-00 (1)	07-09 (2) 09-11 (1) 16-18 (1) 18-20 (2) 20-23 (1) 23-00 (2) 00-01 (3) 01-02 (2) 02-03 (1)	03-05 (1)
Far East	NIL	09-11 (1) 13-15 (1) 17-19 (1) 19-20 (2) 20-22 (3) 22-23 (2) 23-01 (1)	05-07 (2) 07-09 (3) 09-10 (2) 10-12 (1) 20-22 (1) 22-00 (2) 00-03 (3) 03-04 (2) 04-05 (1)	04-05 (1) 05-06 (2) 06-07 (1) 04-06 (1)*
South Pacific & New Zealand	14-16 (1) 16-18 (2) 18-19 (3) 19-20 (2) 20-21 (1)	13-16 (1) 16-18 (2) 18-20 (3) 20-22 (4) 22-23 (3) 23-00 (2) 00-01 (1)	17-19 (1) 19-23 (2) 23-02 (4) 02-05 (3) 05-07 (2) 07-09 (4) 09-10 (3) 10-11 (2) 11-13 (1)	23-01 (1) 01-03 (2) 03-05 (3) 05-07 (2) 07-08 (1) 01-04 (1)* 04-06 (2)* 06-07 (1)*
Australasia	16-17 (1) 17-18 (2) 18-19 (3) 19-20 (2) 20-21 (1)	14-15 (1) 15-17 (2) 17-19 (1) 19-20 (2) 20-21 (4) 21-22 (3) 22-23 (2) 23-00 (1)	22-00 (1) 00-01 (2) 01-04 (4) 04-05 (3) 05-07 (2) 07-09 (4) 09-11 (2) 11-12 (1)	01-03 (1) 03-07 (2) 07-08 (1) 03-06 (1)*
Caribbean Central America & Northern Countries of South America	10-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	08-09 (2) 09-10 (3) 10-12 (4) 12-14 (3) 14-19 (4) 19-23 (3) 23-01 (2) 01-08 (1)	03-05 (2) 05-07 (3) 07-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-01 (4) 01-03 (3)	19-20 (1) 20-21 (3) 21-23 (4) 23-00 (3) 00-03 (2) 03-05 (3) 05-06 (1) 20-22 (1)* 22-04 (2)* 04-05 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	09-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	07-08 (1) 08-10 (2) 10-14 (1) 14-15 (2) 15-16 (3) 16-22 (4) 22-00 (3) 00-01 (2) 01-02 (1)	10-15 (1) 15-17 (2) 17-18 (3) 18-01 (4) 01-03 (3) 03-07 (2) 07-09 (3) 09-10 (2)	20-21 (1) 21-22 (2) 22-02 (3) 02-03 (2) 03-05 (1) 20-03 (1)*
McMurdo Sound, Antarctica	15-18 (1)	14-16 (1) 16-17 (2) 17-18 (3) 18-19 (2) 19-21 (1)	17-19 (1) 19-22 (2) 22-02 (3) 02-04 (2) 04-07 (1) 07-09 (2) 09-10 (1)	02-06 (1)

Time Zone PDT (24-Hour Time) WESTERN USA TO:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Southern Europe & North Africa	NIL	08-09 (1) 09-11 (2) 11-15 (1) 15-17 (2) 17-18 (1) 21-23 (1)	23-01 (3) 01-06 (1) 06-08 (2) 08-14 (1) 14-16 (2) 16-21 (3) 21-23 (2)	20-23 (1)
Central & Northern Europe & European USSR	NIL	07-09 (1) 13-14 (1) 14-16 (2) 16-17 (1)	13-15 (1) 15-19 (2) 19-00 (3) 00-01 (2) 01-06 (1) 06-08 (2) 08-10 (1)	20-22 (1)
Eastern Mediter-ranean & Middle East	NIL	07-09 (1) 11-15 (1) 15-17 (2) 17-18 (1) 22-00 (1)	13-16 (1) 16-20 (2) 20-22 (3) 22-00 (2) 00-02 (1) 06-08 (1)	20-21 (1)
Western & Central Africa	09-14 (1) 14-16 (2) 16-18 (1)	07-11 (1) 11-13 (2) 13-17 (3) 17-19 (2) 19-21 (1)	13-15 (1) 15-17 (2) 17-19 (3) 19-22 (4) 22-00 (3) 00-04 (2) 04-08 (1)	20-22 (1)
Eastern Africa	NIL	09-14 (1) 14-16 (2) 16-17 (3) 17-18 (2) 18-19 (1) 00-02 (1)	15-17 (1) 17-19 (2) 19-22 (3) 22-00 (2) 00-02 (1)	NIL
Southern Africa	09-12 (1)	08-10 (1) 10-11 (2) 11-12 (3) 12-14 (2) 14-15 (1)	14-15 (1) 15-17 (2) 17-18 (1) 22-23 (1) 23-00 (2) 00-02 (3) 02-03 (2) 03-06 (1) 06-08 (2) 08-10 (1)	20-23 (1)
Central & South Asia	NIL	08-10 (1) 10-12 (2) 12-14 (1) 17-19 (1) 19-22 (2) 22-23 (1)	05-07 (2) 07-09 (3) 09-10 (2) 10-11 (1)	05-07 (1) 19-20 (1)
Southeast Asia	11-15 (1)	08-09 (1) 09-11 (3) 11-13 (2) 13-16 (1) 20-22 (1) 22-00 (2) 00-02 (1)	23-01 (1) 01-03 (2) 03-05 (3) 05-07 (2) 07-09 (3) 09-11 (2) 11-14 (1)	03-07 (1)
Far East	14-16 (1)	09-10 (1) 10-12 (2) 12-15 (1) 15-17 (2) 17-19 (3) 19-21 (2) 21-23 (1)	19-21 (1) 21-23 (2) 23-01 (3) 01-04 (4) 04-06 (3) 06-07 (2) 07-09 (3) 09-11 (2) 11-14 (1)	01-02 (1) 02-03 (2) 03-05 (3) 05-06 (2) 06-07 (1) 03-05 (1)*
South Pacific & New Zealand	12-14 (1) 14-16 (2) 16-18 (3) 18-20 (4) 20-21 (2) 21-22 (1)	11-13 (1) 13-15 (2) 15-18 (3) 18-21 (4) 21-22 (3) 22-23 (2) 23-01 (1)	17-19 (1) 19-21 (2) 21-03 (4) 03-05 (3) 05-07 (2) 07-09 (3) 09-11 (2) 11-13 (1)	22-23 (1) 23-01 (2) 01-06 (3) 06-07 (2) 07-08 (1) 23-02 (1)* 02-05 (2)* 05-06 (1)*
Australasia	14-17 (1) 17-19 (2) 19-21 (3) 21-22 (2) 22-23 (1)	07-09 (1) 13-17 (1) 17-19 (2) 19-22 (3) 22-00 (4) 00-01 (3) 01-02 (2) 02-03 (1)	20-22 (1) 22-00 (2) 00-05 (4) 05-07 (3) 07-09 (4) 09-10 (2) 10-13 (1) 13-15 (2) 15-17 (1)	22-00 (1) 00-01 (2) 01-05 (3) 05-06 (2) 06-08 (1) 01-04 (1)*
Caribbean Central America & Northern Countries of South America	09-11 (1) 11-12 (2) 12-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	08-09 (2) 09-10 (3) 10-12 (4) 12-14 (3) 14-19 (4) 19-21 (3) 21-00 (2) 00-08 (1)	08-11 (3) 11-15 (2) 15-17 (3) 17-01 (4) 01-04 (3) 04-05 (2) 05-06 (3) 06-08 (4)	19-21 (1) 21-22 (2) 22-00 (3) 00-03 (2) 03-04 (3) 04-05 (2) 05-06 (1) 21-23 (1)* 23-03 (2)* 03-04 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	09-12 (1) 12-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-16 (3) 16-23 (4) 23-00 (3) 00-01 (2) 01-02 (1)	09-15 (1) 15-17 (2) 17-18 (3) 18-01 (4) 01-03 (3) 03-06 (2) 06-08 (3) 08-09 (2)	20-21 (1) 21-00 (2) 00-02 (1) 02-03 (3) 03-04 (2) 04-05 (1) 02-04 (1)*
McMurdo Sound, Antarctica	17-19 (1)	14-16 (1) 16-17 (2) 17-19 (3) 19-21 (2) 21-22 (1)	16-18 (1) 18-19 (2) 19-02 (3) 02-04 (2) 04-06 (1) 06-08 (2) 08-10 (1)	00-23 (1) 23-01 (2) 01-04 (1) 04-06 (2) 06-07 (1)

* Indicates best time for eighty 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.

a monthly feature by

FRANK ANZALONE, W1WY

Contest Calendar

News/views of on-the-air competition

KH6XX was inadvertently omitted from the World Top Scores block listing in the '78 WPX-SSB Results, Dec, 78, *CQ*. The score, 305,080 was 2nd World High for 3.5 MHz. consequently KH6XX was not listed in the All-Time Records, Feb, 79, *CQ*, although he is the current Oceania, 3.5 MHz record holder. So sorry about this Randall - we promise to do better.

As if I didn't have enough to do, I got saddled with another contest, the Stamford VHF Party on April 1st.

Fortunately it was a small affair and scoring the logs was a simple matter.

The final results show NO winners, all the scores were identical, ZERO points.

However there were several disqualifications.

K2EEK was disqualified for multiplier infractions, claiming a 6½ size shoe. Not those canal boats you are wearing Buster. I recall the verse in an old song. "All the angels have big feet that's why I'm going to Heaven." At least there's some hope for you Al.

K2MGA was also disqualified for multiplier misrepresentation, claiming an age multiplier that would qualify him as a Senior Citizen. Hiding behind that growth of spinach did not fool the Committee, Dick.

WA2LRO's log was not acceptable. Sorry "Boss Man" this was a 2 Meter amateur band contest, not a Citizen Band. 10/4 Good Buddy?

K2VG and W2LZX did not meet the April 3rd mailing deadline. Better check your mail room, you guys.

And Kim Smith, Kim Smith? How did you get in the act? Et tu Kim? You can't trust anybody these days, especially come the month of April each year. A contest on April 1st, my, my. (If you don't know what this is all about you're just not reading my Column.)

73 for now, Frank, W1WY

**14 Sherwood Rd., Stamford, CT 06905.*

Calendar of Events

June	1-4	CHC/FHC/HTH QSO Party
June	2	6 Meter " SMIRK " Contest
June	2-3	Minnesota QSO Party
June	3	Pennyroyal QSO Party
June	6-7	S.O.W.P. QSO Party
June	9-10	ARRL VHF QSO Party
June	9-10	RSGB National Field Day
June	16-17	West Virginia QSO Party
June	16-17	All Asian Phone Contest
June	16-17	VK/ZL/Oceania DX Contest
June	23-24	ARRL Field Day
Ju/Jl	30-1	SEVEN Land QSO Party
July	14-15	IARU Radiosport Champ.
July	21-22	VHF Space Net Contest
Aug.	11-18	Bancroft "Homecoming"
Aug.	25-26	All Asian C.W. Contest
Sept.	8-9	C.L.A.R.A. AC/DC Contest

† Not official

IARS/CHC/FHC/HTH QSO Party

Starts: 2300 GMT Friday, June 1
Ends: 0600 GMT Monday, June 4

This is the summer edition of this activity and as in the past I recommend that you send a s.a.s.e. to K6BX for more detailed information.

Essentially rules are as follows:

Exchange: QSO no., RS (T), name, CHC/FHC no., state, county or similar division. Non-members send HTH instead of membership number.

Scoring: *For CHC* - 1 point per QSO with other CHCers, 2 points if it's a HTHer, 1 additional point if it's a YL, B/P, FHC, Novice, CHC 200, Merit or Club station, or if it's on vhf/uhf. Double above QSO points if QSO is out of own country.

For HTH - Contacts with other HTHers 1 point, with CHCers 3 points. Rest same as above. S.w.l. use same scoring as HTHers.

Multiplier: Each continent, country, ITU zone and each U.S, state. (Counted once only)

Final Score: Total QSO points from all bands times the sum of the multiplier. Multi-operator stations divide score by number of operators. The same station may be worked on each band and mode for QSO points but not a multiplier.

Frequencies: CW - 3575, 3710, 7070, 7125, 14075, 21075, 21090, 21140, 28090, 28125. Phone - 3770, 3790, 3943, 3960, 7090, 7210, 7275, 14320, 14340, 21360, 21440, 28620, 28690. And 50.1 - 50.5, 145 - 147. For U.S. and DX as allowed.

Awards: The party supports hundreds of certificates and trophies in all categories and divisions. A s.a.s.e. will get you a list. Include extra postage for ITU, IARU, IARC, IARS country, prefix and zone lists.

Send all requests and your log to: International Amateur Radio Society, K6BX, P.O. Box 385, Bonita, Calif. 92002

6 Meter " SMIRK " QSO Party

To be held Saturday, June 2nd, during the hours when there is progagation on 6 meters.

The party is open to all but only scores of SMIRK members are eligible for awards.

Exchange: Call, state, province or country and SMIRK number if you are a member.

Scoring: Contacts with members count 2 points, with non-members 1 point. Multiply total QSO points by the number of states, provinces and countries worked for your final score.

Awards: Certificates to the top scores in each State, Province and Call Districts. (for entries outside the U.S.)

Members should have received a detailed copy of the rules, log and dupe sheets.

Mail your log, dupe sheet and a s.a.s.e. before July 1st to: Ray Clark, K5ZMS, 7158 Stone Fence Dr., San Antonio, Texas 78227

Minnesota QSO Party

Starts 1800 GMT Saturday, June 2
Ends: 2359 GMT Sunday, June 3

The Heartland A.R.C. is again sponsoring this party. Phone and c.w. are one contest. The same station may be worked on each band and mode. Only one transmitter may be used at

any one time, cross-band contacts are not allowed. Novices compete with Novices and Techs with Techs.

Exchange: RS(T) and QTH. County for Minn., ARRL section or country for others. Novice and Tech stations must identify their license class.

Scoring: One point for phone QSOs, 2 points if it's on c.w., and 5 points if it's with a Novice or Tech. Contacts with club station WB0TTZ are worth 10 points on each band worked.

Minn. stations multiply total QSO points by ARRL sections and DX countries worked. Others, QSO points by Minn. counties worked. (max. of 87)

Frequencies: C.W. - 28050, 28150, 21050, 21150, 14075, 7075, 7125, 3600, 3725. Phone - 28700, 21400, 14300, 7275, 3950. (Avoid Net frequencies)

Awards: Certificates to each state, DX country, and Novice and Tech high scorers. County awards to Minn. stations having 10 or more QSOs.

Stations making 50 or more contacts must include a check sheet for each band and mode used. Usual disqualification criteria will be enforced.

Include a s.a.s.e. with your log and send to: Heartland A.R.C., c/o Scott Nelson, WD0EZF, 421 W. Wisconsen Ave., Staples, Minn. 56479. Mailing deadline is July 1st.

Pennyroyal QSO Party

0001 to 2359 GMT Sunday, June 3

The Pennyroyal A.R.S. will be operating portable from the Jefferson Davis Memorial Park to celebrate the memory of President Davis, the only president of the Confederacy.

A special certified sequential award will be issued to any amateur station confirming a contact with a P.A.R.S. member during the above period, or with any 10 Kentucky stations during the year.

Frequencies to monitor: 3970, 7270, 14310, 21370, 28610. Novice - 3740, 21140, 28140.

Send $2.00 and your QSL cards to P.A.R.S. Box 1077, Hopkinsville, Kentucky 42240

S.O.W.P. CW QSO Party

Starts: 0000 GMT Wednesday, June 6
Ends: 2359 GMT Thursday, June 7

This is the 4th annual party for the Society of Wireless Pioneers. This year it is being held mid-week to avoid the weekend QRM.

There are no formal requirements, just an exchange of name, membership number and QTH.

Suggested frequencies are 55 kHz. up from the low end of each band. (Novices in the center of each novice band.) Utilize 10 and 15 meters for long haul QSOs.

A special certificate will be available to all members who contact a minimum of ten members during the period of the party.

Request for the certificate must include a list of stations worked, dates, times and membership numbers.

Include a s.a.s.e. with your request and submit before June 30th to: Manuel " Pete " Fernandez, W4SM, 129 Hialeah Road, Greenville, S.C. 29607

RSGB National Field Day

Starts: 1700 GMT Saturday, June 9
Ends: 1700 GMT Sunday, June 10

This is a c.w. only contest and activity is confined to Great Britian.

However while overseas stations are not eligible to compete they can work the British portables. Check logs are welcome and a certificate will be awarded to the overseas station in each continent whose check log shows the most points contributed to competitors.

Send your check log to: RSGB HF Contests Committee, c/o Mr. M. Harrington, 123 Clensham Lane, Sutton, Surrey, SM1 2nd, England.

ARRL VHF and ARRL Field Day

ARRL has two activities going this month, their "biggie" is their Field Day of course. This one probably generates more operator per operator activity than any other domestic competition in the world. *QST* has all the details, naturally.

The VHF Party, June 9 - 10.
The Field Day, June 23 - 24.

Awards: To the highest scorers, both phone and c.w. as follows: Single operator all band, in each country and USA call areas, up to the 5th rank where returns justify. Single band and multi-operator entries in each country only. Continental leaders will also receive and award.

Logs: Keep all times in GMT, fill in country or prefix column only first time it is worked, and use a separate sheet for each band. A summary sheet showing the scoring and other information, and a signed declaration is also requested.

Disqualification regulations will be strictly enforced so check your log carefully for dups and etc. And keep in mind that non-Asians use prefixes for their multiplier, not countries. Club stations are classed as multi-operator. Each oprator of a multi station will give his age in the exchange.

POINTS TABLE

EXCHANGE

YOUR zone \ CORRESPONDENT zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	2	14	10	13	16	18	22	20	25	30	36	37	39	21	22	19	20	17	11	25	29	29	22	22	16	28	25	31	39	35	14	36	25	29	34	39	40	47	44	15
2	14	2	15	8	7	16	16	12	16	23	24	30	30	12	14	16	19	20	19	19	25	31	26	30	28	35	35	40	50	50	25	47	14	21	21	28	33	36	37	6
3	10	15	2	8	11	9	13	14	18	21	28	28	30	26	28	27	29	27	21	32	37	39	32	31	24	37	33	40	43	35	11	32	29	35	35	42	48	50	52	20
4	13	8	8	2	3	8	10	8	12	18	22	25	27	19	21	23	26	26	22	26	33	37	32	34	30	40	38	44	52	44	20	40	21	28	26	33	40	41	44	14
5	15	7	11	3	2	9	9	6	10	17	20	24	25	18	20	22	26	26	24	35	32	38	33	35	31	41	40	45	54	46	22	41	19	27	24	31	38	39	42	13
6	18	16	9	8	9	2	4	7	10	12	19	19	21	27	29	31	34	33	29	34	40	46	40	40	33	46	42	49	47	38	17	32	28	36	30	37	44	43	48	22
7	22	16	13	10	9	4	2	4	6	8	15	15	17	26	29	31	35	36	33	33	40	47	42	44	38	50	46	53	49	40	22	34	26	34	26	33	40	38	44	22
8	20	12	14	8	6	7	4	2	5	11	15	18	19	22	24	27	31	32	30	29	35	42	38	42	37	47	46	51	54	44	24	38	21	30	23	30	38	36	41	13
9	25	16	18	12	10	10	6	5	2	8	10	14	15	23	25	29	33	35	34	29	35	43	41	45	41	50	50	55	52	45	28	38	21	30	20	27	35	32	38	21
10	30	23	21	18	17	12	8	11	8	2	9	7	9	31	33	37	41	43	41	36	42	51	49	52	45	58	52	54	44	37	28	31	28	36	24	29	38	31	38	29
11	36	24	28	22	20	19	15	15	10	9	2	9	7	26	28	33	36	41	43	30	34	42	45	51	52	49	55	49	42	41	37	35	22	29	16	20	28	23	29	27
12	37	30	28	23	24	19	15	18	14	7	9	2	3	35	37	41	45	49	48	39	42	49	53	58	50	52	52	48	37	33	32	27	31	37	34	27	33	27	33	34
13	39	30	30	27	25	21	17	19	15	9	7	3	2	33	35	40	43	48	49	37	39	46	50	56	53	50	52	46	34	34	35	29	29	34	21	24	30	24	30	34
14	21	12	26	19	18	27	26	22	23	31	26	35	33	2	3	6	10	14	18	7	14	21	19	25	27	27	30	32	42	49	34	55	5	10	15	19	21	26	26	6
15	22	14	28	21	20	29	29	24	25	33	28	37	35	3	2	5	9	33	18	6	11	18	17	23	21	25	29	30	39	47	36	54	6	7	15	18	19	25	24	8
16	19	16	17	23	22	31	31	27	29	37	33	41	40	6	5	2	4	8	13	6	10	15	12	18	22	21	24	26	36	42	33	49	10	9	20	21	21	27	25	9
17	20	19	29	26	26	34	35	31	33	41	36	45	43	10	9	4	2	5	12	7	8	12	8	14	19	17	20	22	32	38	32	45	14	10	22	22	20	27	23	12
18	17	20	27	26	26	33	36	32	35	43	41	49	48	14	13	8	5	2	7	12	12	12	6	11	14	15	16	20	30	35	29	40	13	13	27	28	24	31	27	14
19	11	19	21	22	24	29	33	30	34	41	43	48	49	18	18	13	12	7	2	18	19	16	10	10	9	16	15	20	30	32	21	36	23	21	33	34	30	38	33	16
20	25	19	32	26	35	34	33	29	29	26	30	39	37	7	6	6	7	12	18	2	6	14	14	20	26	21	26	25	34	43	39	49	8	3	15	16	15	22	20	12
21	29	25	37	33	32	40	40	35	35	42	34	42	39	14	11	10	8	12	19	6	2	9	11	17	24	16	21	20	28	37	40	43	14	6	18	16	11	19	15	19
22	29	31	39	37	38	47	46	42	43	51	42	49	46	21	18	15	12	12	16	14	9	2	6	10	18	17	13	11	21	29	36	35	22	14	26	22	15	22	16	24
23	22	26	32	32	33	40	42	38	41	49	45	53	50	19	17	12	8	6	10	14	11	6	2	6	13	8	12	11	24	30	31	37	22	16	29	26	21	28	22	20
24	22	30	31	34	35	40	44	42	45	52	51	58	56	25	23	18	14	11	10	20	17	10	6	2	8	6	6	10	20	24	26	30	28	22	35	33	25	32	25	25
25	16	28	24	30	31	33	38	37	41	45	52	50	53	27	27	22	19	14	9	26	24	18	13	8	2	13	9	15	23	30	18	27	32	28	41	40	33	40	33	25
26	28	35	37	40	41	46	50	47	50	50	49	52	50	27	25	21	17	15	16	21	16	7	8	6	13	2	6	5	16	22	31	29	29	21	33	29	21	27	20	29
27	25	35	33	38	40	42	46	46	50	52	55	52	52	30	29	24	20	16	15	24	21	13	12	6	9	6	2	7	15	18	25	25	34	27	40	35	27	32	26	30
28	31	40	40	44	45	49	53	51	55	54	49	48	46	32	30	26	22	20	20	25	20	11	14	10	15	5	7	2	10	17	31	24	34	25	36	30	22	26	19	34
29	39	50	43	52	54	47	49	54	52	44	42	37	37	42	39	36	32	30	30	34	28	21	24	20	23	16	15	10	2	9	15	32	42	33	39	31	24	24	20	44
30	35	50	35	44	46	38	40	44	45	37	41	33	34	49	47	42	38	45	32	43	37	29	30	24	30	22	18	17	9	2	24	7	51	42	47	10	33	32	29	48
31	14	25	11	20	22	17	22	24	28	28	37	32	35	34	36	33	32	29	21	39	40	36	31	26	15	31	25	31	15	24	2	22	39	42	46	53	52	56	51	28
32	36	47	32	40	41	32	34	39	38	31	35	27	29	55	54	49	45	40	36	49	43	35	37	10	21	29	25	24	32	7	22	2	57	48	47	42	38	34	33	50
33	25	14	29	21	19	28	26	21	21	28	22	31	29	5	5	10	14	18	23	5	14	22	22	28	32	29	34	34	42	51	39	57	2	9	10	14	18	22	23	10
34	29	21	35	28	27	36	34	30	30	36	29	37	34	10	7	9	10	15	21	3	6	14	16	22	28	21	27	25	33	42	42	18	9	2	13	17	12	18	16	16
35	34	21	35	26	24	30	26	23	20	24	16	34	21	15	15	20	22	27	33	15	13	26	29	35	41	33	40	36	39	47	46	47	10	13	<	7	15	15	19	20
36	39	28	42	33	31	37	33	30	27	29	20	27	24	19	18	21	22	28	34	16	16	22	26	33	40	29	35	30	31	40	53	42	14	12	7	2	8	8	11	24
37	40	31	48	40	38	44	40	38	35	38	28	33	30	21	19	21	20	24	30	15	11	15	21	25	33	21	27	22	24	33	52	18	18	12	15	8	2	7	5	28
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39	44	37	52	44	42	48	44	41	38	38	29	33	30	26	24	25	23	27	33	20	15	16	22	25	33	20	26	19	20	29	51	33	23	16	19	11	5	6	2	32
40	15	6	20	14	13	22	22	18	21	29	27	34	34	6	8	9	12	14	16	12	19	24	20	25	25	29	30	34	44	48	28	50	10	16	20	24	28	32	32	2

Logs must be received no later than September 30th for phone entries and Nov. 30th for the c.w. section. They go to: J.A.R.L. Contest Committee, P.O. Box 277, Tokyo Central, Japan. Include an IRC and s.a.e. for a copy of the results.

Asian Country List

A4, A51, A6, A7, A9, AP, BV, BY, CR9, EP, HL/HM, HS, HZ/7Z, JA/JE/JF/JG/JH/JI/JJ/JR, JD1/ JT, JY, OD5, S21, TA, UA/UK/UV/UW9 - 0, UD6/UK6C/D/K, UF6/UK6F/O/Q/V, UG6/UK6G, UH8/UK8H, UI8/UK8A/G/I/L/O/T/Z, UJ8/UK8J/R, UL7/UK7, UM8/UK8M/N, VS6, VS9M/8Q6, VU, VU/A, VU/L, XU, XV, XW8, XZ, YA, YI YK, ZC4/5B4, IS (Spratly), 4S7, 4W, 4X/4Z, 7O (Yemen) 7O (Kamaran), 8Z4, 9K2, 9M2, 9M8, 9N1, 9V1.

West Virginia QSO Party
Starts: 2300 GMT Saturday, June 16
Ends: 2300 GMT Sunday, June 17

This one is again sponsored by the West Virginia Amateur Radio Council.

There are no time limits, the same station may be worked once on each band for QSO points, and W. Va. stations may work each other for QSO and multiplier credit.

Exchange: QSO no., RS(T) and QTH. County for W. Va., state or country for others.

Scoring: W. Va. stations multiply total QSOs by (W. Va. counties + states + countries) worked. Multiply total by power multiplier if any.

Others multiply total W. Va. QSOs by W. Va. counties worked. (max. of 55) And multiply total by power multiplier if any.

There is a power mulitplier of 1.5 for stations using 200 watts or less input.

Frequencies: C.W. - 35 kHz. inside each c.w. band. Phone - 10 kHz. inside the " General " portion of each phone band.

Awards: To the 1st, 2nd and 3rd place scorers and Novice in West Virginia. And top scores in each state each country. (Single operator only)

To be eligible for an award logs must contain a minimum of 50 valid contacts (20 for Novices) and be received no later than July 15th.

Set up your log as follows: Date/time in GMT, QSO no., call sign, QSO no., RS (T), QTH and mode and band used.

Logs go to: West Virginia QSO Party, P.O. Box 36, Seneca Rocks, W. Va. 26884

All Asian Contest
Phone: June 16 - 17 C.W.: Aug. 25 - 26
Starts: 1000 GMT Saturday
Ends: 1600 GMT Sunday

This is the 20th year for this JARL activity. The exchange is between Asian countries and the rest of the world.

Classifications: Single operator, single and all band. Multi-operator, single transmitter, all band only. (no multi transmitter)

Exchange: For OM's, RS (T) plus age of operator. For YL's, RS(T) plus 00.

Scoring: One point per QSO. Asians use non-Asian countries for their multiplier. (ARRL list) Non-Asians use prefixes for their multiplier. (*CQ* WPX list) Note: Ogasawara JD1 (Bonin & Volcano) are in Asia. Minami Torishima JD1 (Marcus) is in Oceania. (KA contacts do not count)

Final Score: Total QSO points from each band times the sum of the multiplier from each band.

VK/ZL/Oceania DX Contest
Starts: 1000 GMT Saturday, June 16
Ends: 1000 GMT Sunday, June 17

This is a new one and not to be confused with the VK/ZL/Oceania Contest in October which has been around many, many years.

Three classes, single operator, multi-operator and s.w.l. Multi logs must be signed by each operator and s.w.l. must log both sent and received numbers.

The scoring system is rather complicated and confusing so review the following carefully.

Exchange: RST, Zone number (CQ) and time in GMT.

Scoring: QSO point value as per the Exchange Point Zone Chart. (CARTG). Multiply total QSO points by the number of countries worked, and again by the number of continents. (max. 6) Contacts on 80 count triple, and on 40 double points. (providing they are not with stations on one's own continent, which have normal value.)

After the above calculation world stations add 100 points for each VK/ZL station worked on 14, 21 & 28 MHz, 200 points on 7 MHz and 300 points on 3.5 MHz.

A VK/ZL station may be counted only once if worked on 14, 21 or 28 MHz, but may be counted again if worked on 7. or 3.5 MHz.

The ARRL country list and call areas in W/K, VK/ZL, VE/VO and JA will be used as multipliers.

Awards: Will be issued to 1st, 2nd and 3rd place winners on a world basis and to winners in each country.

Use a separate log sheet for each band, include a summary sheet with your entry showing the scoring and your name and address in Block Letters.

Logs must be received by August 18th and go to: Bill Storer, VK2EG, 55 Prince Charles Road, Frenchs Forest 2086, N.S.W. Australia.

SEVEN Land QSO Party
Starts: 1200 GMT Saturday, June 30
Ends: 2400 GMT Sunday, July 1

This is the 2nd annual QSO Party sponsored by the NAS Whidbey Island A.R.C.

The 7 Land area includes not only the eight W7 US states but also VE7 and KL7.

Operating time is limited to a maximum of 30 hours out of the 36 hour contest period. The same station may be worked on each band and contacts between 7 Land stations are permitted for QSO and multiplier credit.

Exchange: RS(T), QSO no., and state, province or country. 7 Land stations will also include their county.

Points: One point per QSO for 7 Land stations. Five points for each 7 Land QSO for others.

Multiplier: *For 7 Land* - One for each of the 50 US states and 13 Canadian provinces worked on each band. *All Others* - One for each 7 Land state (9) and VE7 worked on each band.

There is also a power multiplier as follows; Five watts or less X 5. - 5 to 100 watts X 2. -100 to 299 watts X 1.5 -300 to 499 watts X 1.25 - Nil if over 500 watts.

Final Score: Total QSO points X sum of multiplier from each band X power multiplier if any.

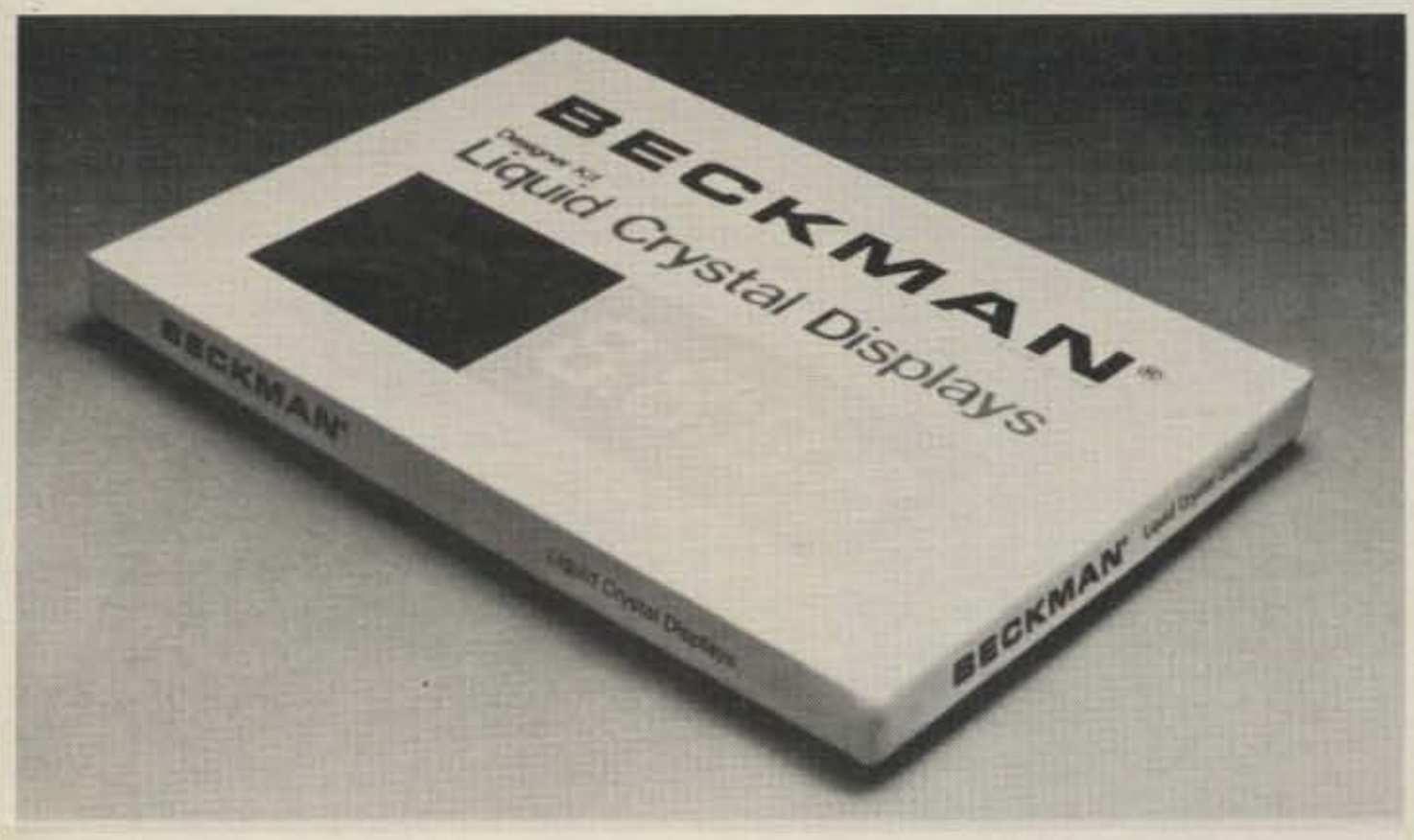
Awards: Certificates to top scoring single operator station in each state, province and DX country. And top multi-opr. station in each W/VE call district.

Logs must show band, mode, date/time in GMT, station worked, exchange sent/rec'd and points. Use a separate sheet for each band and a dupe sheet if your log contains over 100 contacts.

Make up your own log and dupe sheets, but summary and rules sheets are available from the Club if you include a s.a.s.e. with your request.

Mailing deadline is August 1st to: Whitbey Island DX Club, Att: Lloyd Vancil, WB7NVM, 3541 Appain Way, Oak Harbor, WA 98277. Include a s.a.s.e. for results.

CQ Showcase



Beckman (Display Systems Division) LCD Designer Kit

A designer's kit that allows users to experiment with large area liquid crystal displays in various applications is available from Beckman Instruments. The kit, which sells for $11.95, includes a Beckman one-half inch, four-digit liquid crystal display, an easy-to-mount connector/bezel assembly, printed circuit board, complete specifications and applications information. A list of manufacturers that provide integrated circuits with LCD interfaces is also included.

For more information, contact Display Systems Division, Beckman Instruments, Inc. 2500 Harbor Blvd., Fullerton CA 92634, or circle number 69 on the reader service card.

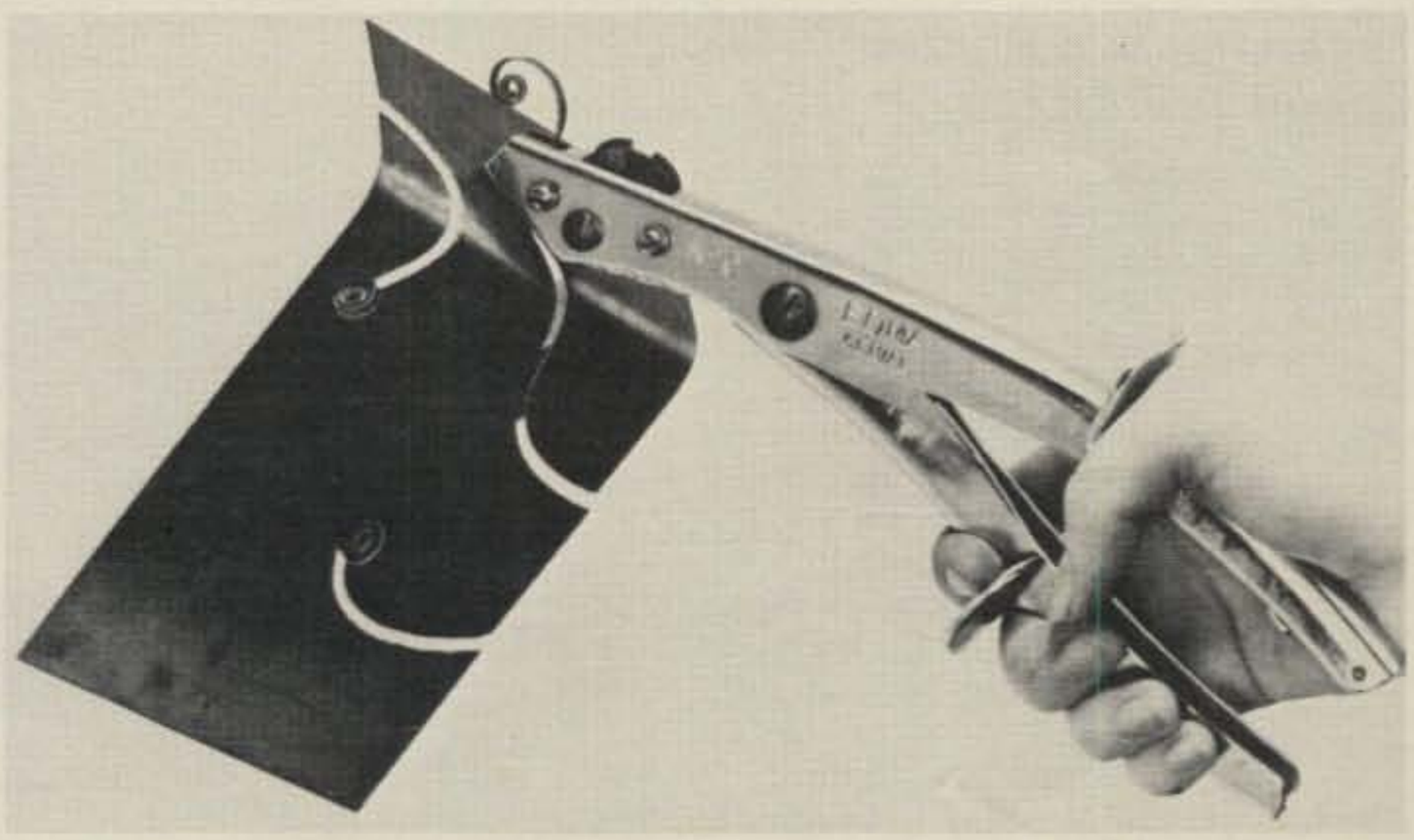
Jilson Corp.'s QuikSnip *Cutting Shears*

Jilson has just marketed a new pair of cutting shears which they say can cut aluminum, brass and copper sheets up to 15 guage, and mild steel up to 18 guage.

Cutting can be started in the center of work by cutting a quarter-inch hole to accomodate the *QuikSnip* cutting jaws.

Four models are available to cut all materials from sheet metal to plastic sheeting in any desired pattern. Model J1252WC has a special wire cutting feature.

For detailed information, contact The Jilson Corporation, 291 S. Van Brunt St., Englewood NJ 07631, or circle number 63 on the reader service card.



Cincinnati Electrosystems' Model 400 Pulse Generator

A compact pulse generator has been introduced by Cincinnati Electrosystems as an addition to their Black Box series. The Model 400 costs $59.95.

The unit uses a quasi-complimentary VMOS FET output, producing a less than 10 ns rise and fall time with an output impedance of less than 5 ohms. Pulse width and repetition rate are variable from one microsecond to one second. One shot pulses are pushbutton or externally triggered. Output amplitude typically swings within 0.1 V of the 5-to-15 volt external supply voltage and is current limited to approximately 100 mA and can withstand a direct short to V_{CC} or ground.

The Model 400 is small (4 × 2.875 × 1.5625 inches). For more information contact Cincinnati Electrosystems at 469 Ward's Corner Road, Loveland OH 45140, or circle number 67 on the reader service card.

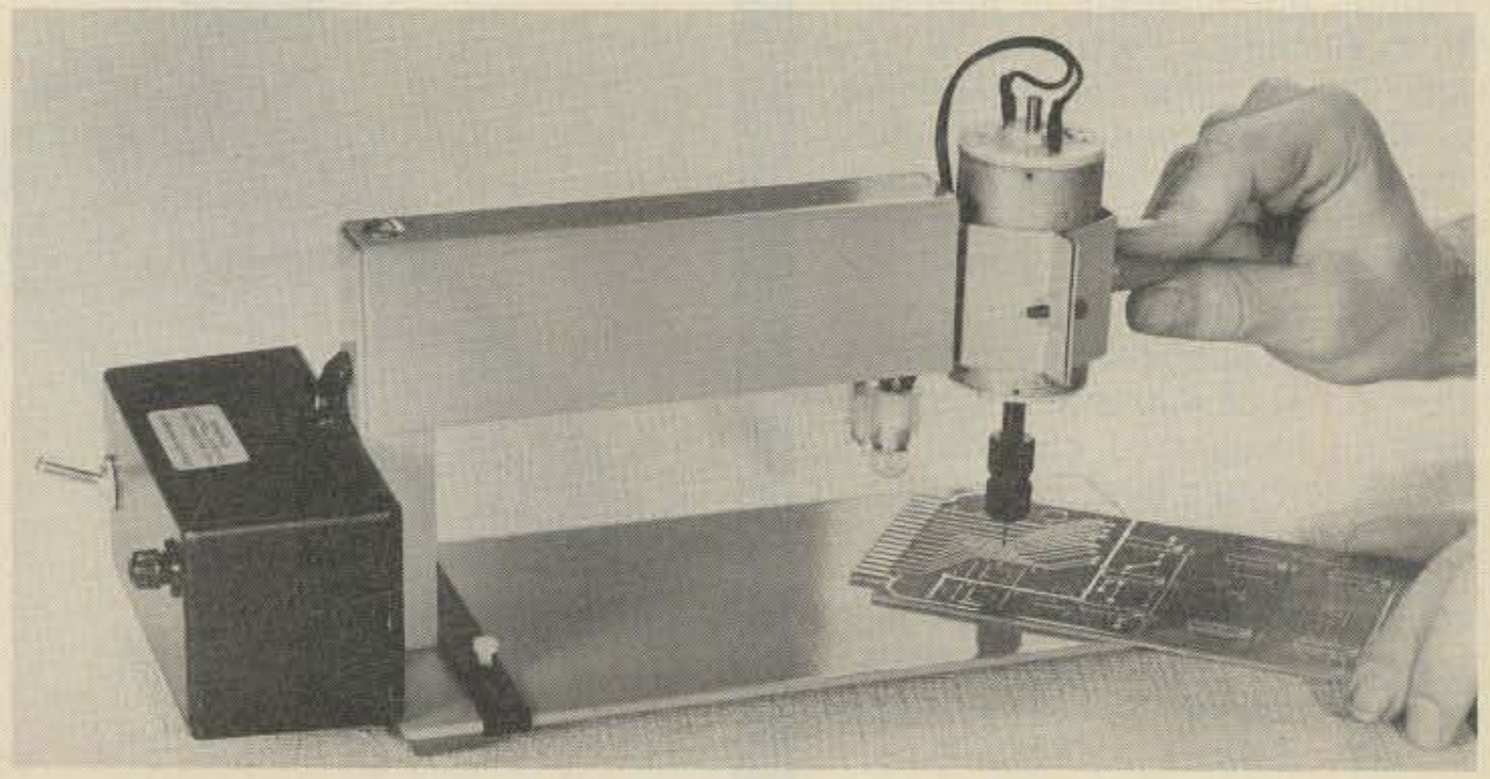
Technomark's Printed Circuit Drill Stand

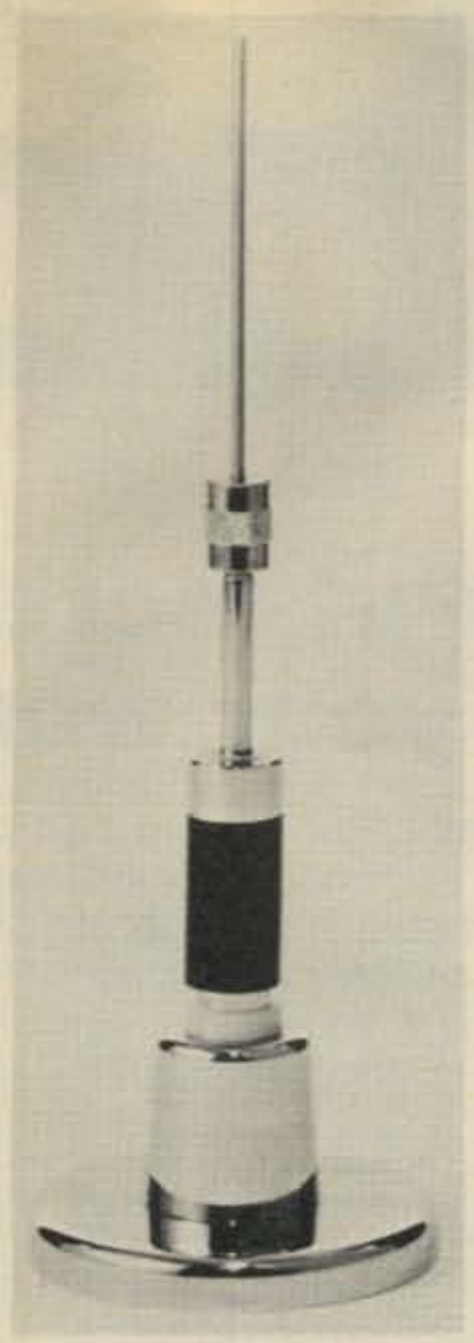
Technomark has just announced an interesting and valuable tool for makers of printed circuit boards.

The drill press is specifically designed for drilling p.c. boards and would be a welcome addition to the home-brewers workbench.

The drill chuck ("collet" for you philologists) can accomodate drill bits up to 1/4 inch. It is powered by a built-in 12 v.d.c. power supply. The press costs £61 (about $122).

For more information contact Technomark at Allnut Mill, Lower Tovil, Maidstone, Kent, England ME15 6RS, or circle number 64 on the reader service card.



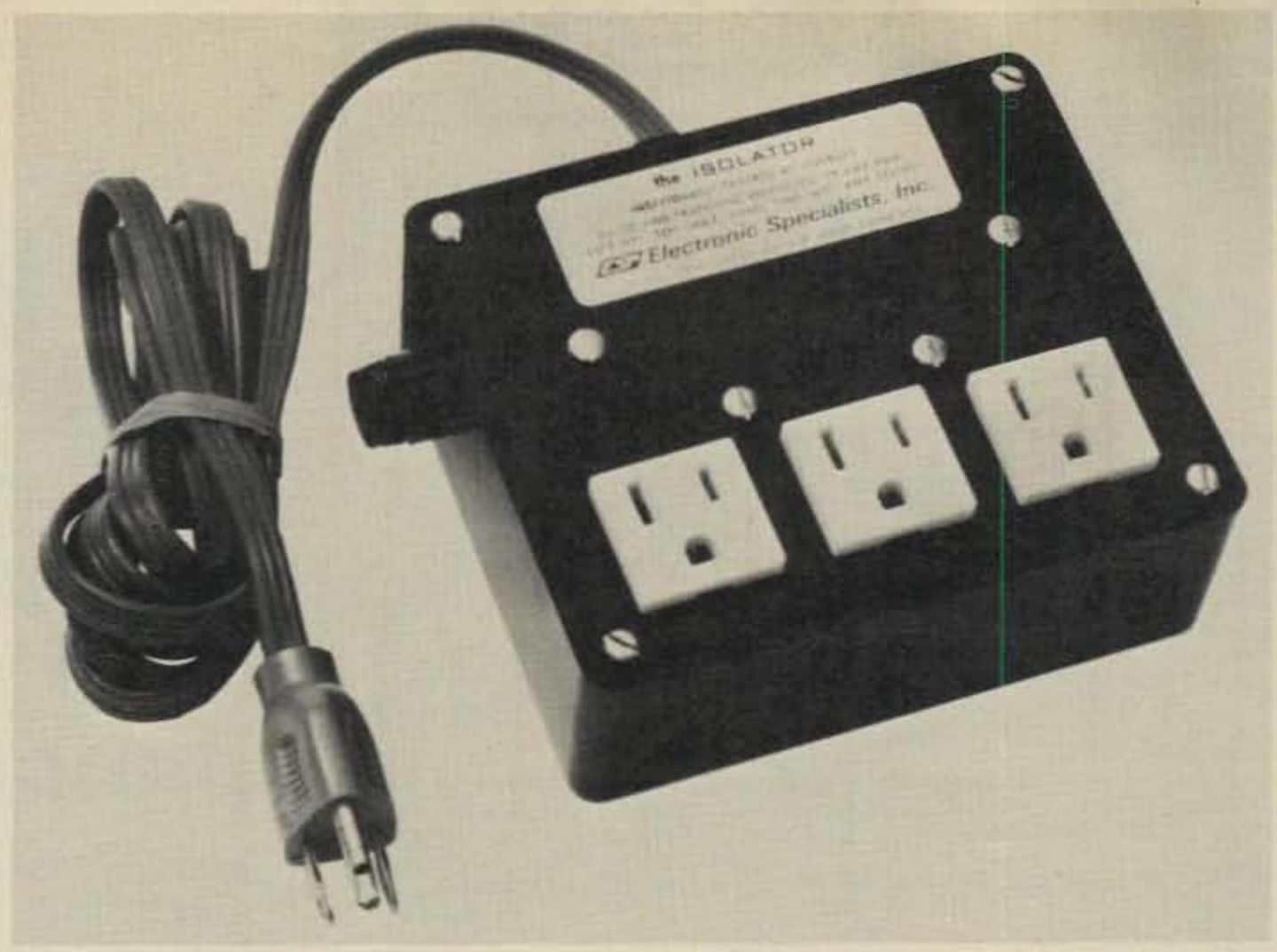


Cushcraft Corp.'s V.H.F./U.H.F. Mobile Antennas

Cushcraft has introduced two new high performance v.h.f./u.h.f. mobile antennas. They feature 3 dB gain with 5/8 wavelength stainless steel whips, and precise frequency adjustment with a finger tip connect. They are trunk lip and magnetic mount models which have been tested to speeds in excess of 90 mph. The antenna packages include 18′ of RG-58/U cable with connectors plus car finish protective pads.

The v.h.f. models cover 144-174 MHz, including the 2 meter subband. The u.h.f. model covers 220-225 MHz.

For more information write to Cushcraft Corp., P.O. Box 4680, Manchester NH 03108, or circle number 60 on the reader service card.



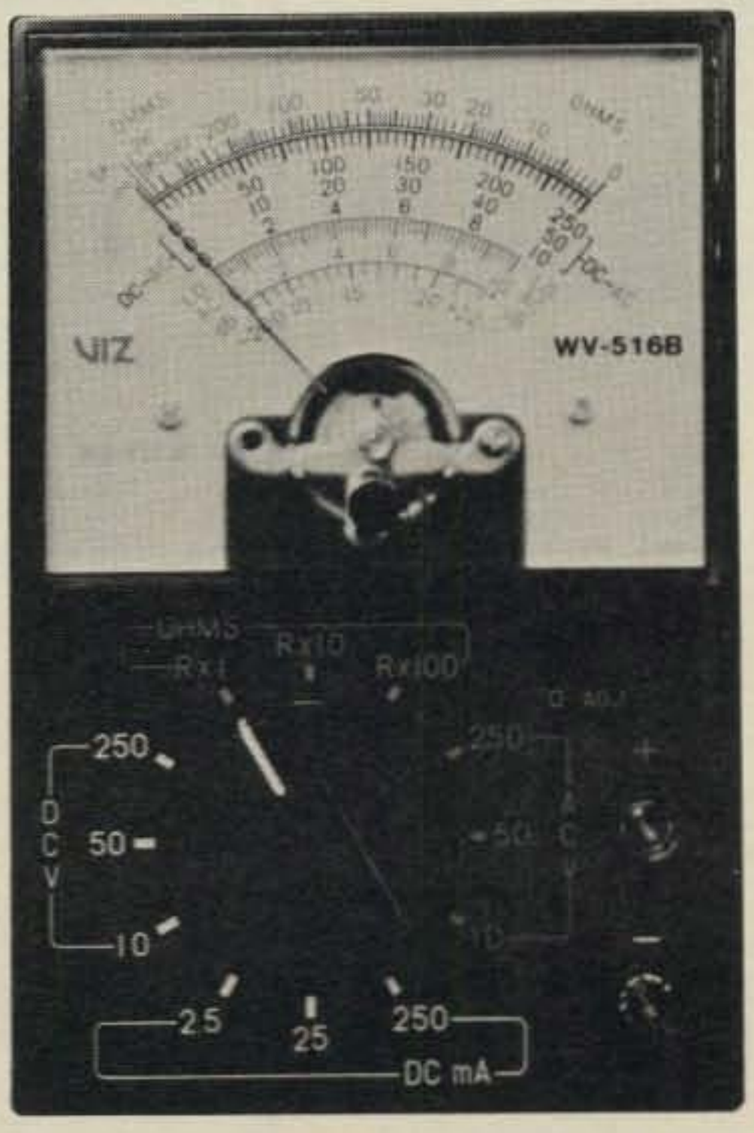
Electronic Specialists, Inc.,'s Isolator

Electronic Specialists announces the introduction of the *Isolator,* comprising three individually filtered 3-pronged a.c. sockets with integral surge suppression. With each socket isolated from the other sockets, equipment interactions are eliminated. The *Isolator* is particularly valuable for isolating sensitive pre-amps and tuners from the power amplifier. Isolation of disruptive power line hash and damaging power line surges is also provided by the *Isolator.*

Connected to the 120 v.a.c. line with a standard 3-prong plug, the *Isolator* can accomodate an 1875 watt total load, with each socket able to handle a 1000 watt load.

The *Isolator* costs $49.95.

For more information, contact Electronic Specialists at 171 S. Main St., Natick MA 01760, or circle number 62 on the reader service card.



VIZ Manufacturing Co.'s Five Function V.O.M.

Only 4-5/8 inches long, this new v.o.m. fits comfortably in the hand for convenient use.

Known as the Model WV-561B, the instrument can be used to measure d.c. and a.c. volts up to 250 V, resistance up to 500k ohms, current up to 250 mA and decibels from -20 to +22. Each function has three ranges which are easily selectable by means of a rotary panel switch with three color coded function indications.

The cost of the WV-561B is $19.95.

For more information contact VIZ Manufacturing Co., 335 E. Price St., Philadelphia PA 19144, or circle number 61 on the reader service card.

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COMPLETE KITS: CONSISTING OF EVERY ESSENTIAL PART NEEDED TO MAKE YOUR COUNTER COMPLETE. **HAL-600A** 7-DIGIT COUNTER WITH FREQUENCY RANGE OF ZERO TO 600 MHz. FEATURES TWO INPUTS: ONE FOR LOW FREQUENCY AND ONE FOR HIGH FREQUENCY; AUTOMATIC ZERO SUPPRESSION. TIME BASE IS 1.0 SEC OR .1 SEC GATE WITH OPTIONAL 10 SEC GATE AVAILABLE. ACCURACY ±.001%, UTILIZES 10-MHz CRYSTAL 5 PPM.
COMPLETE KIT.....~~$149~~.....$129

HAL-300A 7-DIGIT COUNTER WITH FREQUENCY RANGE OF ZERO TO 300 MHz. FEATURES TWO INPUTS: ONE FOR LOW FREQUENCY AND ONE FOR HIGH FREQUENCY; AUTOMATIC ZERO SUPPRESSION. TIME BASE IS 1.0 SEC OR .1 SEC GATE WITH OPTIONAL 10 SEC GATE AVAILABLE. ACCURACY ±.001%, UTILIZES 10-MHz CRYSTAL 5 PPM.
COMPLETE KIT.....~~$124~~.....$109

HAL-50A 8-DIGIT COUNTER WITH FREQUENCY RANGE OF ZERO TO 50 MHz OR BETTER. AUTOMATIC DECIMAL POINT, ZERO SUPPRESSION UPON DEMAND. FEATURES TWO INPUTS: ONE FOR LOW FREQUENCY INPUT, AND ONE ON PANEL FOR USE WITH ANY INTERNALLY MOUNTED HALTRONIX PRE-SCALER FOR WHICH PROVISIONS HAVE ALREADY BEEN MADE. 1.0 SEC AND .1 SEC TIME GATES. ACCURACY ±.001%. UTILIZES 10-MHz CRYSTAL 5 PPM.
COMPLETE KIT.....~~$124~~.....$109

PRE-SCALER KITS

HAL 300 PRE.....$19.95
(Pre-drilled G10 board and all components)

HAL 300 A/PRE.....$24.95
(Same as above with preamp)

HAL 600 PRE.....$34.95
(Pre-drilled G10 board and all components)

HAL 600 A/PRE.....$39.95
(Same as above but with preamp)

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HIGHLY STABLE DECODER KIT. COMES WITH 2 SIDED, PLATED THRU AND SOLDER FLOWED G-10 PC BOARD, 7-567's, 2-7402, AND ALL ELECTRONIC COMPONENTS. BOARD MEASURES 3½ x 5½ INCHES. HAS 12 LINES OUT. ONLY **$39.95**

DELUXE 12-BUTTON TOUCHTONE ENCODER KIT utilizing the new ICM 7206 chip. Provides both VISUAL AND AUDIO indications! Comes with its own two-tone anodized aluminum cabinet. Measures only 2 3/4 × 3 3/4". Complete with Touch-Tone pad, board, crystal, chip and all necessary components to finish the kit.
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For those who wish to mount the encoder in a hand-held unit, the PC board measures only 9/16" × 1 3/4". This partial kit with PC board, crystal, chip and components.
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ACCUKEYER—MEMORY OPTION KIT THIS ACCUKEYER MEMORY KIT PROVIDES A SIMPLE, LOW COST METHOD OF ADDING MEMORY CAPABILITY TO THE WB4VVF ACCUKEYER. WHILE DESIGNED FOR DIRECT ATTACHMENT TO THE ABOVE ACCUKEYER, IT CAN ALSO BE ATTACHED TO ANY STANDARD ACCUKEYER BOARD WITH LITTLE DIFFICULTY. **$16.95**

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COMPLETE KIT CONSISTING OF 2 PC G10 PRE-DRILLED PC BOARDS, 1 CLOCK CHIP, 6 FND 359 READOUTS, 13 TRANSISTORS, 3 CAPS, 9 RESISTORS, 5 DIODES, 3 PUSH-BUTTON SWITCHES, POWER TRANSFORMER AND INSTRUCTIONS.
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CLOCK CASE Available and will fit any one of the above clocks. Regular Price . . . $6.50 **But Only $4.50 when bought with clock**

SIX-DIGIT ALARM CLOCK KIT for home, camper, RV, or field-day use. Operates on 12-volt AC or DC, and has its own 60-Hz time base on the board. Complete with all electronic components and two-piece, pre-drilled PC boards. Board size 4" x 3". Complete with speaker and switches. If operated on DC, there is nothing more to buy.*
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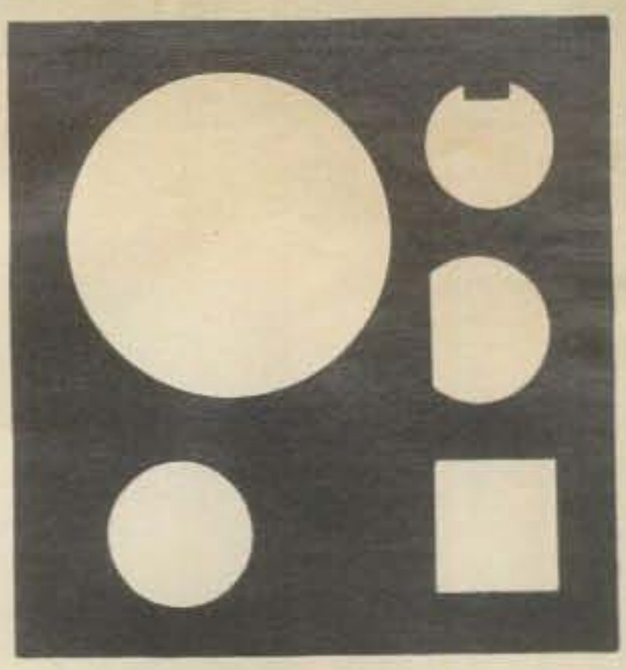

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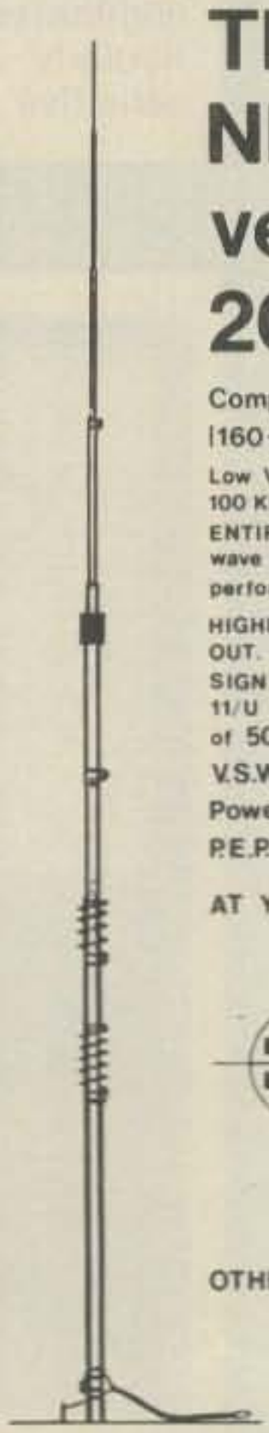

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Low V.S.W.R. over entire 40, 20, 15, & 10m bands plus ANY 60-100 KHZ segment of 80/75m. NO ANTENNA TUNER NEEDED! ENTIRE 26 ft. length active on 80, 40, 20, & 10m with full 1/4 wave resonance on 15 m for greater bandwidth & superior DX performance. Ground, roof, or tower mount-no guys needed.

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V.S.W.R. at resonance: 1.5:1 or less; all bands.

Power rating: Legal limit SSB/CW 40-10m; 1200 W. P.E.P./500 W. CW on 80/75m.

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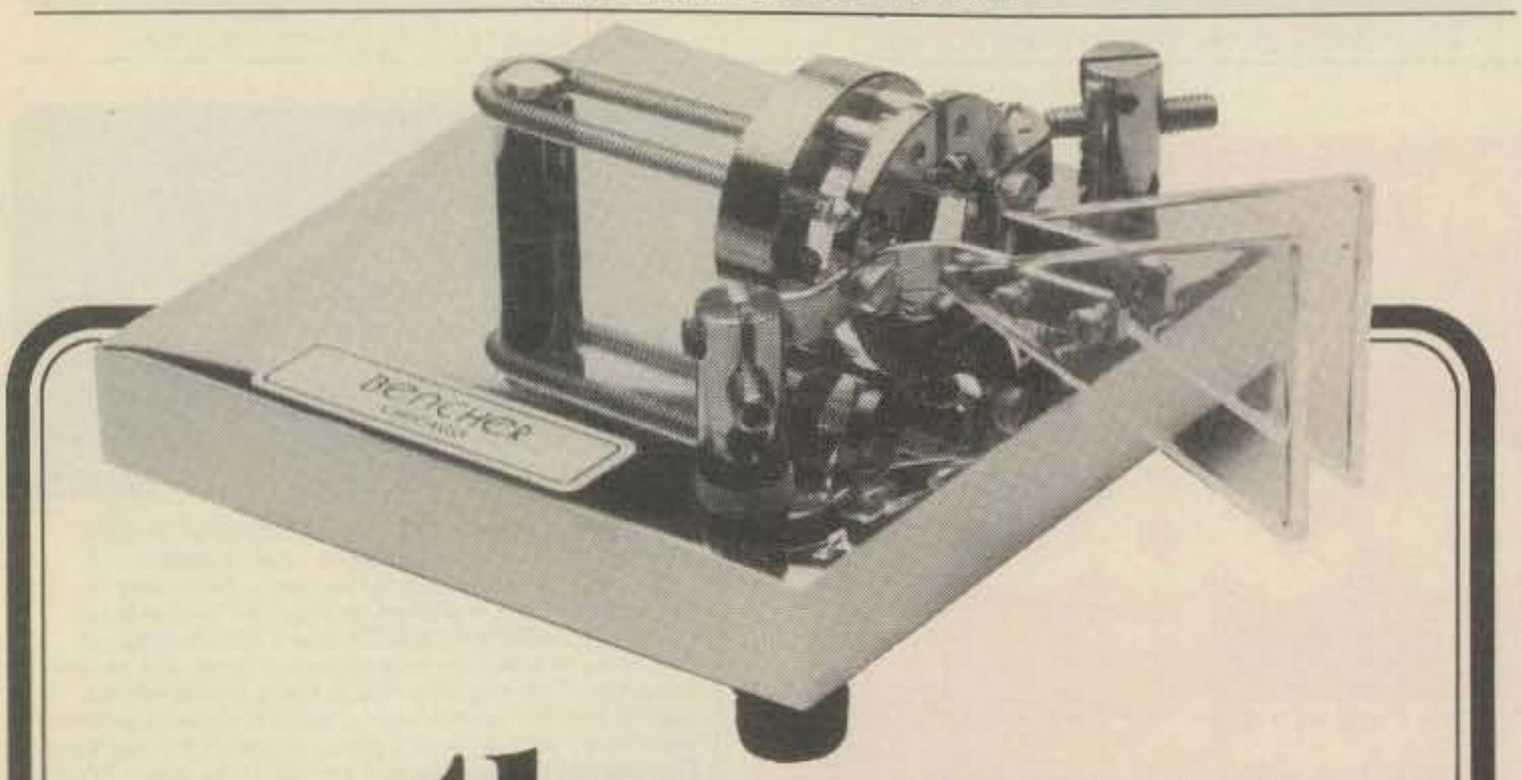

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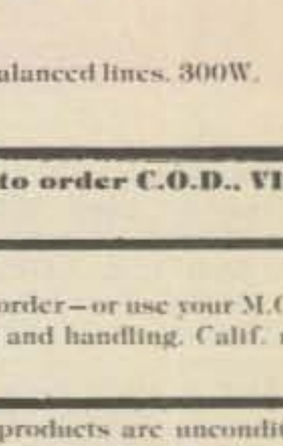

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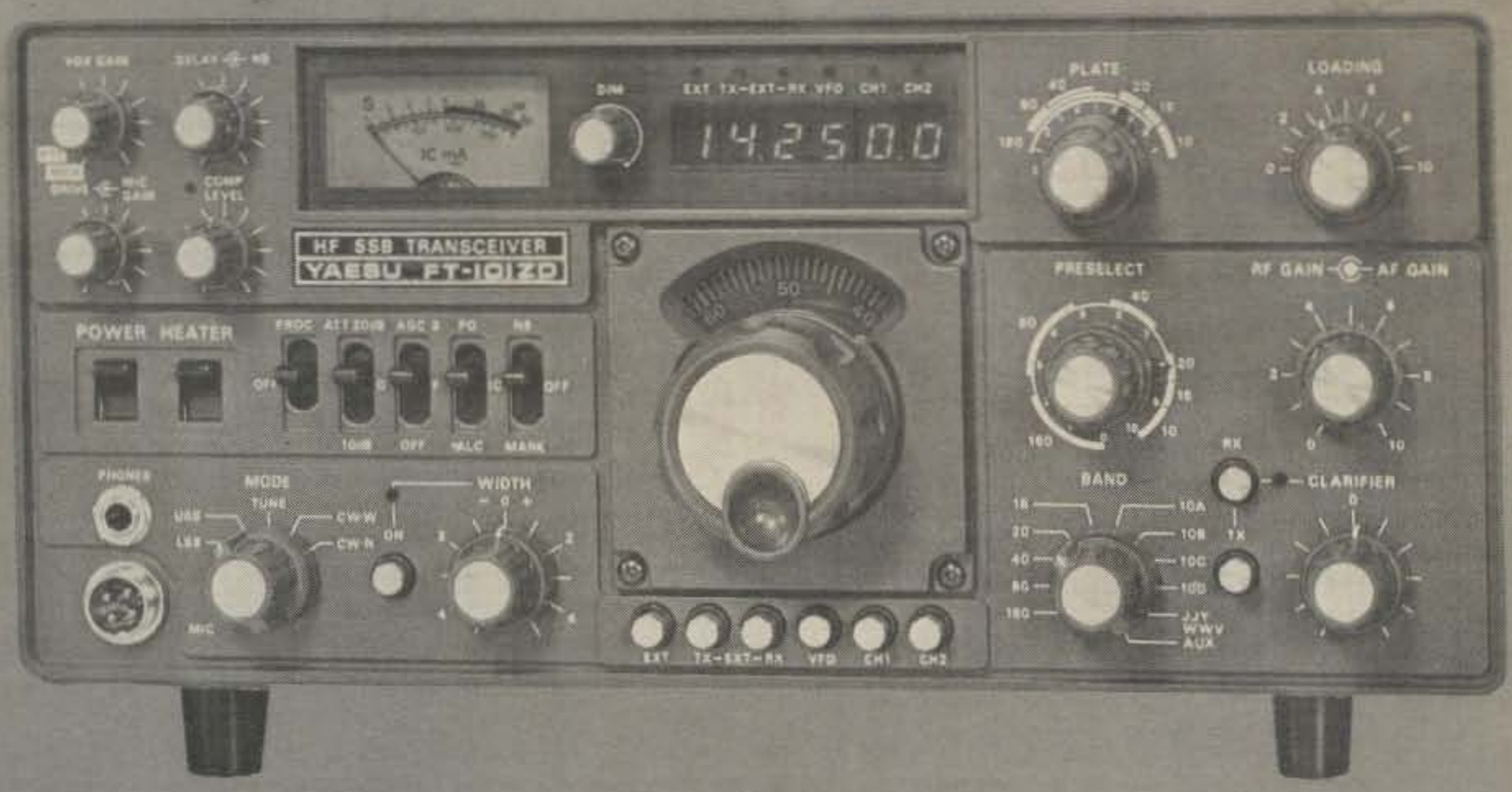

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