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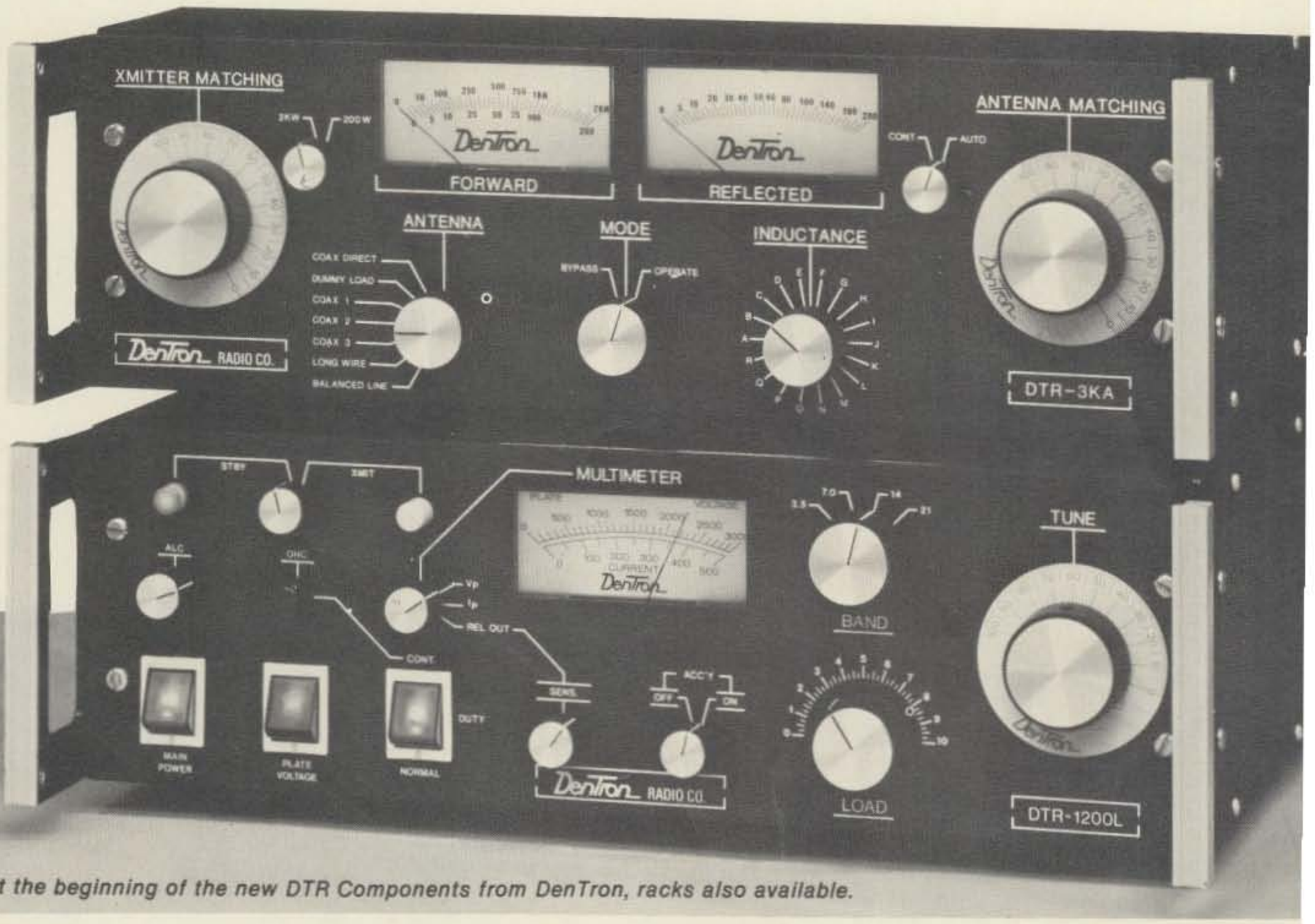

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Offices: 76 North Broadway, Hicksville, NY 11801. Telephone: 516 681-2922. CQ (ISSN 0007-893X) is published monthly by CQ Publishing Inc. Second-Class Postage paid at Hicksville, N.Y. and other points. Subscriptions prices: one year $14.00, two years $25.00. Entire contents copyrighted CQ Publishing Inc. 1979. CQ does not assume responsibility for unsolicited manuscripts. Allow six weeks for change of address. Printed in the United States of America.
Postmaster: Please send form 3579 to CQ Magazine, 76 North Broadway, Hicksville, NY 11801.

CQ The Radio Amateur's Journal

ON THE COVER: The Canadian sunset silhouettes VE3BMV's stacked razor beams as he seeks to work the rare ones.

JULY, 1980 VOL. 36, NO. 7

FEATURES

DEPARTMENTS

Zero Bias

AN EDITORIAL

Jim Fisk, W1HR

I got the news about Jim's death as I was packing for a business trip prior to the Dayton Hamvention. It was Friday afternoon and I remember being taken aback by the news, as Jim was one of the people I was looking forward to seeing at the Hamvention. I went back a long time with Jim, back to those days before *Ham Radio* when he was working up the ladder at *73* magazine. We shared a similar interest in collecting old magazines and books on amateur radio, and he was also very much involved with collecting old radio equipment.

I had talked with Jim about two weeks prior to his death, and we had discussed the CQ USA-CA Award, which he had earned, and his participation in our 5 Band WAZ program. Jim had called to let me know that he was updating his cards soon to reach the new plateau. Jim had been number 24 in the original 5 Band WAZ Award applications and wanted to keep that number. I'm exercising my prerogative to hold his number out of the sequence now. It's his number, he earned it, and it retires with him. We talked some about the publishing business and about the new 100-foot tower he was putting up, and ironically, how he planned to start taking it easier, not working so hard.

I thought of him as a friend and not as a competitor and truly admired his many talents. He was really quite accomplished in many areas, including having the ability to sense the future with regard to the technology to come. *Ham Radio* reflected Jim Fisk and his personality. At this writing plans are uncertain, but I'm sure he will be difficult to replace. I know that everyone in our industry and the amateur community will miss him.

The Monday before the Dayton Hamvention found me taking to the air again. My week started with a trip to Stow, Ohio and a visit with the folks at Dentron. I met with Denny Had and Charlie Darrow, who proudly escourted me around their new building. I got a chance to see some of their new products coming off the assembly line just in time for the Hamvention. In fact, Charlie hand-carried one of their new mono-band rigs down to the FCC facility for type acceptance and had it approved just in time to be displayed at Dayton. One non-amateur highlight of that visit was the drive to lunch in Denny's fully restored, yellow, 1948 Ford convertible.

On Tuesday, I flew up to Benton Harbor to see the Heath Company and how they turn out all of those kits. To say it is impressive is an understatement. I was told that the plant measured 500,000 square feet, and every square foot seemed to be occupied to the point of bursting. In fact, there was talk of further expansion of the building while I was there. I met with Joe Shafer who heads up their Amateur Division and the people from their Advertising and PR departments, including Myron Kukla and Matt Beha. Judging from the antennas on the building and on the cars in the parking lot, there seem to be quite a number of hams working for Heath. I especially want to thank Marge Streit who was gracious enough to come out to the airport to pick me up and arrange for me to meet and see the Heath facility. I understand that they do have tours of the plant during the summer, so if you are near there this summer, plan on it as part of your trip. It's a unique experience.

Wednesday I flew into Dayton and drove down to Miamisburg to spend some time at the R.L. Drake Company. The Drake Company building in Miamisburg is quite old and is reported to have been an old carriage manufacturing plant and was even used to make airplanes at one time. There were many additions to the original building, and part of it encompassed a house on the corner so that one of the offices on the older side is in effect the house's living room, complete with fireplace.

Although manufacturing is no longer done at this site, they do have business offices and engineering and repair facilities quite in evidence. Bill Frost took me around and showed me where the A and B lines were made at one time and the repository of old parts that they still stock for their older gear still in use. Bill and I then drove down to Franklin where the all-new Drake manufacturing plant is located. They seem to manufacture as many of their own components as possible, including most of the variable capacitors and inductors. I did see them running the TR7 assembly line and the burn-in procedures used to check them out. The plant is quite large, and from its design I can see where they can easily build onto it to make it even bigger. I dropped Bill back at Miamisburg and headed back up to Dayton, which is actually a short drive.

Dayton, 1980

The Dayton Hamvention this year was one of the best ever by anyone's standards. Most of the exhibitors, if not all of them, wrote more business than in recent years with a very enthusiastic crowd turning up. I never did find out the exact number who registered or showed up, but I would guess that it was slightly under 20,000 amateurs.

While not exactly an optimist, I do believe that the current concern over recession, inflation and high interest rates weighed on people's minds (mainly exhibitors); it truly is just a state of mind when it comes to amateurs. We were buying things in record numbers for whatever reason. We can all point to the old stereotypic observation that sometimes the kids go without shoes, the house needs painting, and the wife hasn't had a new dress in 5 years, but lo and behold there's a new rig at the operating position. It seems we all judge our priorities differently. Unlike some previous years, this year amateurs seemed to be updating their stations in record numbers, and I think that every HT that was brought by an exhibitor must have been sold.

It was almost embarrassing to have so many people come over to the *CQ* booth to say how much they enjoyed the new *CQ*. It was also very gratifying to have a record number of people subscribe at the booth, wishing us well and giving their support. It's becoming evident that quite a number of you are talking about *CQ* and saying that you "saw it in *CQ*." Keep it up.

73, Alan, K2EEK

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Announcing

• **Maple Ridge ARC Hamfest** – The Maple Ridge Amateur Radio Club is hosting Hamfest 80 on the 5-6 July at the Maple Ridge Fairgrounds located 30 miles east of Vancouver. Registration $4 program with draw ticket $2. Registration, including banquet, $11 at the Hamfest. Food, prizes, swap & shop, ladies program, and much more. Camper space available (no hookups). Talk-in freq. 3.755, 146.34/94, 146.19/79. For more information write Bob Haughton, VE7BZH, #20625 – 114th Ave., Maple Ridge, B.C. V2X 1S7.

• **Charleston Hamfest** - The Charleston Hamfest, sponsored by the Charleston Amateur Radio Society, will be held July 12-13 at The Omar Shrine Temple. General admission is $3.50 and includes a prize ticket. Flea market tables are $5; commercial booths, $35 (includes two admission tickets). Prizes include a Kenwood TS 120S, an Azden PCS 2000 2-meter rig, and an ICOM IC-2A synthesized 2-meter handie-talkie. Talk-in on 146.34/94, 146.16/76, and 146.19/79 for general use. For more information, contact Charleston Hamfest Committee, P.O. Box 30643, Charleston, SC 29407, tel: (803) 747-2324/563-2523.

• **ICHN/MARAC Convention** - The annual ICHN/MARAC convention will be held at the Holiday Inn North, I-25 at I-70, in Denver on July 9 through the 12. The program will include the annual meetings of the two organizations, a meeting of the c.w. county hunters, various conducted tours of local entertainment spots, and a banquet M.C.'d by Joe Slattery, W9DRL. The speaker will be W0BWJ, ARRL first vice president and WARC delegate. For more convention information, contact WB0ICP or W0GV.

• **Broadcasters' ARC Hamfest** - The Broadcasters' Amateur Radio Club will conduct its third annual Hamfest on July 13 from 9 a.m. to 4 p.m. at the Pocono Downs Race Track, Rt. 315, 1½ miles north of Wilkes-Barre, Pennsylvania. Unlimited outdoor and indoor space, refreshments, prizes, free FM clinic and AC power available. Admission $2.50, XYL's and children free; no additional charge for sellers. Gates open at 8 a.m. for set-up. Talk-in 147.66/.06 and 146.52 simplex. For more information: Charles Baltimore, WA3NUT, (717) 823-3101; B.A.R.C., 62 S. Franklin Street, Wilkes-Barre, PA 18773.

• **Indianapolis Amateur Radio Convention and Hamfest** - This event will be held on Sunday, July 13, at the Marion County Fairgrounds. For further information write to Indianapolis Amateur Radio Assn., Box 11086, Indianapolis, IN 46201.

• **Special Event Station** – The Black River Amateur Radio Club wil be operating a special event station during the National Blueberry Festival in South Haven, Michigan, on July 16-20 (Monday through Saturday). The call of the station will be WD8AGC, and the frequencies used will be on or near 3.975, 7.275, 14.275, 21.375, and 28.375 MHz. C.W. operations will be conducted randomly throughout the Novice/Technician sub-bands. Any station working WD8AGC during this period can receive a colorful postpaid certificate by mailing a QSL card to: The National Blueberry Festival, P.O. Box 224, South Haven, MI 49090.

Two Rivers ARC Hamfest – The Two Rivers Amateur Radio Club of McKeesport, Pennsylvania is sponsoring their annual hamfest on Sunday, July 20 at Penn State University, McKeesport Campus. Flea market outside. Vendors $5 per car space and admission is free. There will be door prizes, food, and drinks. Talk-in on 146.22/82 MHz.

• **Kenwood and Icom International User's Net** The Kenwood and Icom International User's Nets meet each Sunday, Kenwood at 2000 UT and Icom at 1600 UT, on 14.320 MHz for exchange of information. Owners and prospective owners are encouraged to participate. N8RT net control.

• **Palmyra, Illinois Hamfest** – The 23rd annual Breakfast Club Hamfest and Picnic will be held on Saturday and Sunday, July 19 and 20, at Terry Park, Palmyra, Illinois. A flea market, family movies, games, food, music, and prize drawing are scheduled. Camping on the grounds for self-contained units. Activities start at noon Saturday and close about 4 p.m. Sunday. Talk-in on 52 simplex and on 3973 kHz. Tickets on the grounds at $2 each. Information available from Quad-Co Radio Club members WA9ARY, K9UCC, or W9KIC.

• **Indian Foothills ARC Hamfest** – The Indian Foothills Amateur Radio Club will hold its 5th annual hamfest on July 20th at the Saline County Fairgrounds multipurpose building in Marshall, Missouri. There will be campgrounds available (no connections for utilities), flea market, displays of old and new equipment, 10-X booth, prize drawings, refreshments. Tickets are $2 each or 3 for $5 at the door, or 4 for $5 in advance. For information and tickets contact John Roe, WD0FZF, Route 1, Miami, MO 65344, tel. (816) 852-3244 after 6 p.m. or (816) 886-2637. Talk-in on 52, 28/88, and 147.84/24.

• **Mark Your Calendar** – On Sunday, July 20 the RMRL will have its annual Field Day Demonstration and SwapFest at Karl Ramstetters', WA0HJZ, Ranch, located on top of Guy Hill, Golden, Colorado, Highway 93. There will be talk-in on 34/94. Signs will be posted. The time is 10 a.m. Bring your family and trading goodies. Ask the YL or XYL to make her favorite for a pot luck lunch. Soft drinks will be provided. Don't forget chairs and or blankets.

• **B.V.A.R.A. Hamfest** – The Third Annual B.V.A.R.A. Hamfest will be held July 20th at the Community College of Beaver County. Indoor space for vendors, plenty of free parking, also paved outdoor flea market. Registration is $2.00 or three for $5.00. Prizes. Check in on 146.25-85, 223.26-86, 146.52 simplex. For details write to Gary Mohrbacher, WB3FKE, 3114 47th Street, New Brighton, PA 15066.

• **Detroit Lakes, Minnesota** – The Detroit Lakes Amateur Radio Club will hold its 4th Annual Picnic and Swapfest on Sunday, July 20 from 10:00 a.m. to 4:00 p.m. at Long Lake Park, 1½ miles west of Detroit Lakes on Highway #10. Tickets for drawing – $1.00. Picnic and swap tables available. Talk-in on 146.22/82 and 146.52/52. Contact Russ Berger, N0ARZ, 1046 Long Avenue, Detroit Lakes, MN 56501.

• **West Jersey Radio Amateurs, Inc., Hamfest** – This hamfest will be held on July 20 at McGuire AFB, Wrightstown, NJ, from 9:00 a.m. to 4:00 p.m. Admission $2.50, advance orders receive additional chance at door prizes (spouses and children free). Tailgate or table space $2.50 per space; bring your own table. Refreshments and activities will be available. Continuous door prizes will be awarded, and major door prize of a 2-meter transceiver will be drawn at 3:30. Talk-in on 52 and 146/925. Advance tickets available from club members or s.a.s.e. to Mary Lou Shontz, WB2QIU, 107 Spruce Lane, Rte. 16, Mt. Holly, NJ 08060. Additional information can be obtained by calling Mark Millman, N2ME, at (609) 871-6691.

Beaver Valley Hamfest – The BVARA is sponsoring the Beaver Valley Hamfest on Sunday, July 20 from 9 a.m. to 5 p.m. at the Community College of Beaver County on Broadhead Road just off the Beaver Valley Expressway Rt. 60, Monaco, Pennsylvania. Tickets are $2 each or three for $5. It will feature free indoor vendor space, free outside fleamarket space, mobile check-in prize, door prizes all day, main drawing at 4 p.m. Talk-in on 146.25/85, 223.26/86, and 146.52 simplex. For more information, contact Adam Horniak, WB3JZN, 182 Edgewood St., Aliquippa, PA, 412-378-9667, or Gary Mohrbacher, WB3FKE, 3417 47th St., New Brighton, PA, 412-843-9546.

• **Cass County Amateur Radio Club's Third Annual Hamfest** – This hamfest will be held on Sunday, July 20, from 7:00 a.m. to 4:00 p.m., at the 4-H Fairgrounds. Go north of Logansport on Highway 25, turn right at Road 100, follow QSY signs. Advanced tickets $1.50, $2.00 at the gate. Outside setup free, undercover $1.00. Bring your own tables. Free overnight camping, refreshments, and door prizes. Talk-in on 146.52 and Logansport Repeater on 147.78-18. Write to Roy E. Mannikko, WB9PKN, 530 North Cicott Street,

(continued on page 96)

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ICOM's 551D is Essential to the 6 mtr DX Formula.

The IC-551D is the high powered brother to the ICOM IC-551. With an 80+ watt output, you have all the punch you need for that really good DX when the Sunspots are working for you. The 551D has the same no-backlash, no-delay dual VFO light chopper system, coupled to the microprocessor for split frequency as well as completely variable offsets.

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SPECIFICATIONS

Frequency Coverage: 50~54MHz

Power Supply Requirements:
13.8V DC±15%, negative ground
Current drain 18A max.
(at 200W input). AC power supply speaker console is available for AC operation.

Emission Modes:
A3J SSB (USB/LSB)
A1 CW
A3H AM
F3* FM

Dimensions: 111mm (H)×
241mm (W)×311mm (D)

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W7CSD has taken the art of scrounging and raised it to a new high in constructing this linear amplifier. Half the fun in building it is rounding up the parts from all sorts of unlikely sources.

The Frugal Final

A Low-Cost Multi-Band Linear Amplifier

BY ROBERT BAIRD*, W7CSD

I have always avoided a construction article, in detail, chiefly because I wouldn't think of making a "Chinese copy" of someone else's design myself. I don't recommend the reader should follow this one to the last detail. Take some of the ideas and work out your own details.

First of all, the secret to building a low-cost homebrew anything is scrounging. You have to find out where things are that you can get for nothing or next to nothing. (A large junk box from previous projects, surplus stores, or neighbors who had old radios, TVs, diathermy machines, etc.) The local junk yard may have aluminum, copper tubing, coax cable rejected by the TV cable company, and even usable chasses. Sometimes you can even get an old pole transformer.

The biggest single item in a sizeable linear is the tube or tubes. Half of the a.m. broadcast stations in the country that run 1 kw use 4-400A tubes in both the modulator and final amplifier. When the emission goes down they are no longer usable for broadcasting. You should be able to talk the chief engineer of your local one kilowatter out of one of these "dead indians" for free. Rated filament voltage is 5 volts. Put the old tube on 6 volts and you will find that you have the equivalent of a new 4-400A. You may have to buy or trade for a socket. A lot of old military gear had 803's. An 803 socket will fit a 4-400. The 833A is used by the other half of the 1 kw BC stations and should work just as well. You could even make your own socket for one of these. Although this article does not take up power supply components there are bargain sources for these as well. Old TV transformers hooked in series would be one source. You might find 10 of these at the city dump. I know of one chap who bought 100 17" black and white TVs for $3 each from a hospital putting in color. Incidentally he is selling them for "pong" games so dad and mom can get their good TV back to watch programs.

1000 volt piv diodes rated at 1 amp are available for as low as 10 cents each in many of the magazine ads. Figure the piv that you are going to have in each branch of your rectifier and put about twice as many diodes in series per branch as this calls for. Let's say you want to bridge a 3000 V RMS transformer. Peak voltage will be on the order of 4500 volts, so put in 8 or 9 or even 10 diodes in each of the four legs of the bridge.

Back to our amplifier. Having obtained a tube and socket, the next thing is a filament transformer, filament choke and fan. The Ferrite core for the choke is available from Amidon and others for less than $3. Get some #12 enameled wire and bi-filar wind the ferrite core full, with ends left over to connect to the tube and transformer. I had a surplus transformer rated at 6.3v and 15 amps. One source would be to disassemble a TV transformer. Take off the 6.3 volt winding, counting the turns. Take off all of the windings except the primary. Rewind the 6.3 volt winding with maybe a couple of extra turns with heavy wire (#12 or #10). Reassemble the transformer, with core in place, connect thru filament choke to tube and turn it on. Pull off a couple of outside turns at a time until you get 6 v.a.c. at the tube pins on the socket. You are now in business. Wire the fan. As indicated in the photographs, I had two surplus chasses to start with, with too many holes. If you follow this particular construction you will need two identical chasses from somewhere. Because of having these chasses I used vertical stacking using 1 inch angle aluminum for the uprights. You may decide to spread it out horizontally on one chassis. I grounded the two grids right at the socket and also selected a central spot on the chassis for a common ground connection. Input comes from a chassis mount coax connector by way of a couple of capacitors to each side of the filament at the socket. A filament choke is mounted on stand offs, to secure it between the filament transformer and the socket, and wired in. We have now fabricated the entire lower chassis if we bring in the a.c. line cord. I *did* bring the hv in at the bottom, to the plate blocking capacitor (a cylindrical column) was mounted on the lower chassis. However this cap which was a .005 rated at 15 kv turned out to be a wrapped foil type with more inductance than capacitance. It had to be removed in favor of a mica (two .01 2500v WV in series) hanging from above.

Now for the top chassis. I obtained 10 feet of quarter inch copper tubing from the local electrical and plumbing supply store for too much money. (The junk yard didn't have any.) With one end in a vice I wrapped the tubing around a piece of 2 inch water pipe which is about 2½ inches on the outside and wound up with 14 turns. The coil was spread by threading a screw driver through the turns. I flattened each end, drilled a hole and mounted the coil on stand-off insulators. The tuning capacitor and the two loading capacitors as well as the three position tap switch were mounted and wired on the upper chassis. The tap switch comes up through the chassis and is adjustable by reaching thru a hole in

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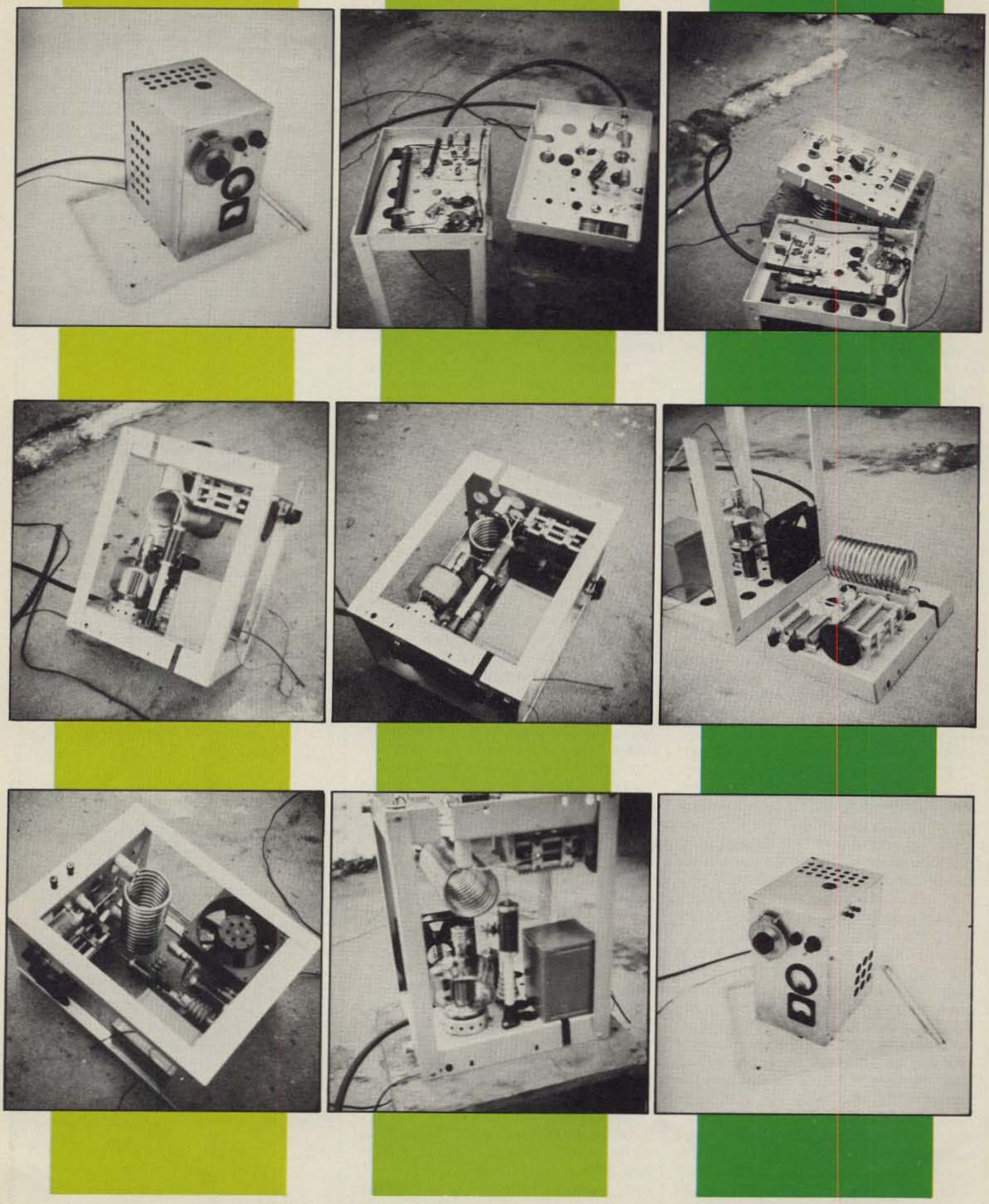

A photo montage showing the various assembly steps and construction techniques for the frugal final.

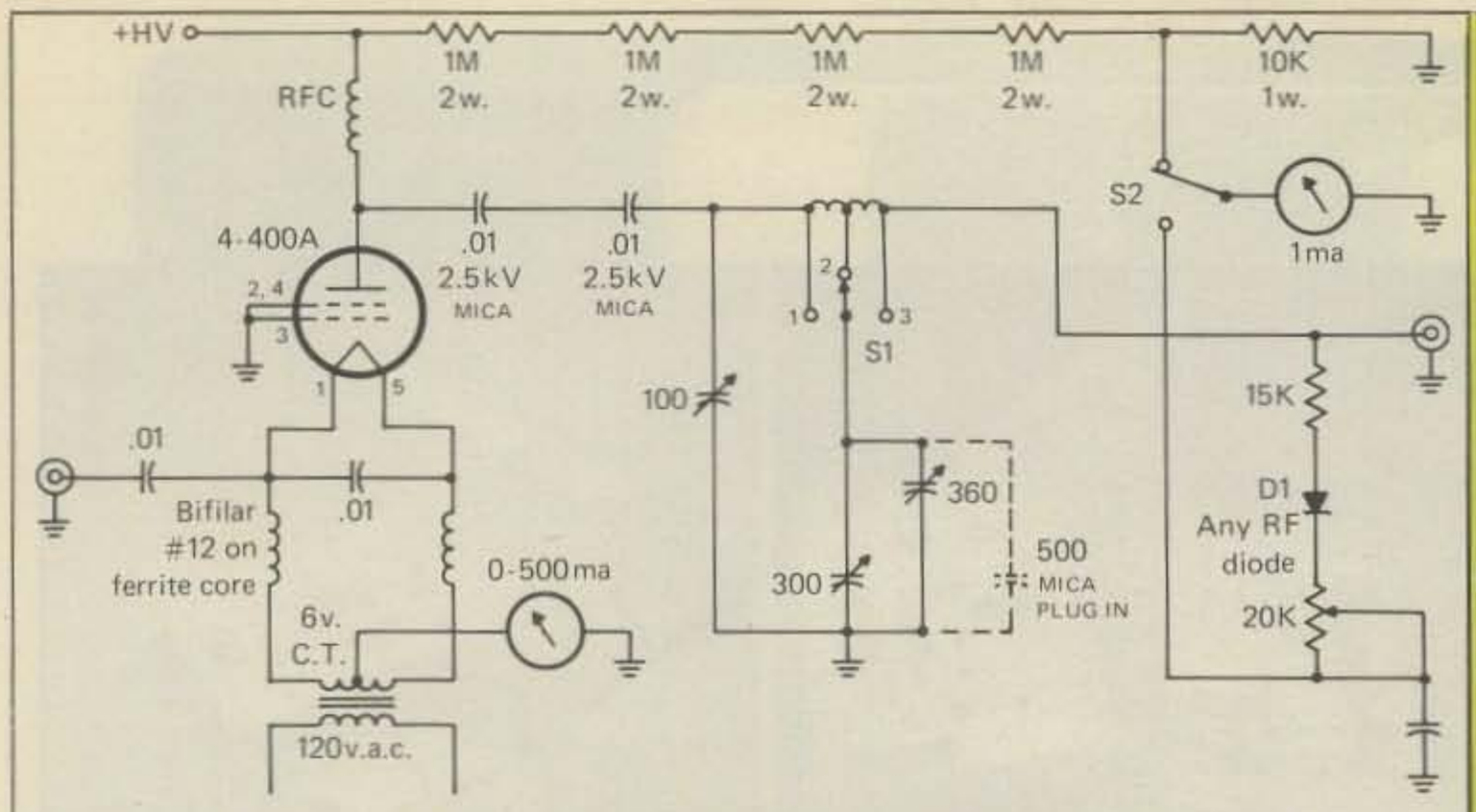

Fig. 1- The schematic diagram for the frugal final

the top of the finished cabinet. This keeps the leads short.

At this point the two chasses and uprights were assembled together for the first time. With the tube in place, connected from the plate to the parasitic choke to the blocking capacitor to the upper chassis, the tank circuit was grid dipped to determine the tap points. Luckily the whole coil, with the two loading capacitors meshed plus a .0005 fixed capacitor outboard at J3, hit the 40 meter band with the tuning capacitor about 2/3 meshed. The next tap we adjusted was for 20 meters. This also gave 15 meters with the tuning capacitor almost open and the right loading. The third tap gave us 10 meters in the 3/4 open position and tap switch. With just this skeleton we fired the amplifier up and driving a dummy load we checked all bands. Assuming an r.f. ammeter which we had was correct (reading 2.8 amps), we had nearly 400 watts output when running 2500 volts and 300 ma. So we put it on the air on 15 meters and worked two or three ZLs, receiving good reports. The horizontal Christmas tree pattern on the scope looked excellent.

Having determined that the amplifier was operational, the front panel was completed out of heavy gauge aluminum with meters and switch and dials in place. I also decided to incorporate a low pass filter in the inverted upper chassis. You can find the details of a low pass filter in any handbook. To complete the metering, the relative power output circuit and the plate voltage meter were added. R_3 extends out thru the right side of the cabinet and can be adjusted for any band so that the meter reads somewhere in the center. This only tells you when you have maximum r.f. voltage out which indicates proper loading. The 4 1 meg 2 watt resistors are simply a multiplier to get 4 kv full scale on a 0–1 ma meter. The 10K just completes the circuit when the meter is not in the circuit. Accuracy of this meter is debatable but at least it tells you if there is any change. S_2 selects plate voltage or relative power output.

If you are interested in 75 or 80 meter operation you could make a coil from #10 wire with a few more turns and possibly an extra tank capacitor in parallel with the tuning capacitor. It might not be self supporting but that's your problem. You will need a tap switch with more taps. My primary interest in a linear is the higher bands with maybe occasional use on 40. I certainly have no need for a linear on 75.

Our amplifier was now working but the cabinet wasn't complete. A supply of aluminum sheet obtained from a newspaper which uses aluminum plates in the printing process was on hand and cuttable with a standard paper knife. This is very thin but still good shielding. Holes were punched to allow the fan to cool the 4-400A. Three sides, top and bottom were made from this material. If you are in a weak signal strength TV area you might need to double shield the whole cabinet. The high voltage was delivered from an unshielded power supply via some RG-8 and an earth ground was brought direct to the aluminum frame. Again in case of TVI you may need an r.f. filter in the a.c. line. We had some herring bone on the TV until we moved the TV to the other side of the 240 volt line from the side used in the ham shack.

Conclusions: No two home brew linears are going to perform exactly alike. No two junk boxes contain the same goodies. No two amateurs are going to run across exactly the same bargains. But all in all this is a frugal final that works very well even if the 4-400A is a tired old refugee from a broadcast station. No way can we compute the cost because of the origin of all the parts. However if you are a brand new amateur with no junk box and your only interest in home brewing is to save money, Forget It.

Parts List

C_1 thru C_5 — .01 disc ceramic 500V

C_6 — 2 .01 micas 2500V WV in series

C_7 — 100 pf w/3000 volt spacing or similar. This one came out of a BC 375E surplus xmtr.

C_{8-9} — 300 pf which happened to be on hand. A single 500 or 600 would be fine.

C_{10-11} — .005 disc ceramic

RFC_1 — #12 wire bi-filar wound to fill Amidon ferrite form 6 inches long

RFC_2 — Any good plate r.f. choke that will pass 500 mA. National R 175A would be ideal. The one used came out of a surplus unit.

R_1 — 10K 1 watt

R_2 — 1K 1 watt

R_3 — 5K pot

R_{4-7} — 1 meg 2 watt (multiplier for 1 ma meter)

R_8 — 10K 1 watt

L — 10 feet of ¼" copper tubing wound on 2" (ID) water pipe—14 turns. Tapped by trial and error.

LPF — Low-pass filter from handbook. External commercially built l.p.f. may be used.

T_1 — 6.3 volt filament transformer rated at 15 amps.

J_{1-2} — Std. u.h.f. coax connectors, chassis mount.

M_1 — 0-500 ma meter plate current meter.

M_2 —0-1 ma meter for relative power out, and plate voltage.

S_1 — 3 position tap switch designed for r.f. To switch—reach thru hole in top of cabinet. Position 1 covers 10 and 15, position 2 covers 15 and 20, and position 3 (the whole coil) covers 40.

S_2 — S.P.D.T. toggle switch

J_3 — 2 banana jacks to plug in outboard capacitor on 40 meters (loading—parallel with C_{8-9}.

D_1 — Any Germanium r.f. diode.

PC — Parasitic choke 3 150 ohm 1 watt parallel resistors with 3 turns of #12 wire wrapped around them.

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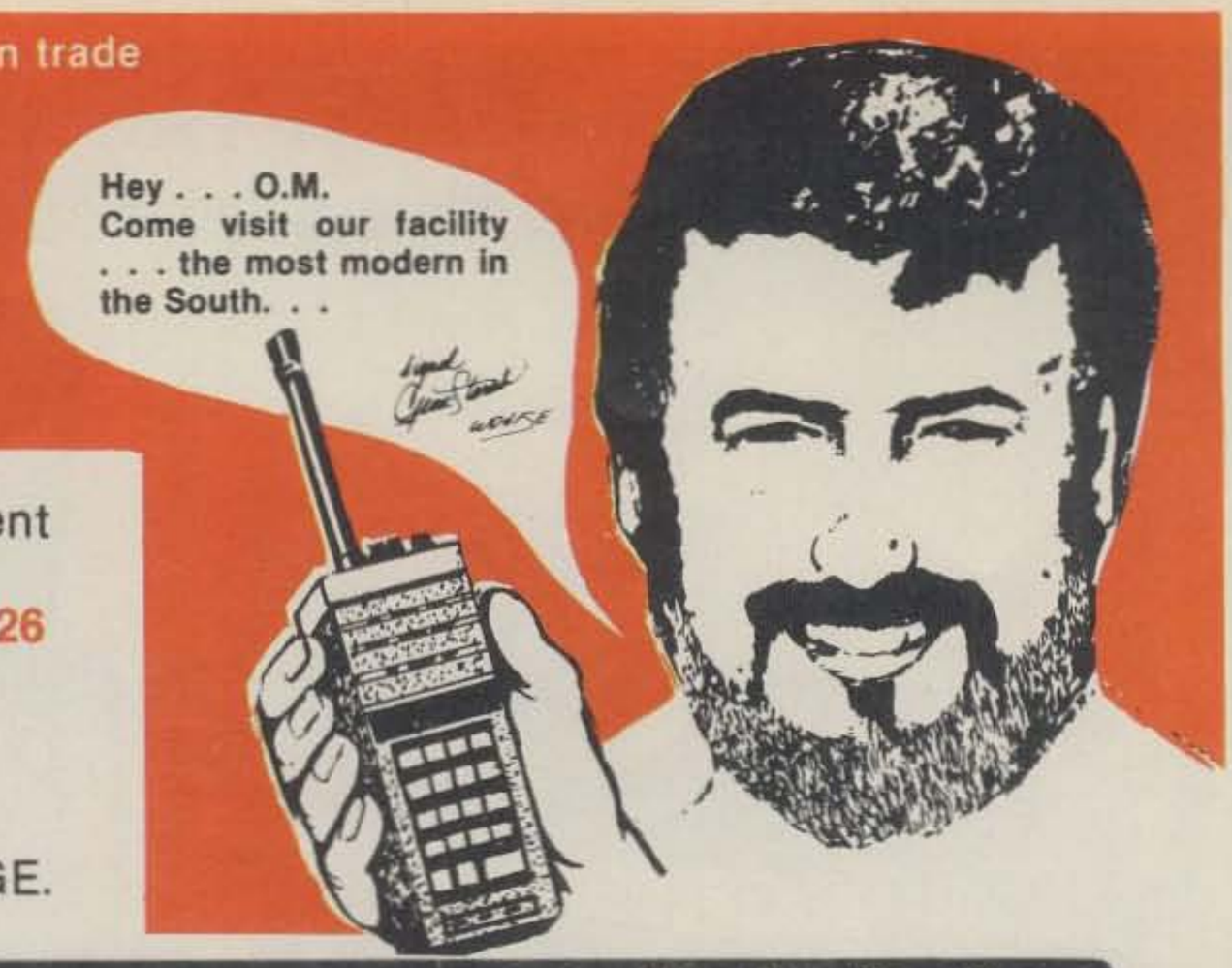

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Matching power supply (PSU-5) and antenna tuner (ST-3) provide the necessary additional units for a complete base station.

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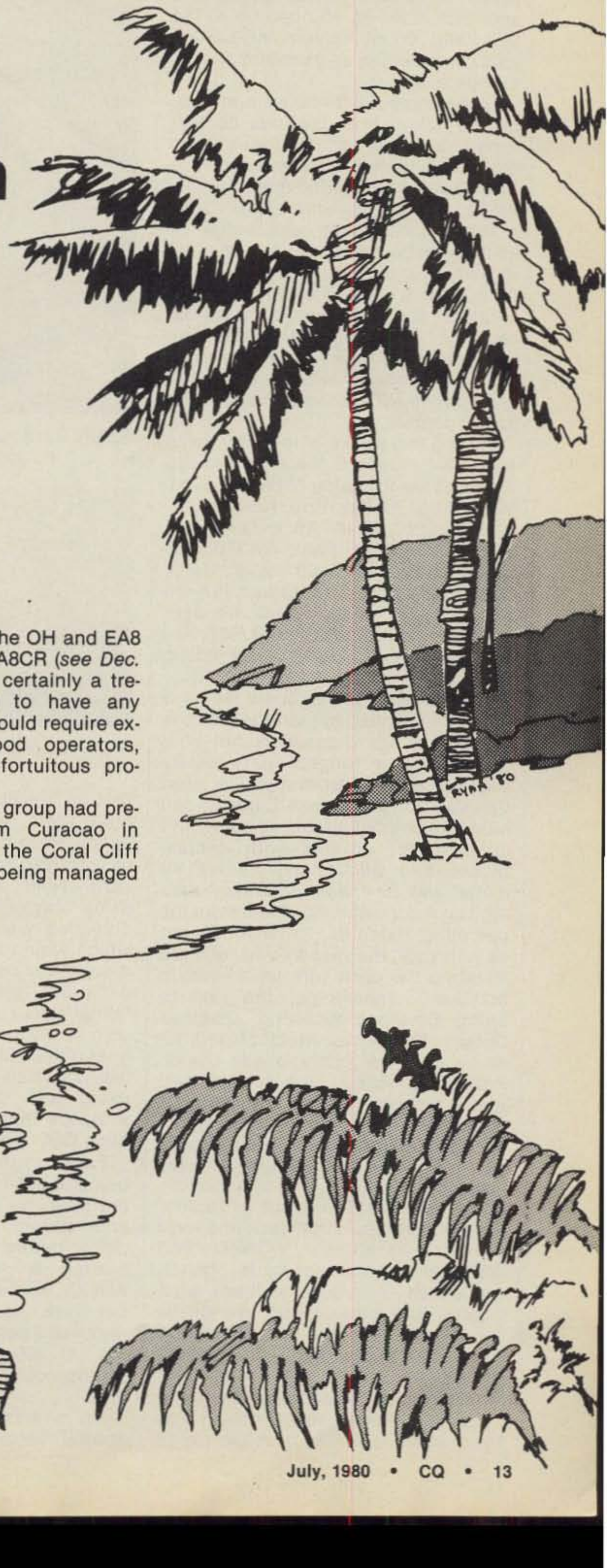
A DXpedition to Curacao captures the record for the 1978 CQ World-Wide DX Phone Multi-Operator, Multi-Transmitter Category.

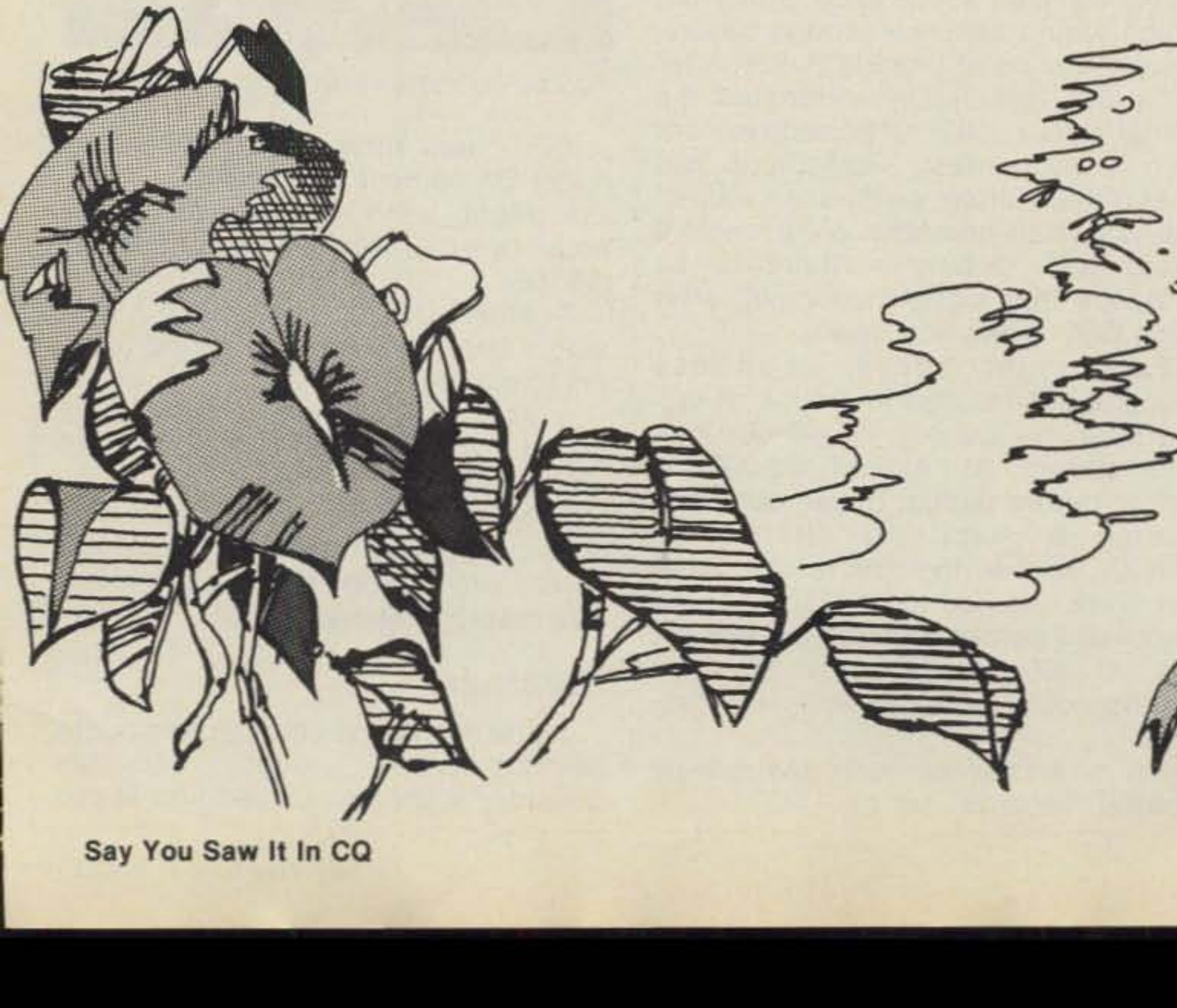
A DXpedition To Curacao By PJ9JR



BY LEW GORDON*, K4VX

During the summer of 1978 a small group of Potomac Valley Radio Club members met at the QTH of N4RV to discuss the possibility of making an assault upon the newly established world record for the CQ World Wide DX Contest in the multi-multi phone category. The record of 21,351,898 points set in 1977 by the OH and EA8 gang under the call EA8CR (*see Dec. 78, CQ, page 60*) was certainly a tremendous effort, and to have any chance of beating it would require extensive planning, good operators, good antennas, and fortuitous propagation.

Since several of the group had previously operated from Curacao in years past, and since the Coral Cliff Hotel was once again being managed



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by Chet, 9J9EE, it was quickly agreed by all that Curacao was possibly the best QTH for any successful assault upon the EA8CR record. Curacao is about as close as you can be to the USA and count three-point QSO's, plus Curacao has an excellent shot to Europe and Asia.

Since some antennas were already on the island from previous contest activities, it was decided that only 40 meter and 15 meter beams needed to be shipped. Anticipating the good possibility of losing the antennas enroute, a 402BA and a home brew 4-element 15 meter yagi were boxed and shipped in early August for the October contest. After six weeks of being unable to locate the whereabouts of the antenna box, it was finally traced to Kennedy Airport in New York. Fortunately, the "lost" box eventually arrived in good shape at Curacao one week prior to the contest.

After a few weeks of recruiting plus the usual dropouts, the crew evolved finally to the following operators: Don, W3AZD (40 meter); Bob, K3RT (20/10 meter); Eric, K3NA (15 meter); Bob, K3EST (20 meter); Paul, WA3ZAS (80 meter); Jack, N4RV (20 meter); John, N4MM (15 meter); and Lew, K4VX (10 meter). Once on the island we were greatly supported by Chet, PJ9EE; Ari, PJ2ARI; John, PJ2AAX; and Freddie, PJ2FR.

Several of us arrived about ten days before the contest to start the antenna erection effort. Curacao is not your sterotype palm fringed, white, sandy beach island—seen one you've seen them all. In many areas Curacao can be a highly inhospitable volcanic and coral desert covered with cactus, thorns, and wild goats! As our 40 meter and 80 meter antennas were high on a ridge about 500 feet from the operating position, a machete-cut path through the stickers was required to string the open wire feed lines. In addition, someone got the idea to string Beverage receiving antennas through the cactus, which proved not to be easy nor operationally useful. For some reason the higher land where we strung the Beverages is more like a huge, porous, ceramic insulator than the more desirable lossy soil areas, so the Beverages were useless.

After the usual amount of frustrations and endless trips back and forth to Willemstad by W3AZD and WB3ANE to obtain (or try to obtain!) overlooked items such as fuses, wire, u-bolts, and other items, we finally saw Eric, K3NA, climb down the 15 meter pole at noon on Friday, about eight hours before the contest! All antennas were up and operational!

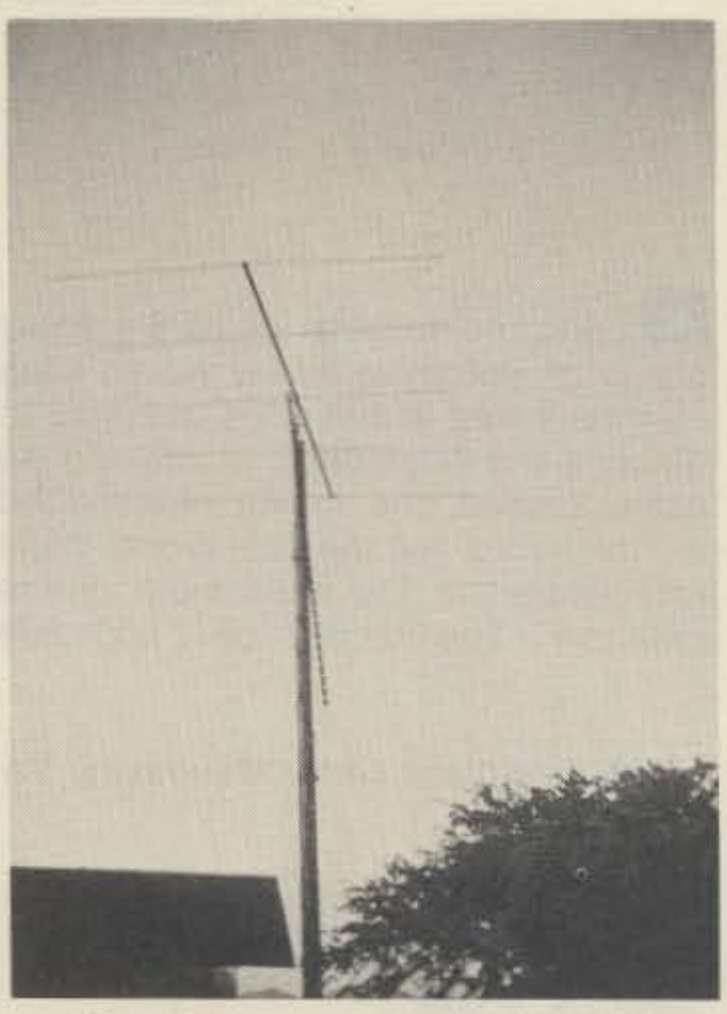
Our PJ9JR operational strategy was simple: Talk as fast as possible; log as fast as possible; and, pass as many multipliers as possible between bands. Prior to the contest several of us practiced saying "W1XYZ Fie - Nien - Oh - Nine" and "Thanks, Pea - Jay -Nine - Jay - Rrr" as fast as we could. The idea was to develop a rhythm which would become second nature. Also, the style of signing PJ9JR after each QSO practically eliminated the "What's your call?" QRM so prevalent with many contest DXpeditions and operations. Since we had a peak of 360 QSO's in one hour on 10 meters using this technique, there is no evidence that signing your call after each QSO slows you down.

Forty-eight hours, countless bologna sandwiches and cups of coffee later, we quickly tallied our logs and arrived at almost 32,000,000 points before dupes. It was over, and barring a surprising effort from KH6XX, we had the new record. Later our score reduced to 29,211,300 as we removed 7 percent duplicates from the log. At 300 plus/hr rates, no dupe sheets could be kept during the contest.

As a matter of fact, there were several "records" set by PJ9JR:

PJ9JR Back row, left to right, K4VX, N4RV, K3EST, K3NA, WB3ANE; front row, left to right: WA3ZAS, W3AZD, and N4MM. Not pictured: K3RT.

Chet, PJ9EE, with K4VX and N4RV.

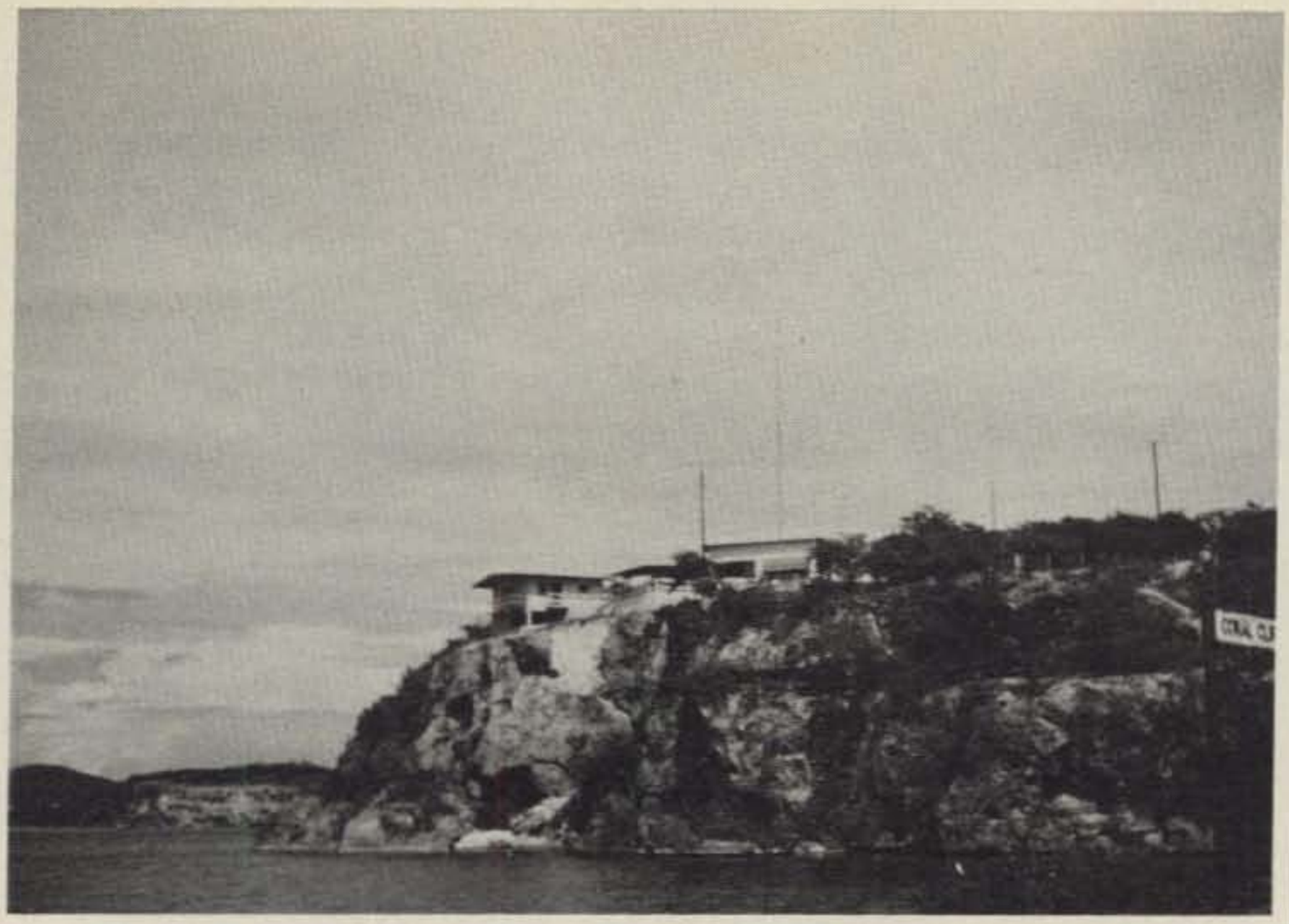


The 10 meter antenna at PJ9JR.

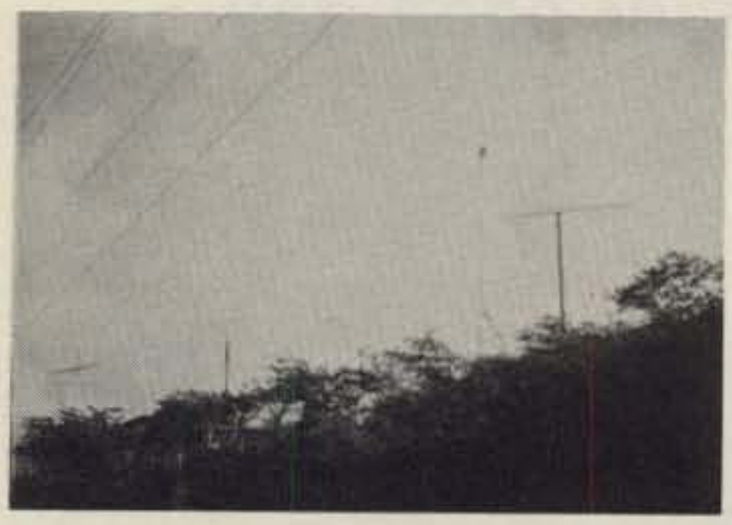
1. Highest score ever made in any major DX contest (29,211,300).
2. Most valid QSO's ever made under one call sign in a 48-hour period (14,598).
3. Most QSO's ever made on a single band in a 48-hour period (4616 on 10 meters).
4. Most QSO's ever made on a single band in one hour (360 on 10 meters).
5. Most bologna sandwiches ever consumed by ten people in a 48-hour period (we are not able to document this record, however!).

Summary

In the event that other groups might be "unbalanced" enough to seriously consider a contest DXpedition in the



The tall pole is the 4-element 15 meter yagi at 110 feet. Just to the left is the 5-element 10 meter antenna. The other antennas are backups.



The black dot on the 110-foot pole is K3NA 8 hours prior to the start of the contest. We coaxed (pun) him down in plenty of time to get us fired up on 15 meters.

The 2-element 40 meter beam in the background was about 500 feet through the "jungle" of thorns and cacti. Note the open wire feed lines going up the hill.

multi-multi category, the following "do's" and "don'ts" might be of some use.

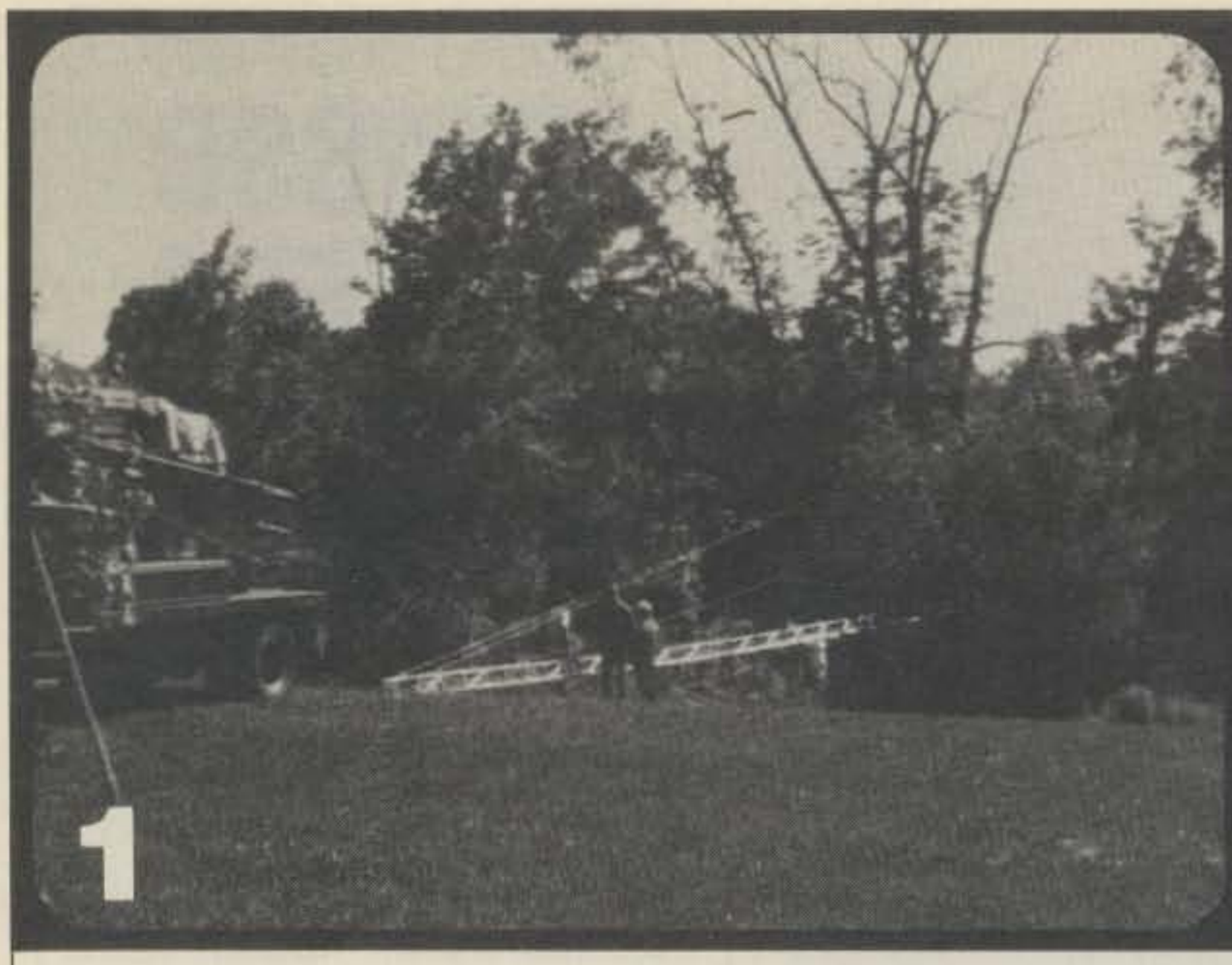
- Do plan as early as possible. Six months in advance is not too early.
- Don't rely on the local economy to purchase anything electronic.
- Do obtain backup emergency a.c. power if possible. Don't take for granted it works; try it out!
- Do construct high and low pass filters to reduce desensing adjacent receivers.
- Do take sufficient coaxial fittings, barrels, PL-259's, adapters, and plugs.
- Do remember the first law of DX-peditions—"There is never enough coaxial cable!"
- Don't sacrifice logging accuracy during the contest for speed. Busted call signs and omitting received zones costs your score later.
- Do take proof of ownership on all gear to avoid a hassle with U.S. Customs.
- Don't attempt to keep a dupe sheet during the contest; you can sort out the dupes later.

Do keep a multiplier check-off sheet for each band.

- Do have fun!

Contest operation from a DX location gets in your blood. By the time this article appears in print, several of us from the PVRC, joined by several from the Connecticut Wireless Association, and others will have made an attempt in November 1979 at recapturing the CQ World Wide CW multi-multi record set in 1978 by that same intrepid gang, EA8CR. Our call will have been PJ2CC.

We have heard through the grapevine that the OH boys may have tried to recapture our phone record in the 1979 contest. If they managed to do it, we'll be back to PJ in 1980! Some year we must form a team with our European counterparts and put the record out of reach!



"I need it," you say, and that's enough to get you thinking about adding just a few more feet to your tower which in your mind is getting smaller each day.

40 Plus 30 Equals A Lot Of People And A Crane

or

I Think I'll Make My Antenna A Little Higher

BY BRUCE JACOBS*, K2QK

Somewhere in the deep recesses of every man's mind there is a little voice that says if my antenna were only a little higher. . .

Well, there I sat with that voice in my head. My TH3 was mounted at 30 feet on top of an Aluma Tower and it was doing okay for the little operating I was doing. But for some it is the creation of a monument to our own insanity that drives us so I decided to go to 70 feet with my tower and ordered two 20 foot sections from Aluma.

I chose 70 foot because I would be able to guy out 70 feet from the base and be within my property. Also, I would retain all of the backyard for the kids to play in without worrying about guy wires decapitating them.

After many conferences with many "experts" I decided that there was only one way to put up the tower — in one piece complete with guys, rotor and antennas. Gary Ashe, K2RKW, said this was the easiest way and since Gary knows more about hamm-

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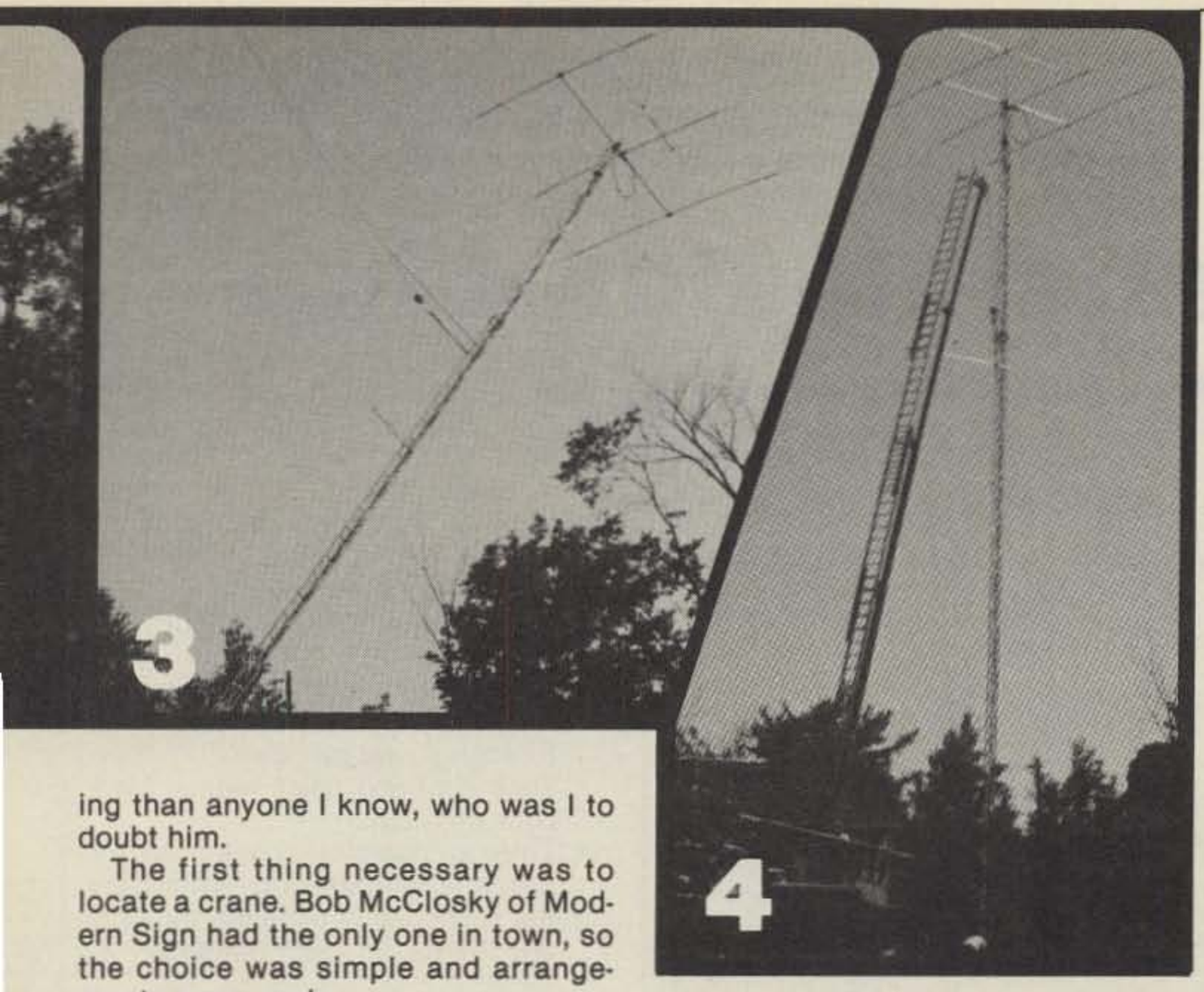

The tower is laid out on the ground. The two back brace cables can be seen in cantilever fashion rising from the top. The crane truck is pulling up in line with the tower.

In this series of shots all 70 feet of tower and antennas are being raised through the trees to an upright position. Notice that the tower remains perfectly straight during the "lift-off" as the brace carries all of the stress. The crane supports the raised tower as Andy DeMarco puts the bolt in the third and last leg. The braces are still in position.

ing than anyone I know, who was I to doubt him.

The first thing necessary was to locate a crane. Bob McClosky of Modern Sign had the only one in town, so the choice was simple and arrangements were made.

The most important thing about doing the job is to understand the theory. The base of the tower is pinned on two legs. The crane pulls the tower at the balance point to a standing position. A backbrace running the length of the tower keeps it from breaking under the strain. Once the crane pulls the tower to a standing position, the tower is bolted at the base through the third leg and the guys are tied off. Sounds easy.

I must admit that all did not go as smoothly as I will describe. The first attempt was foiled by a tree limb which hooked the two meter antenna. The second attempt, one week later, was an unqualified success and the result of five months of planning.

My construction crew for the preliminary work consisted of my family and Jimmy Sena, K2PKU, who was my guardian angel when problems arose. Louis (my oldest son) and I poured the base for the tower. Five hundred pounds of concrete and a four foot deep hole seemed about right. Gary welded the baseplate together and I leveled it on the base using 5/8 lag shields, screw rods, washers and nuts. The ten foot bottom section of tower was aligned and holes were drilled in the base and legs (5/8 in.). Case hardened stove bolts were purchased.

Guy anchors were installed at 70 feet from the tower. Two 4 foot augers were screwed into the ground and the third dropped into 300+ pounds of concrete poured into a hole that was dug as an upside down cone. I would not have used concrete if I had the choice but the one anchor is very near leaching fields. All hardware, including individual turnbuckles, was attached to the anchors. The turnbuckles and hardware are Agway's finest and open to about one foot in overall length.

The tower was assembled by Louis, Sean (my 6-year-old) and myself. Care was taken not to make the bolts holding the sections together overly tight. After the rotor, thrust bearing and mast were installed and tested, we were ready to make the backbrace.

I decided on a ten foot mast that I had available. A hole was drilled in one end and an eye from a turnbuckle was inserted. The mast was clamped to the tower at the 48 foot level. I chose this point because it seemed to be where the tower would balance. Very unscientific, I know, but it felt right. A piece of guy wire was strung from one end of the tower, through the eye in the top of the backbrace to the other end. The cable was pulled tight bowing the tower about 2 feet. This is the reason the bolts must be left a little loose in joining the sections. When the crane pulls the weight of the tower, the cable, not the tower, takes all the strain.

Our old jungle gym was moved into position as a support and the tower was moved to the gym and the base and tower were bolted together. The antennas were put on facing east/west since the rotor and control were preset in this direction. Each antenna was bolted to and through the mast as was the mast to the rotor. If the rotor goes "south" it can be removed easily since the thrust bearing supports the weight of the antennas. All coax was run inside the tower along with the rotor cable. Two spare coax cables were also run, one for a dipole I had planned on and "one to grow on."

Heavy plastic coated steel guywire was my choice because it is easy to work with. I installed the guys at 70, 50 and 30 feet and carefully ran them down the sides of the tower and taped the coils near the bottom so they would not foul. A fourth set would be added at the 60 foot level later on. The antennas were tested and a crew was recruited.

All went well the first time except for the tree problem. The second time was a breeze. The crane pulled evenly and the two men on the top guywires kept the tower in line with the crane. The crane pulled the tower upright, the third leg was bolted, and the guys were tied off and in a few hours we were all enjoying a cold drink. There were some minor problems but they were solved in a short time.

Considering the cost of the tower and the antennas, etc., a crane is a bargain. Again, the trick with the crane is to pull evenly and keep the tower and crane in line.

I climb the tower regularly to try new dipoles. I put the TV antennas on it plus an f.m. dipole. After the first 60 days the guys were repulled and retensioned to compensate for the inevitable stretching.

It helps to have an understanding wife who, with the kids, has always been my antenna crew. This was the fifth tower installation, and the last!!

My special thanks to Jimmy Sena, George Entwistle, Andy DeMarco, Gary Ashe, Bob Johnson, KA2AZS, and my wife Lois.

Irv has the unique ability to teach us something we weren't sure we wanted to know and make us glad he did. He takes the complexity and mathematics out of the theory as well as dispelling the mental and physical state of flux we associate with the subject.

The Transmission-Line Transformer

BY IRVING M. GOTTLIEB*, W6HDM

If an alternating current is available from a coil of wire, you can bet your last dollar that the coil is "linked" to another current-carrying coil via a time-varying magnetic field. In other words, we have an ordinary transformer. Such a wager, unfortunately, could turn out to be rather short of a sure thing! For, although it isn't commonly appreciated, electrical energy can be transferred from a "primary" to a "secondary" by *different* modes of action than that associated with ordinary transformers.

The transmission-line transformer is an important new entree in solid-state r.f. techniques. Such a transformer may bear close resemblance to transformers of the ordinary kind. Indeed, inspection may reveal two windings, a "primary" and a "secondary." The presence of a core will only confirm our conviction that the device under scrutiny is just an ordinary transformer. Of course, such identity will be partially correct—a device which "transforms" electrical energy from one winding to another almost has to be referred to as a *transformer*. However, to further describe it as an "ordinary" transformer is grounds for contention. For, unlike ordinary, or conventional, transformers, the transmission-line transformer does *not* link its windings with a common magnetic flux. If it is thought that this involves hair splitting or monkeying with semantics, one need only consult any elementary text on physics or electrical engineering. Therein will invariably be found strong statements attesting that the basis of transformer action is the *linkage of windings by a common time-varying magnetic flux*. Accepting this at face value, we may well ponder the possibility of having a transformer in which the windings are *not* linked by such a flux!

As though part of a conspiracy to confuse us further, it often has been stated in technical literature that the transmission line transformer operates as a transmission line over the higher part of its frequency range, and as a conventional transformer over the lower frequency portion. There is a spark of truth here, but such a statement is misleading. Indeed, the inordinately high operating efficiency of this device leads us to suspect that its performance is mainly predicated on a *different* principle from the ordinary transformer. Before investigating this, let's look at some of the practical features of transmission-line transformers:

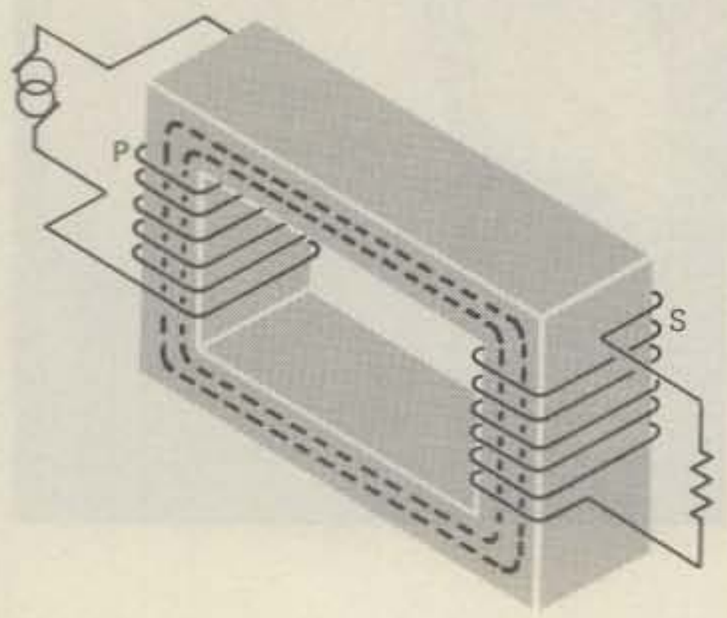

Fig. 1– The basic features of an ordinary transformer. The operating principle is predicated upon the linking of the windings by a closed path of magnetic flux.

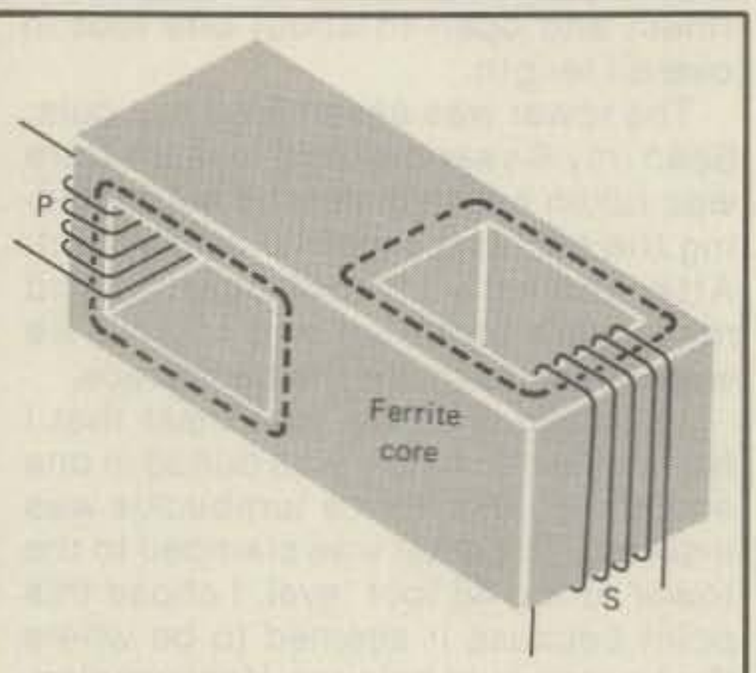

Fig. 2– The parametric transformer. "Transformer action" occurs in this novel device despite the fact that the primary and secondary windings are not linked with a flux path threading through each.

- Transmission line transformers operate at high efficiency—98% and better is readily attained.
- They are physically compact, even for high power ratings.
- Their confined fields reduce feedback problems.
- They are particularly suited for *broadband* operation—relatively flat response is possible throughout the h.f. amateur bands (1.7-30 MHz).
- Bugaboos which plague the design of ordinary transformers are practically of negligible proportions. These include core saturation, leakage inductance, and the effect of interwinding capacitance.
- Exotic or costly high-frequency core materials are not needed.
- Many useful ratios of impedance transformation can be attained.
- They are well-suited for 2 meter and v.h.f. applications.
- They tend to generate relatively little intermodulation distortion when used in linear amplifiers.
- They are readily reproducible, and in v.h.f. work can be fabricated via printed-circuit techniques.
- They perform well in hybrid arrangements, providing the functions of the balun, isolator, power combiner, or power splitter.

It may be argued that ordinary transformers can perform the functions required in solid-state r.f. circuits. And the clincher to such contention is simply that ordinary transformers have operated and continue to operate satisfactorily. Favoritism of the transmission-line transformer is predicated on the fact that high levels of performance are more easily forthcoming. And simultaneous excellence of *more than one feature* is a more commonplace achievement. That being the case, let's revert back to our investigation of its operating principles.

It has been pointed out that the transmision-line transformer, unlike ordinary types, does not make use of

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magnetic flux-linkage embracing input and output windings or circuits. Can you think of other instances where energy transference takes place without benefit of a common flux path? To name a few, energy can be "coupled" via **radiation, capacitance,** or a **mutual impedance**. And, interestingly, there is another type of electromagnetic transformer in which energy is developed in the secondary winding without benefit of a mutual magnetic flux threading through primary and secondary. Such a device, known as a **parametric transformer**, is illustrated in fig. 2. Its operating principle does not bear much relevance to that of our transmission-line transformer, but a quick peek at it will help unshackle the mind from the commonly-held notion that flux linkage between windings is a must for energy transfer. The portion of the core physically shared by the primary and secondary windings of the parametric transformer undergoes periodic variation in its magnetic permeability when the primary is excited from an a.c. source. This, in turn, causes the inductance of the secondary to vary in similar fashion. Note that the secondary winding is resonated with a tuning capacitor. Under such circumstances, oscillation is developed and supported in the secondary circuit. Although this is a little-known phenomenon, practical applications include high-performance regulated power supplies. For the instructive purposes at hand, we see that there is, indeed, more than one way to skin the proverbial cat.

It is now *apropos* to consider certain aspects of transmission lines which are not always presented in an obvious way by texts covering the subject. In fig. 3 (A) and (B), the long and short transmission lines exhibit essentially similar operation providing that the generator impedance, $\mathbf{R_g}$, the characteristic impedance of the line, $\mathbf{R_o}$, and the load impedance, $\mathbf{R_L}$, are resistive and all of the same value. An advantage of the short line of (B) is that its ohmic resistance will be less than the longer line of (A) and therefore there will be less power loss in the line itself. (In practice, R_g, R_o, and R_L may approximate the above-stated requirements closely enough to produce useful results, as will be seen.)

Fig. 3(C) illustrates a feature of transmission lines having considerable practical significance. Specifically, the line may be curved back upon itself, wrapped around a solenoid, or coiled around a toroidal core. Surprisingly, the transmission line properties are little affected by these arrangements even if the cores are made of material with high magnetic permeability, or high dielectric constant! Moreover, these statements apply equally well to other than parallel-wire lines—coaxial lines or twisted wire lines also display such immunity to geometric configuration or core material. Incidentally, things which *do* effect a line—primarily its characteristic impedance—are ratio of spacing to conductor size, and tightness of twist in twisted-wire lines.

A bit more detail concerning the proximity effects of materials to ideal transmission lines is depicted in fig. 4. In (A) and (B) of fig. 4, dielectric and magnetic materials are shown placed *between* the conductors of the transmission line. In both instances, there are pronounced effects. In (A) the capacitance of the line is increased. The characteristic impedance, R_o, of the line is therefore reduced. In (B) the inductance of the line is increased. Accordingly, R_o is increased. It is important to realize that the situations represented in (A) and (B) do *not* prevail when a transmission line is wound on a cylindrical or toroidal form. Instead, we then have the condition represented in (C) and (D). Because the dielectric or magnetic material is not positioned *between* the conductors, there is no effect on the properties of the transmission line! That is why core losses in the transmission line transformer are very low—there is negligible interaction between the line and the core material. Of course, it has not yet been explained what purpose the core serves if it does not interact with transmission-line currents. If your yearning to know has been turned on, this article is accomplishing its in-

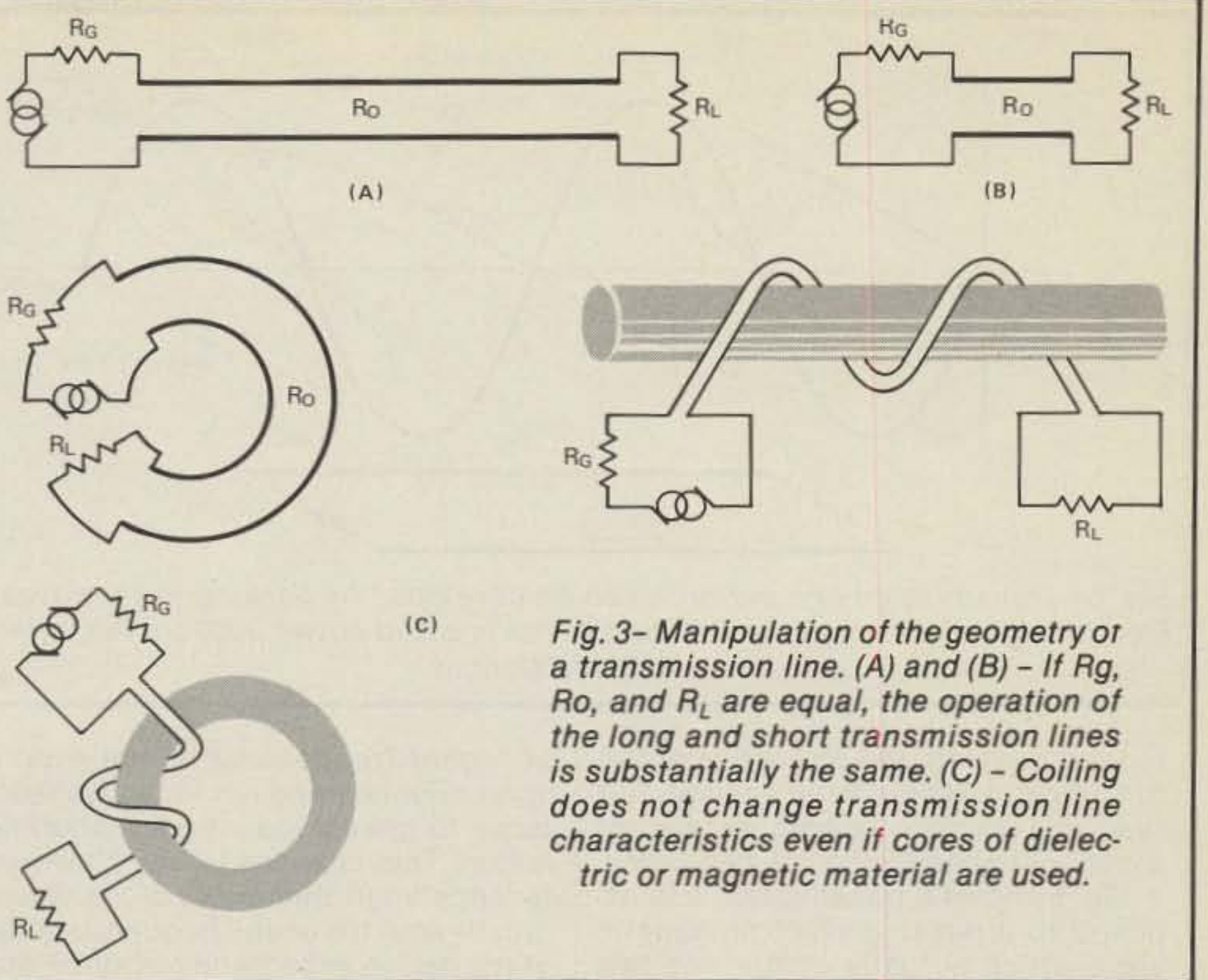


Fig. 3– Manipulation of the geometry or a transmission line. (A) and (B) – If Rg, Ro, and R_L are equal, the operation of the long and short transmission lines is substantially the same. (C) – Coiling does not change transmission line characteristics even if cores of dielectric or magnetic material are used.

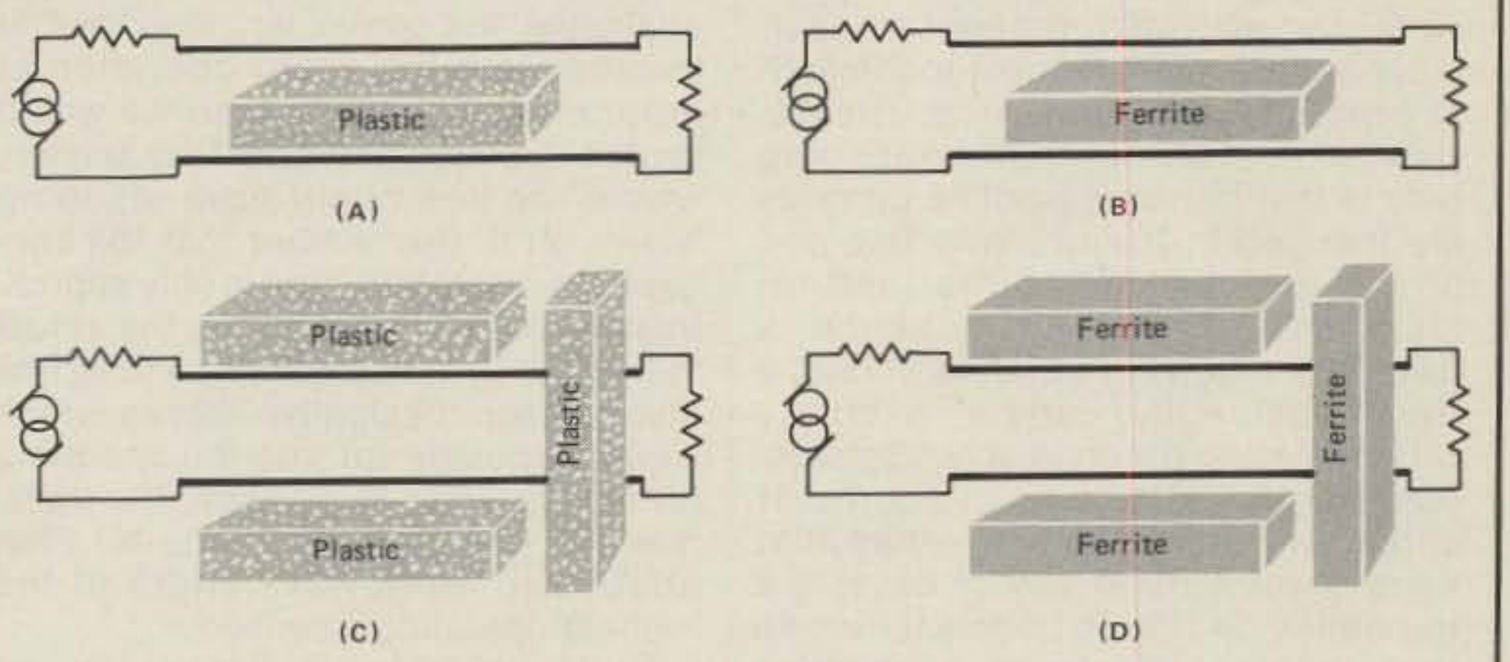


Fig. 4– The effects of dielectric and magnetic materials on transmission line properties. (A), Strong effect—characteristic impedance of the line is decreased. (B), Strong effect—characteristic impedance of the line is increased. (C), No effect in ideal situation. Negligible effect attainable in practice. (D), No effect in ideal situation. Negligible effect attainable in practice.

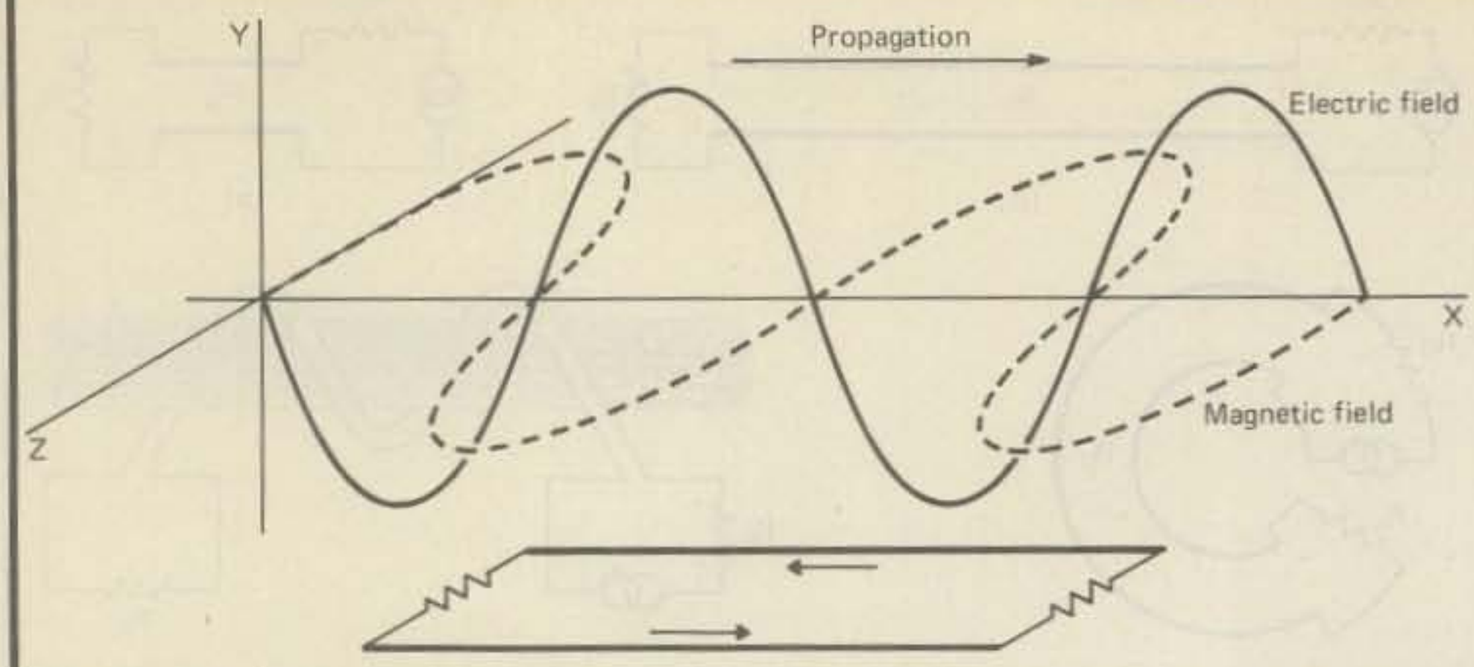


Fig. 5– Transmission-line currents can be developed by passing radio waves. Electromagnetic energy is transferred to the line and power appears in the terminating resistances.

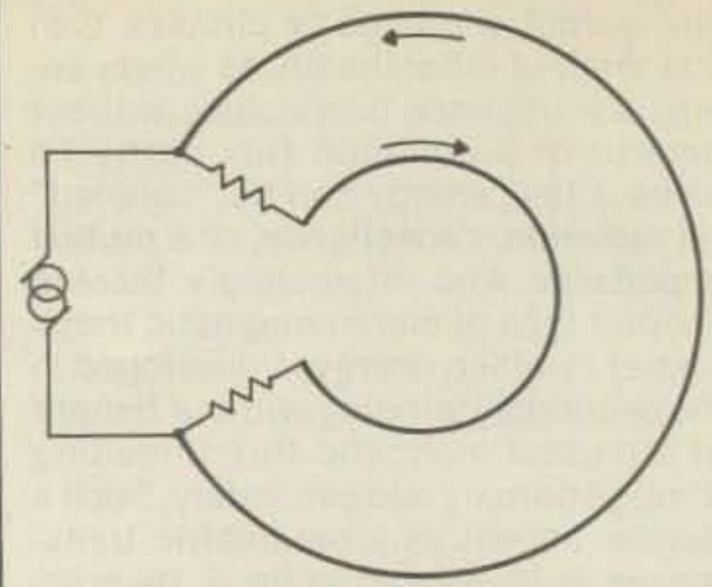


Fig. 6– A true transmission-line transformer. Although only one line is "driven," power is delivered to the load resistances connected across the terminations of both conductors.

tended mission. We will arrive at the function of the core soon enough. But first, let's consider yet another relevant aspect of transmission-line behavior.

Fig. 5 shows a transmission line exposed to a passing electromagnetic wave which actually comprises two components, the electric and magnetic time-varying fields. These are displaced 90 degrees with respect to each other and also with respect to the path of propagation. From our particular viewpoint, the important happening here is that transmission-line currents are induced in the two-wire line and power is delivered to the load resistances. (This is, in essence, a Beverage receiving antenna.) Thus, a transmission line can be "excited" without having the ends of two conductors connected to an a.c. source. It should not come as a surprise that there is yet *another* way of causing a transmission line to "operate"—one that, incidentally, bears even more directly on our transmission-line transformer.

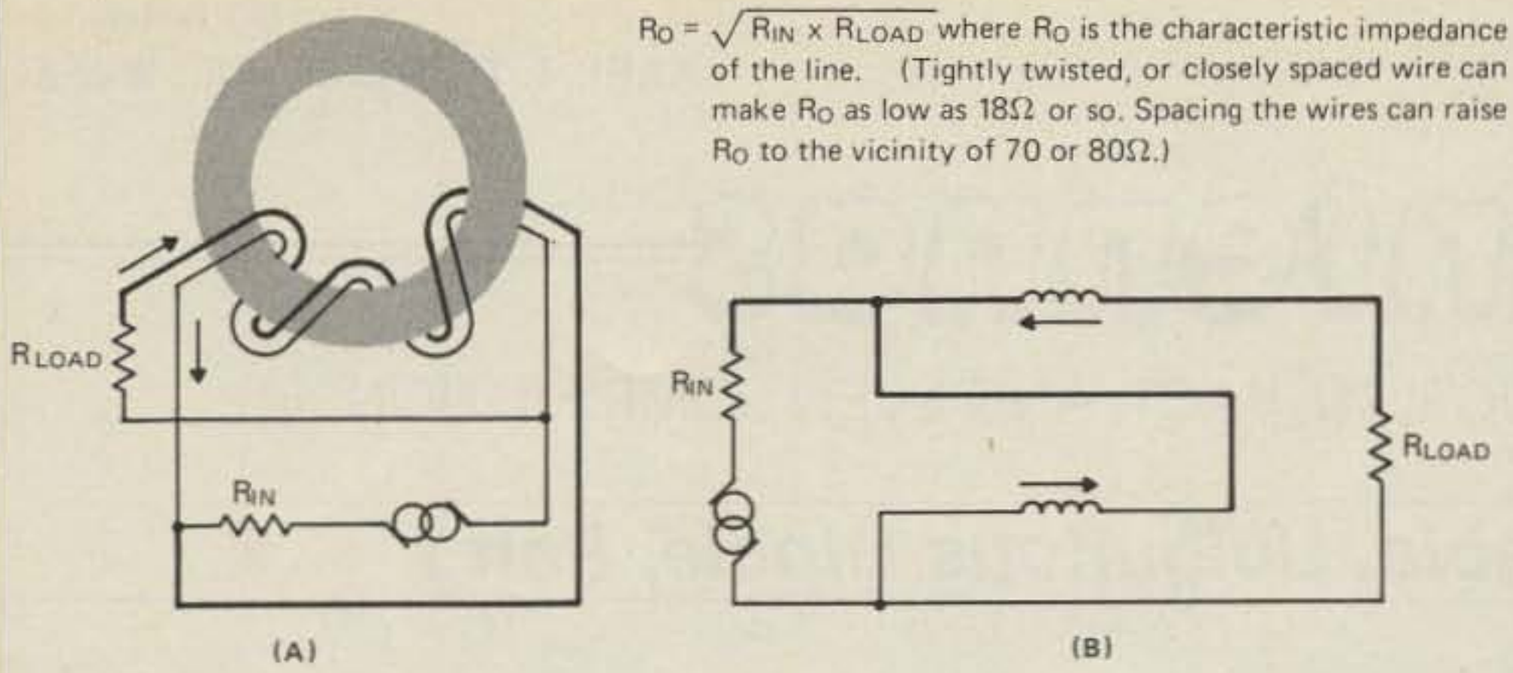
In fig. 6, *one* conductor is connected across the high frequency a.c. source. Again, transmission-line currents flow in *both* conductors and power is delivered to the load resistances. Note that this technique is feasible only when the transmission line is coiled up. But, we have previously decided this is OK—the line is just as happy as it would be if extended linearly. At this point, you may rightfully suspect we have finally acquired sufficient information to see what goes on in the transmission-line transformer.

Except for specific applications, this transmission-line transformer is not yet a practical device, however. First off the bat, we see that the a.c. source, being connected directly across the single outer conductor, must suffer the consequences of being short-circuited—or, at least, heavily loaded down. As devil's advocate, we might argue that this would no longer be true at higher frequencies where even a short wire has enough inductive reactance to greatly reduce such shorting action. This is, indeed, true. However, reliance upon this effect *alone* would greatly limit the useful frequency range of the device. Broadband response, one of the compelling features of transmission-line transformers, would not be attainable. Nor can we lengthen the line in order to bring about operation at lower frequencies. For then we would invite trouble at the higher frequencies, where the line might have standing waves on it. (Remember that the concept of a "matched" line is only approximated when transistors are the actual "terminating" resistances.) A long line also causes dissipative losses which would seriously eat into the operating efficiency. Thus in practice, the transmission line(s) are kept shorter than about two-tenth wavelength of the highest operating frequency.

From our previous discussion, we know what to do in order to eat our cake and have it too. We simply reconfigurate our transmission-line transformer in the form of a multi-turn coil, such as the toroidal winding shown in fig. 7. The conductors now have much more self-inductance than they did in fig. 6. But let's not stop here. While we are at it, let's specify the toroidal form to comprise material having a high magnetic permeability. This will greatly increase the self-inductance of the conductors and the driven one will not act as a short-circuit down to a very low frequency. This technique obviously helps make our device have broadbanded response. And, as previously pointed out, the operation of the transmission line remains virtually unaffected by these fabrication procedures.

Note that our toroidal transmission-line transformer of fig. 7 is connected as an auto-transformer. This happens to be one of the most popular arrangements, for, like a conventional auto-transformer with two identical windings, it provides a one-to-four impedance transformation, or if source and load are interchanged, a four-to-one impedance transformation. To get the feel of this, compare fig. 7 with the conventional auto-transformer of fig. 8. Although both auto-transformer devices provide basically similar functions, there are some differences in the characteristics of the two. The main difference is depicted in the response curves of fig. 9. We see that the broadband performance of the transmission-line type greatly excells that of the conventional transformer. Also, the operating efficiency of the transmission-line device is better than that of the conventional one. This is very important, for it enables us to use these unique devices for high-power rigs without running into heat removal problems. The primary reason for the superb efficiency is that the core does not participate in energy transfer throughout the major portion of the transformer's passband; therefore core loss can be quite small. (The curves of fig. 9 represent devices which might serve somewhat similar needs as far as impedance transformation and power handling capability are concerned.)

Aside from efficiency and frequency response, there is yet another difference in the characteristics of the auto-transformers of figs. 7 and 8. The transmission type is more restrictive with regard to the impedances it is connected to. This is because the transmission must "see" terminations which properly relate to its own characteristic impedance. The designer has some latitude here because the characteristic impedance of a line depends upon the diameter of its conductors and the spacing between them. In twisted lines, the tightness of the twist affords a measure of control over the characteristic impedance. While the conventional auto-transformer is less fussy, its already skinny response is further impaired if source



$R_O = \sqrt{R_{IN} \times R_{LOAD}}$ where R_O is the characteristic impedance of the line. (Tightly twisted, or closely spaced wire can make R_O as low as 18Ω or so. Spacing the wires can raise R_O to the vicinity of 70 or 80Ω.)

Fig. 7– The transmission-line auto-transformer. (A) is a semi-pictorial illustration and (B) is the schematic diagram. In this arrangement, $R_{LOAD} = 4 \times R_{IN}$.

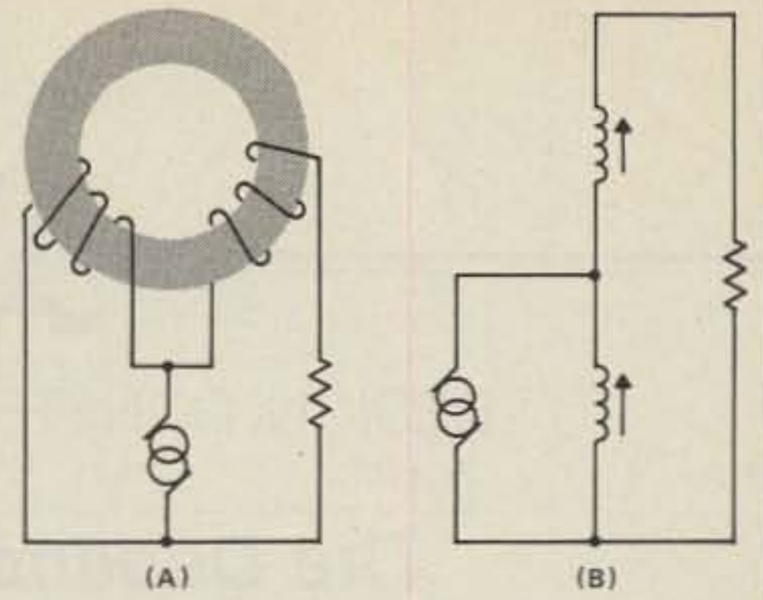


Fig. 8– The conventional auto-transformer. (A) is the semi-pictorial representation and (B) is the schematic equivalent.

and load impedances are too high or too low.

Although our discussion has involved open-type lines, coaxial lines are much used and their operating principle is the same. Also, there are a number of other arrangements besides the one-to-four or four-to-one auto-transformer. We do not have space or time to cover those in this article, but their operating principles remain the same as those we have discussed for the auto-transformer connection.

In closing, it would be *apropos* to clarify a couple of points which conceivably could lead to a troubled mind. One of these involves the statement that there are no flux linkages in the operation of transmission lines. This should not be construed to imply that no interaction between magnetic fields and conductors exists. What *is* true is that the type of mutual flux-path which couples the primary and secondary windings of conventional transformers does not cause currents in transmission lines—no matter how they are excited or driven. This is evidenced by the fact that the currents in the two conductors of a transmission line flow in *opposite* directions (as indicated in figs. 5, 6, and 7. If these currents were induced by ordinary flux-linking as found in conventional transformers, they would flow in the *same* direction.)

The fact that the currents flow in opposite directions also means that their magnetic fields cancel insofar as any effect on the core is concerned. As mentioned, this leads to low core losses. The core is effective in boosting the self-inductance of the "driven" conductor of the line, thereby alleviating shorting action at lower frequencies and allowing the device to *continue* its operation as a transmission line. In this way, the low-frequency end of the passband is greatly extended.

The alert reader may have inferred that the semi-pictorial drawing in fig. 7 also illustrates a conventional transformer wound in bifilar fashion. It is indeed true that the transmission line and the conventional transformer "blend" into one another. That is exactly why there has been confusion where one "begins" and the other "ends." However, if we were to construct a conventional transformer, the bifilar windings would tend to be too long for good results in the transmission-line mode of operation. Also, it is likely that the input and output impedances "seen" by the conventional transformer would not be suitable for operation in the transmission-line mode. Another way of looking at this is to contemplate that the transmission-line transformer is specially designed and operated so that the inter-winding capacitance is constructively used as part of the characteristic impedance of transmission lines. (In conventional transformer action, the inter-winding capacitance *ruins* the frequency response, making broadbanding very difficult.)

Finally, do not be dismayed if the focus of your understanding alternates from sharp to fuzzy. Consider that many years went by before this device emerged. Its discovery stemmed from a combination of empirical and analytical approaches. Although simple to construct and use, it can hardly be said that the transmission-line transformer was an invention in quest of an inventor. Now that it is here, it is both a mathematician's delight and a headache for those who fail to grasp its operating mechanism. At the same time, the results of proper use are so rewarding that it would be a step backward to try to match its performance with conventional transformers. The author sincerely hopes the home-constructor will feel motivated to supplement this article with more detailed design-data and with experimentation. It may well be found that getting in on a new technique can be as much fun as working DX—expecially when the former is likely to lead to the latter!

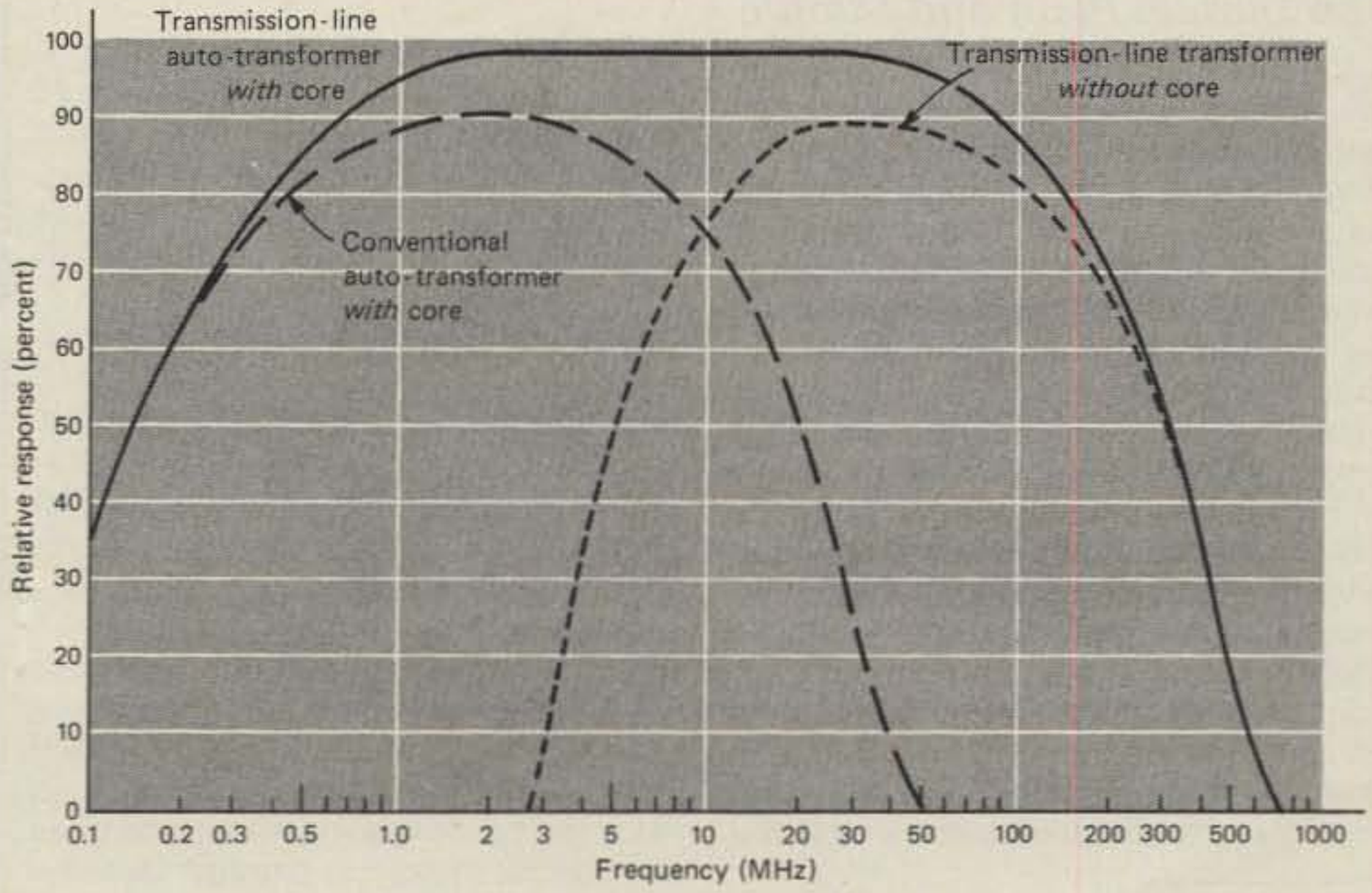


Fig. 9– Comparison of transformer types.

a monthly feature by
KARL T. THURBER, JR., W8FX

Antennas

DESIGN, CONSTRUCTION, FACT, AND EVEN SOME FICTION

The Dependable, Ubiquitous Dipole, Part I

Antennas come in all shapes and sizes, as do the amateurs who erect them. They range from the simplest 80-meter dipole put up by the s.w.l.-cum-Novice, to the all-band trap vertical, the multielement beam, single-wire and long-wire variants, Quads, log-periodics, and so on.

However, at least on the lower h.f. bands, 80 and 40 meters, the center-fed dipole is far and away the most popular antenna. Why? The fact is that the dipole *works* and it's inexpensive. It's also easy to install and adjust, a cinch to feed, and it can usually be forgotten about once installed. It also doesn't require any special ground system, as does the vertical.

There are probably more versions of the dipole antenna around than any other antenna type. These include the simple, monoband doublet; the single-band dipole fed on odd-harmonics; paralleled multiple-dipoles; folded dipoles; and many others. In this first of a two-part series, we will look at these elementary dipole types. In the second part, we will cover some important dipole variations.

The Dipole: Plain and Simple

Without doubt, the simplest, lowest-cost, and most reliable h.f. antenna is the half-wave dipole, sometimes referred to as the "doublet." On balance, this antenna beats out the so-called single-wire or random-wire when *reliability* is considered. The latter types of antennas are simple but they are notoriously hard to feed and often cause "hot" equipment problems, TVI and BCI.

The dipole has two arms or poles which are separated by a center insulator and connected to one another by means of the transmission line. Normally made of wire, the dipole is a resonant half-wavelength antenna, its overall length being cut to five percent less than one-half of the "free-space" wavelength of the frequency for which the antenna is designed. (Less-common full-wave "double Zepp" and 1.28 wave "extended double Zepp" dipoles result in some gain, but require more than twice the space than do the shorter ones and special matching arrangements.)

In the simple dipole, the wire is cut exactly in the middle of the span and a transmission line (lead-in) is attached at the center point. The ends of the dipole and the two halves must be insulated so that there is no electrical connection betwen them and other objects. Insulators of plastics, porcelain, or even rubber can be used for the center and end insulators; wire halyards can be used at the ends to support the antenna between, say, two poles, or between a tree and your home, but the wire halyards must be insulated from the antenna ends.

Fig. 1 shows several dipole configurations, and fig. 2 gives typical dimensions for single-band h.f. dipoles.

The theoretical radiation resistance (feedpoint impedance) of the half-wavelength wire dipole is about 72 ohms. In practice, when the dipole is installed at moderate heights above ground, the antenna will provide a good match to 50- to 75-ohm coaxial cables or 72-ohm transmitting-type twinlead. (See fig. 3.)

The dipole is "balanced" with respect to ground—both sections of the antenna are symmetrical. Feeding this kind of balanced antenna directly with 72-ohm twinlead is technically proper, though this type of transmission line has become somewhat less-popular over the years due to its expense, loss and potential for undesirable radiation. Feeding a dipole with coaxial cable (an unbalanced line) results in currents in the shield which may cause line radiation and antenna pattern distortion, though the problem is largely academic. Antenna purists insist that the dipole be fed through a balun transformer to eliminate this problem, though this measure is not absolutely necessary and may cause additional loss due to the introduction of the balun into the circuit.

In practice, the dipole can be directly fed with one of several types of 50- to 75-ohm coax. The smaller, RG-58/U (53-ohm) and RG-59/U (73-ohm) types are o.k. for medium power levels and short runs on the lower bands. However, they are not designed to handle high power, and loss increases considerably on the higher bands. Larger,

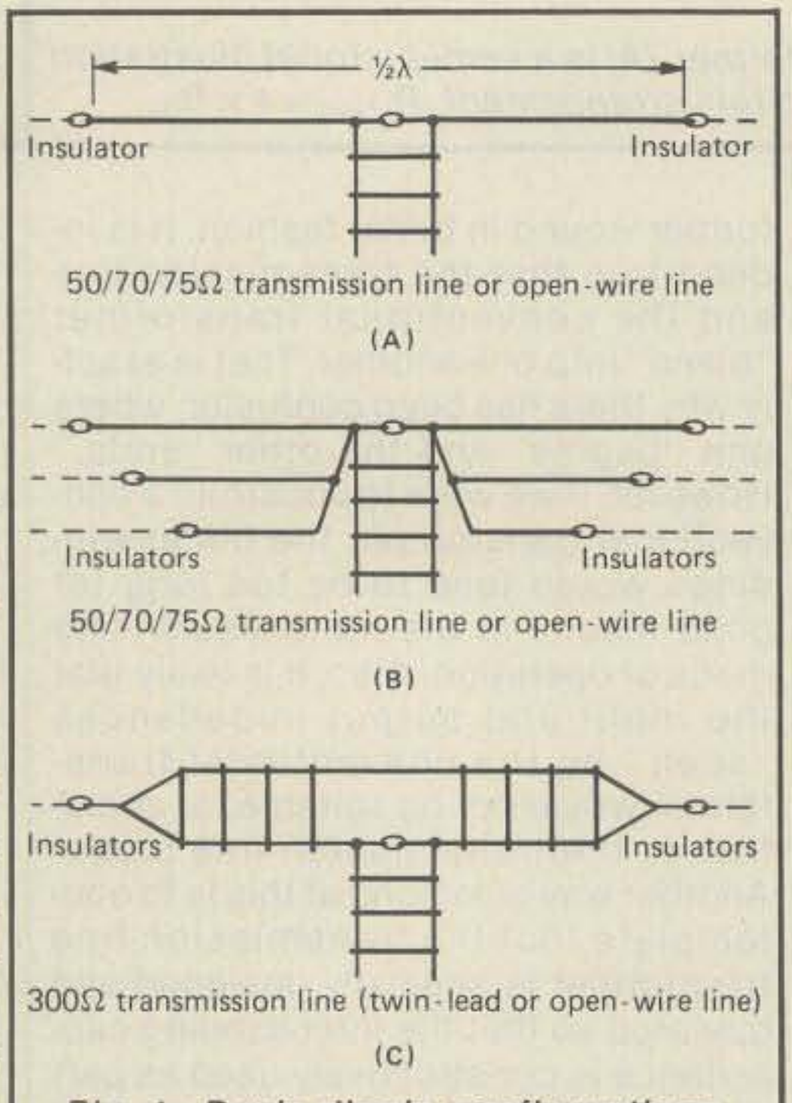


Fig. 1- Basic dipole configurations.

(a) **Basic half-wavelength dipole.** Length is determined by the formula, $L = \frac{468}{f}$. L = length in feet, f = frequency in MHz.

(b) **Multiple-dipole.** Top dipole is one-half wavelength at the lowest operating frequency. Higher bands can be covered by paralleling shorter dipoles with the longer dipole and suspending them from it.

(c) **Folded dipole.** Folding the dipole back on itself, so to speak, results in a quadrupling of the dipole's center impedance from 70 to 300 ohms. The antenna's effective usable bandwidth is also increased.

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Band	(kHz) Frequency	Use	Half-wavelength dimension (feet)
160	1850	160-low	253′ 0″
160	1950	160-high	240′ 0″
80	3600	C.W.	130′ 0″
80	3725	Novice C.W.	125′ 8″
80	3750	Mid-band	124′ 10″
75	3850	Phone	121′ 7″
40	7075	C.W.	66′ 2″
40	7150	Mid-band	65′ 6″
40	7175	Novice C.W.	65′ 3″
40	7225	Phone	64′ 10″
20	14050	C.W.	33′ 4″
20	14175	Mid-band	33′ 1″
20	14275	Phone	32′ 10″
15	21075	C.W.	22′ 3″
15	21175	Novice C.W.	22′ 2″
15	21225	Mid-band	22′ 1″
15	21350	Phone	22′ 0″
10	28050	C.W	16′ 9″
10	28150	Novice C.W.	16′ 8″
10	28750	Phone-low	16′ 4″
10	29075	Phone-high	16′ 2″
10	29475	OSCAR (receive)	15′ 11″

Fig. 2– Half-wave dipole dimensions for h.f.

Wire dimensions shown are rounded to the next higher inch. The span on each side of the center insulator would be half that shown in the table.

For ease of adjustment, start with a length that is a few percent longer than the figures listed. It's much easier to trim the flattop to resonance than to make it longer once the wire is cut.

more efficient RG-8/U or RG-11/U should be used for best results. A new, small-diameter, low-loss, high-power cable known as RG-8X has recently been introduced. It has real potential for such applications.

The coax, which has a center conductor surrounded by an outer shield braid, is connected to the antenna at the center insulator. One side of the antenna is connected to the braid and the other side is connected to the cable's center conductor. Ensure that the connection is mechanically firm and well-soldered. Several firms sell enclosed, weatherproof center insulator/connectors that have an insert support for the coax or even an SO-239-type connector to mate with a PL-259 plug.

The typical dipole radiation pattern is shown in fig. 4. Although the familiar doughnut pattern (maximum radiation at right angles to the antenna) is produced, directionality is not too pronounced in practice, particularly on the two lower bands (80 and 40 meters). Bandwidth of the dipole is typically about ± 2% of the design frequency, to stay within a 2:1 s.w.r.

Dipoles and Odd Harmonics

It so happens that the basic dipole will readily accept power from the transmitter at odd multiples of the design frequency, that is, at frequencies for which it is an odd number of half-wavelengths long. Thus, for this special case, a dipole cut for the 40-meter band will provide a good match to the transmission line on 15 meters.

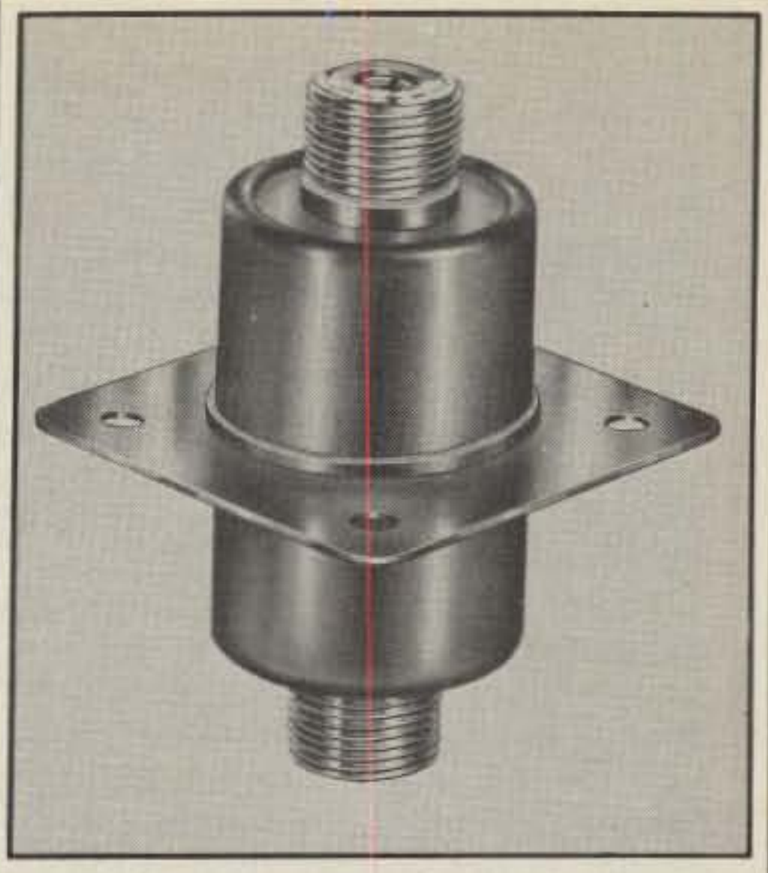
If you cut your 40-meter dipole for resonance fairly low in the band, around 7075 kHz, its third-harmonic resonance will be around 21,225 MHz, squarely in the middle of the band. Cutting the 40-meter dipole for phone operation (around 7225 kHz) would result in an out-of-band resonance on 15, around 21.675 MHz, too high for practical use.

The resultant antenna should show low s.w.r. across most of the 15-meter band if the 40-meter resonance is placed as indicated, and no antenna tuner or transmatch is required to load it up.

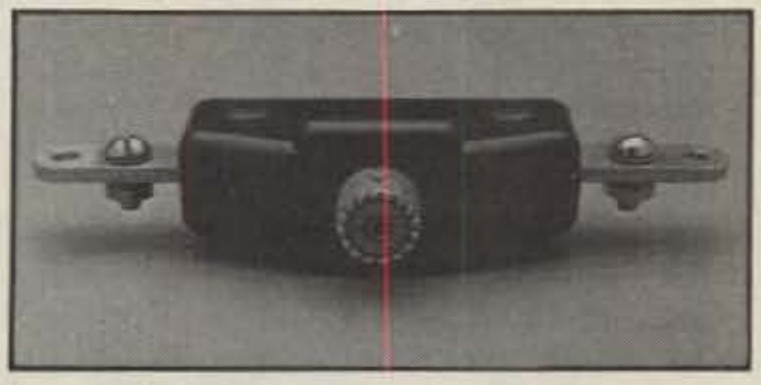
The basic dipole can also be used as an "all-band" antenna, 80–10 meters, if it is fed using low-loss open wire line through an antenna tuner. This type of antenna will be covered in some detail in a future column.

Multiple-Dipole Antennas

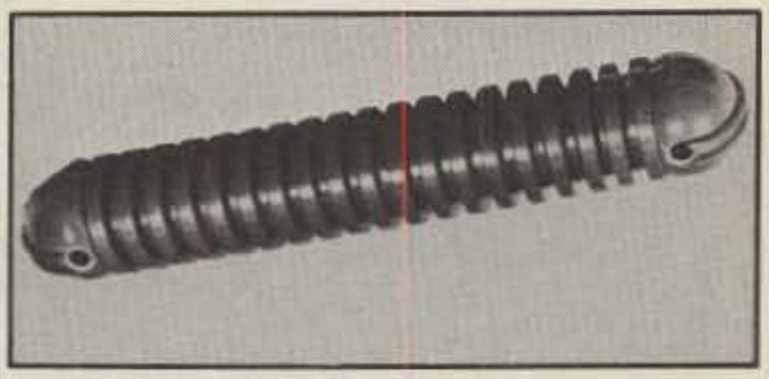
For straightforward direct feed with a single coaxial cable, the multiple- or parallel-dipole antena is an inexpensive choice that does not require the use of special traps, loading coils, or antenna tuners.



Coaxial-cable lightning arrestor operates to reduce static buildup around the antenna and thus reduce the possibility of direct lightning strikes. The effects of a direct hit *by lightning are difficult to predict, but the manufacturer asserts that the LA-1 unit shown is "the only lightning arrestor on the market that will safely bypass to ground ten or more lightning strikes." Unit is based on a design intended for airborne electronic gear protection. (Photo courtesy Hy-Gain Electronics)*



Hy-Gain doublet (dipole) center insulator has a built-in SO-239 connector for easy hookup to a PL-259 on attaching coaxial cable. A heavy-duty unit, the insulator is designed to handle 1 kW average and 2 kW p.e.p. It is molded from high-impact ABS plastic, and internal parts are weatherproofed and silicone-insulated. Hardware is iridite-treated. (Photo courtesy Hy-Gain Electronics)



Dipole end-insulators are important, too. Hy-Gain El insulator shown here is a rugged, 7-inch long end insulator molded from a high-impact material known as Cycolac® . The insulator is heavily serrated to increase leakage path to approximately 12 inches. (Photo courtesy Hy-Gain Electronics)

This type of antenna consists of two or more full-size, half-wavelength dipoles cut for each band on which operation is desired, joined together at the center and fed "in parallel" with one another. The antenna is connected to a low-impedance transmission line such as 50- to 75-ohm coax or 72-ohm transmitting-type twinlead. As many as four dipoles can be paralleled to enable full 5-band h.f. coverage. A separate antenna is not necessary to work on 15 meters, as previously indicated.

There will be some interaction between the dipoles, but as a rule the dipoles that are not resonant at the frequency in use have little effect on the feedpoint impedance of the active antenna. The separation between the dipoles is not critical, though the farther apart they are spaced, the less interaction that will result and the easier it will be to adjust the antenna.

Several different mechanical arrangements for this kind of antenna have been devised. You can simply fan out the suspended dipoles' ends to run to lower supports; this will allow you to get maximum separation between the antennas. Or you can use TV- or transmitting type open-wire ladder line for the dipoles; the ladder spacers keep the dipoles from touching one another. Some fellows have had good results using 300-ohm TV twinlead for the antenna. However, using TV twinlead

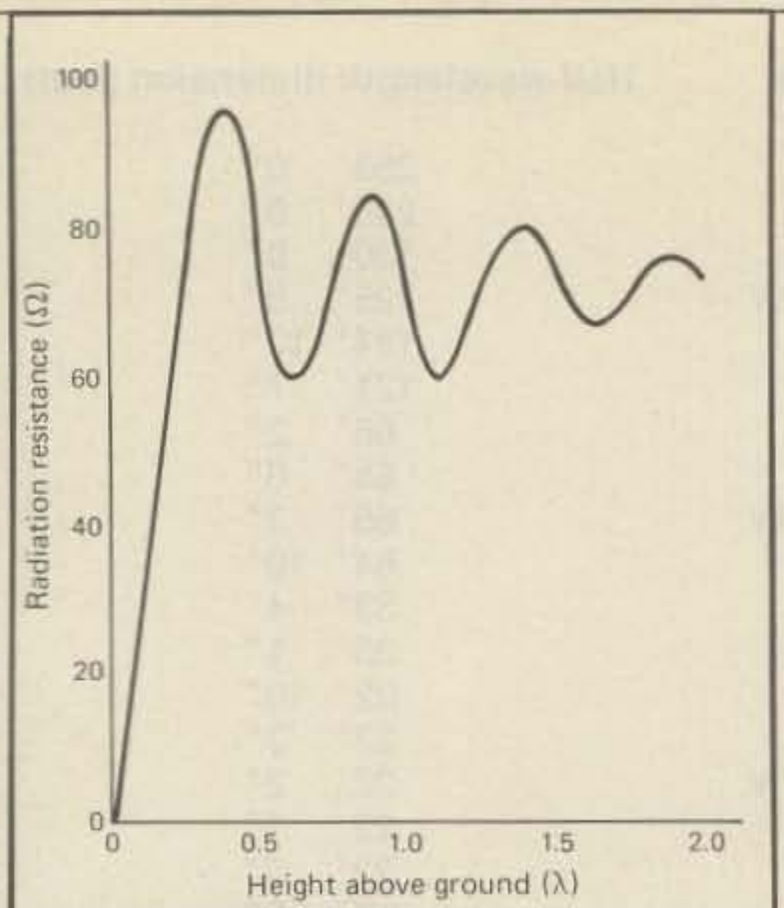


Fig. 3- Dipole radiation resistance. Depicted above is the radiation resistance (feedpoint impedance) for a horizontal half-wavelength antenna at varying heights above a perfectly conducting ground.

may result in a mechanically inferior antenna.

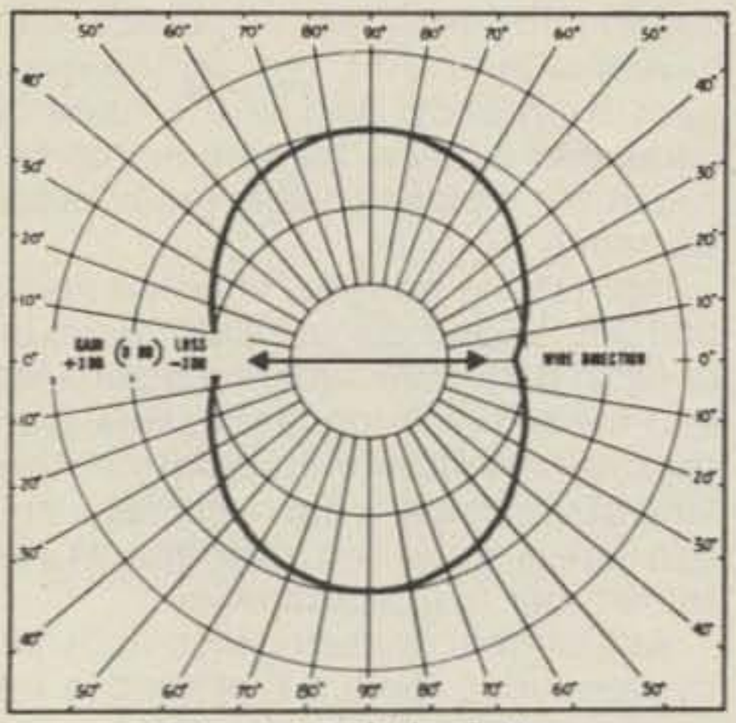
In any case, cut each dipole somewhat *longer* than the theoretical length to allow for interaction effects. In adjusting the antenna, trim each dipole for minimum s.w.r. starting with the *lowest* operating frequency. Be prepared to go through several iterations in adjusting the antenna. Also, don't be surprised if the closely-spaced dipoles exhibit varying s.w.r.'s in high winds or on rainy days.

Bear in mind, also, that building harmonic radiation capability into an antenna can have drawbacks, particularly with older transmitters that do not have adequate harmonic suppression in their amplifier stages. Most modern transmitters have overcome the harmonic problem, but it's still a good idea to feed *any* multiband antenna through an antenna coupler to further reduce the possibility of out-of-band harmonics from reaching the antenna and being radiated.

Folded Dipoles

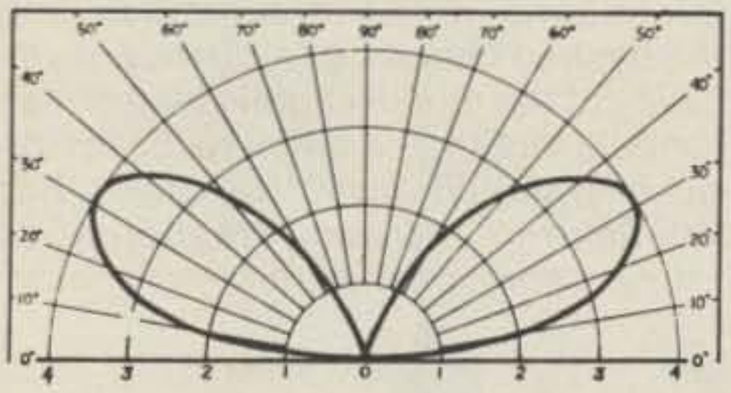
A long-time favorite antenna is the folded dipole. This type of antenna is similar to the ordinary dipole, except that it has a slightly broader frequency response, and the feedpoint impedance is considerably higher, around 300 ohms. Like the basic dipole, it's inexpensive, easy to match to a transmission line, and a snap to build. As the name suggests, it's a dipole that is folded back on itself. Adding the top wire quadruples the center impedance to 300 ohms, as opposed to about 70 ohms for the straight dipole.

The dipole antenna radiates in an essentially bidirectional pattern, as shown below. Maximum radiation is at right angles to the axis of the wire.



Horizontal Radiation Pattern of Horizontal Dipole ½ Wave Length High

Shown below is the typical *vertical* radiation pattern of a horizontal half-wavelength dipole installed at ½-wavelength above ground.

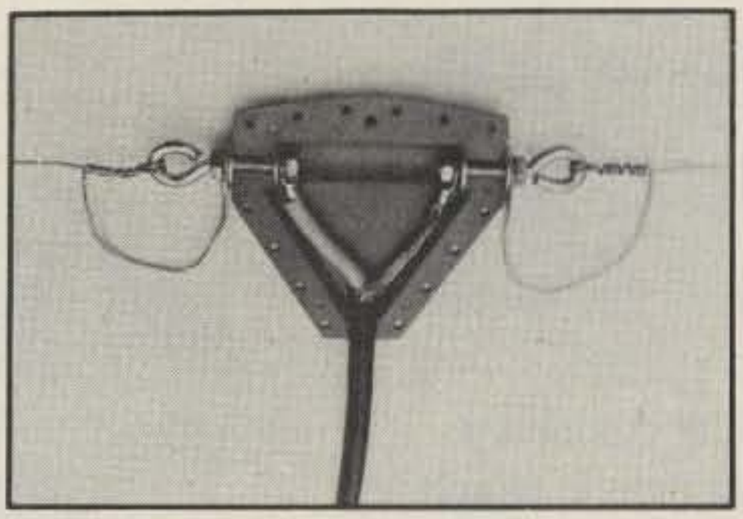


Generally, if the antenna can be mounted at least 1/8-wavelength above ground, results will be satisfactory. Directivity will not be so pronounced on the lower bands (80 and 40 meters) but will be much more noticeable on 20 meters and up.

Installing h.f. antennas at extreme heights can be self-defeating, since the angle of radiation may be lowered or raised undesirably. Heights of 35 to 70 feet represent a good "compromise" height for most purposes.

Fig. 4– Dipole radiation patterns. (Drawings via Western Radio Electronics product literature)

Baluns provide smooth electrical transition between the unbalanced mode of coaxial cable and the balanced mode of the dipole antenna. Balun proponents claim that their use prevents undesirable currents from flowing on the outside of the coax, which would otherwise distort antenna pattern and possibly result in TVI. W2AU balun shown has handy hang-up hook and coaxial connector built-in. (Photo courtesy Unadilla/Reyco)



Commercial center insulator is designed for dipole (doublet) antennas and provides strong, lightweight, weatherproof characteristics. The Hy-Gain insulator shown here with one "clamshell" removed is molded from a high-impact material, and hardware is Iridite® -treated to MIL specs. Connector accepts 1/4" or 3/8" diameter coaxial cables. (Photo courtesy Hy-Gain Electronics)

The folded dipole can easily be made out of TV-type ladder line, transmitting-type open-wire line (450- or 600-ohm types), or even 300-ohm twinlead. Length and stress to be placed on the antenna should determine what type of line you use for the flattop.

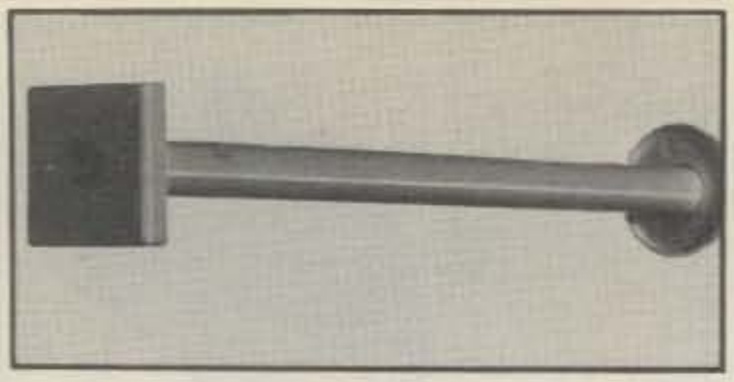
The folded dipole is a balanced, single-band antenna, though it, like the straight dipole, can be excited on odd harmonics. It can be fed directly with 300-ohm twin line through an antenna coupler or a set of balun coils installed at the transmitter. It can also be fed by coaxial cable using a 4:1 transformer balun at the antenna, letting the balun double as a center insulator. In no case should the folded dipole be fed *directly* with coax.

The folded dipole is an especially popular antenna for the 75/80 meter bands, as its wide bandwidth makes possible good performance over the entire band.

Installation

The beauty of the dipole is that it is a simple antenna to build and install. It can be constructed of wire of any size strong enough to hold itself up between appropriate supports. Copperweld™ antenna wire, consisting of a steel core with a thin coating of copper, is strong and stretches very little. Number 14 or even no. 16 wire is good enough for spans up to about 150 feet. If you use hard-drawn copper wire rather than Copperweld, you will need to use a slightly larger-diameter wire, such as no 12, especially for long runs. The antenna wire may be insulated, but stranded wire is not recommended due to the fact that the stranding may affect the wire's r.f. characteristics, making it resonate somewhat off the calculated frequency. Use high-quality glass or porcelain insulators.

There is no substitute for "wire high in the air." Get the antenna up as high as practical, at least 25–30 feet; a height of at least 1/8-wavelength is usually recommended. The high-current center portion of the antenna, especially, should be kept away from obstructions such as buildings, power lines, metal surfaces, and the like. The transmission line should be kept at right angles to the flattop for as long a distance as is possible. No particular precautions need to be taken with



Specially-designed lead-in tube provides good protection to cables run through walls up to 13" thick. End-mounted grommet seals out weather. (Photo courtesy Radio Shack)

coax, but twinlead and open-wire lines must be carefully routed to avoid close proximity to other objects.

Rope, plastic clothesline, or wire can be used for halyards. If wire is used and the supporting spans are long, it's a good idea to break up possible resonances in the halyards with small egg insulators to avoid unpredictable effects on the antenna's operation. Also, recognizing the fact that it probably will be necessary to raise and lower the antenna several times during checkout and adjustment, it's a good idea to install pulleys on the supports to enable easy up-and-down maneuvers. The pulleys will also make it easy to lower the antenna during severe weather conditions.

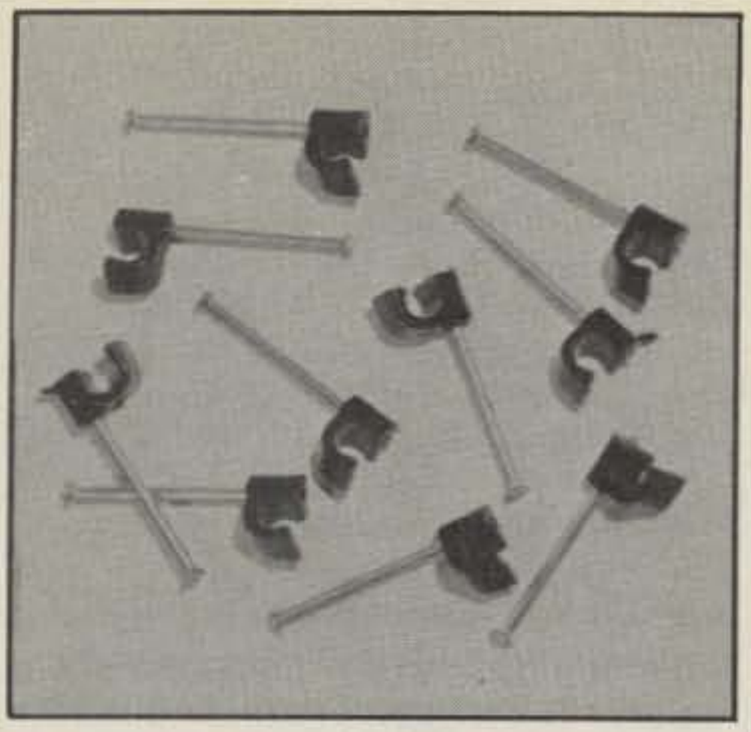
Tweaking, Tuning and Troubleshooting

If installed properly and according to formula, the dipole should work "as advertised" with little adjustment required. However, nearby objects can have a significant effect on the resonant frequency, and in the case of paralleled dipoles, the interaction between the dipoles usually requires adjustment.

Impedance bridges, antenna noise bridges, or grid dip oscillators can be used to determine antenna resonance and feedpoint impedance. However, for ordinary dipole installation, this kind of precision is not necessary. You can use a good s.w.r. bridge at the transmitter to effect tuneup.

Adjustment is easily accomplished by measuring the s.w.r. at various frequencies above and below the desired center frequency, and tabulating or graphing the results. The point at which the s.w.r. is lowest represents the resonant frequency.

Once the resonant frequency of the antenna is determined, the antenna can be trimmed in length until the minimum-s.w.r.-point coincides with the desired operating frequency. If you have cut the dipole slightly longer than formula length, the initial resonant frequency should always be *lower* than the desired operating frequency, so



Insulated coaxial nail clips allow securing of small-diameter coax cable without deformation of the cable. (Photo courtesy Radio Shack)

that the antenna will need to be shortened to resonate where you want it.

How much do you shorten the antenna on each "lowering"? Knowing the point of minimum s.w.r. and the desired operating frequency, then subtracting the two, gives you the total frequency change required. The effect of your snipping forays increases as frequency increases, roughly as follows:

80 meters — 1.5 kHz/inch
40 meters — 9 kHz/inch
20 meters — 36 kHz/inch
15 meters — 80 kHz/inch
10 meters — 142 kHz/inch

Make length adjustments in small increments, especially on the higher bands. It's a lot easier to take more off than to add some!

When working with multiple dipoles, start with the longest one first and work upwards in frequency. Once adjustment is complete, go back through the bands, one-by-one. A second set of adjustments may be required. Keep in mind that the interaction between three or more paralleled dipoles may make fine-grain s.w.r. adjustment a very frustrating affair. To avoid getting an ulcer, consider the antenna adjusted if average s.w.r. is below about 2.5:1.

Next month, we will conclude our discussion of dipoles by considering several variations, including vertical dipoles, Vees, slopers, bazookas, Zepps, and other antennas of the dipole family. See you then.

73, Karl, W8FX

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(Source material and an extended discussion of the antenna topics covered can be found in the references listed above).

NOTE: Some of the antenna subjects we touch upon are extremely broad in nature, a prime example being that of the dipole. No column could adequately cover the field—we'll always just be touching on interesting but deep areas fruitful for investigation. So, from time to time, we will print bibliographies of related articles we have come across in our own research. We'll list any source we feel you, the reader, will find useful—whether it be *CQ, QST, 73, Ham Radio, Ham Radio Horizons, Popular Electronics*, a CB magazine, or handbook. And we'll include the older reference sources, too, if the material isn't outdated. Not being in a position to furnish article reprints, we ask that you try your local library, radio club, or the publishers for back issues.

It's not always the "how" but the "why" that's interesting. W2JTP gives us some basics on the RTTY local loop that will make the "how" easier to understand.

The RTTY Local Loop

BY BYRON H. KRETZMAN*, W2JTP

For the radio amateur to be able to hook up his teleprinter machine to receive, some understanding of the basics of radioteletype reception is desirable. In this article some of those basics will be discussed, and, in particular, some of the reasons behind the actual connections to the machine.

Let's look at fig. 1, the simple d.c. circuit which connects the machine to the radio equipment. For the sake of establishment of convenient parameters we will assume that the machine is a teleprinter with its receiving selector magnet having 200 ohms d.c. resistance. We will also assume reception of the Baudot code at 60 w.p.m. Looking at the basic circuit, we see that it is a series circuit. The box labeled **TU** is the receiving converter, demodulator or terminal unit (TU), whichever term catches your fancy. The station receiver feeds the TU, usually with **mark** and **space** audio tones. The output of the TU, a switching transistor or polar relay contacts[1], keys the loop current on for *mark* and off for *space,* operating the selector magnet in the teleprinter (TTY) machine. This is a simple on-off "telegraph" circuit, called a *neutral* circuit. The selector magnet, in conjunction with a selector mechanism in the machine which determines which character is received, releases the mechanical motor-provided force required to move the typing bars of the machine. It is the selector magnet which must follow the coding pulses keyed into the local loop by the TU.

Teleprinter Machine Considerations

Remember, the teleprinter is a mechanical device, controlled by the selector magnet. It was designed to operate on d.c. land-line "telegraph" circuits using the start-stop Baudot code, seven units to a character. Each unit, called a pulse, is either a *mark* (current flowing) or a *space* (no current). Each unit is 22 ms long except for the last (stop) pulse, always a *mark,* which is 31 ms long. The first pulse of a character, called the start pulse, is always a *space,* by the way, because the machine is stopped on *mark* at the end of each character.

The pulse train for the letter "R" is shown in fig. 2. While the mechanism of the machine only requires 20%, or 4.4 ms, of each selecting unit, it is not difficult to imagine how these short pulses can get shortened, lengthened and moved in time over long radio transmission paths, and, under the conditions of a worn machine or a machine, not in good adjustment.

The teleprinter machine has a readily accessible adjustment, called a **range finder,** to enable the 4.4 ms selecting interval to be set mechanically in the middle of the received pulses. Adjustment, called **orientation**, is simple. The range finder is calibrated 0 to 100. Upon reception of a string of RY's (the closest to reversals), the range finder is moved up and down to where errors are printed. A perfect machine will have an operating *margin* or range of 10 to 90. The range finder would then be set to 10 plus 90 divided by 2, or 50, to put the selecting interval in the middle.

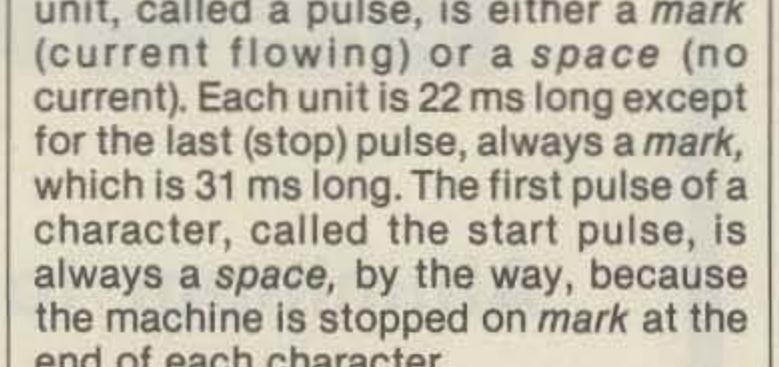


Fig. 1- The local loop teleprinter receive circuit.

Local Loop Considerations

Getting back to fig. 1, you will see a resistor **R** of 1,800 ohms, and a 120-volt "Battery," actually a rectifier-type of power supply. As per Ohm's Law, the selector magnet current is therefore 12 volts. Naturally, you will ask, why are we throwing away all that power in the 1,800 ohm resistor? Why not use a low-voltage supply, like 12 volts, and eliminate the resistor? The answer lies in the *time* required for the selector magnet to operate.

A selector magnet has a large inductance, perhaps 4 Hy. For the sake of this discussion let us consider the selector magnet as a 4 Hy inductance in series with a 200 ohm resistor. Now, when "Battery" voltage is applied to this series circuit the current will not reach maximum (60 ma) instantly but will approach it exponentially, reaching 63% of the final current in a time equal to L/R in seconds. (L/R is the "time constant.")[2] With a 120-volt "Battery" the time constant is 2 ms, short compared to the 22 ms pulse length.

Fig. 3(A) is an approximation of the current vs. time in this circuit. Note how rectangular this wave form appears. It gives the selecting interval some space (margin) if the received pulse moves around.

Now, suppose we eliminate the resistor R and apply a "Battery" of 12 volts to give us the "required" 60 ma across the selector magnet coil. L/R now gives us a time constant of 20 ms – a large, large, part of the 22 ms pulse.

Fig. 3(B) is an approximation of the current vs. time in this low-voltage cir-

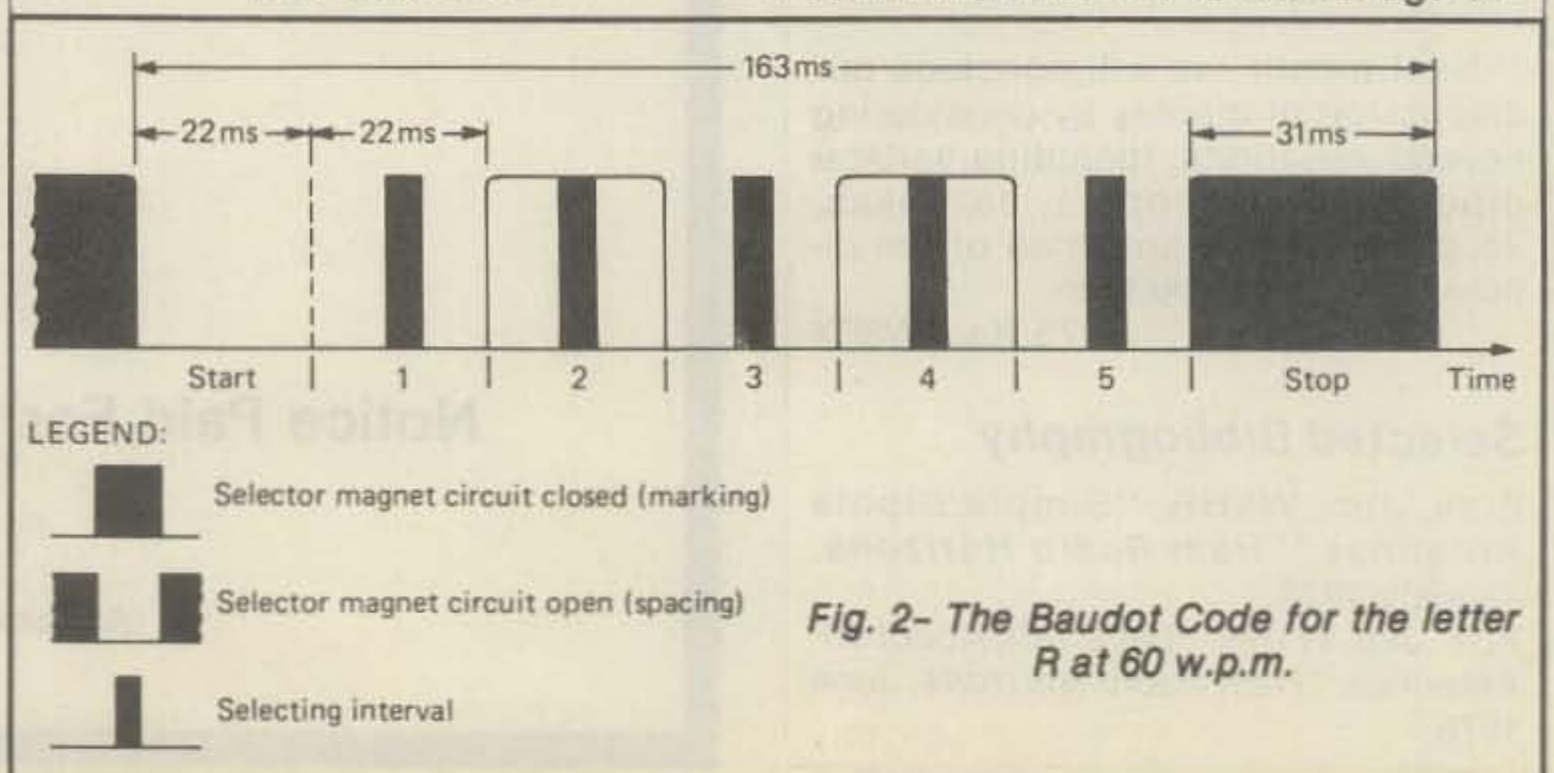


Fig. 2- The Baudot Code for the letter R at 60 w.p.m.

**431 Woodbury Road, Huntington, N.Y. 11743*

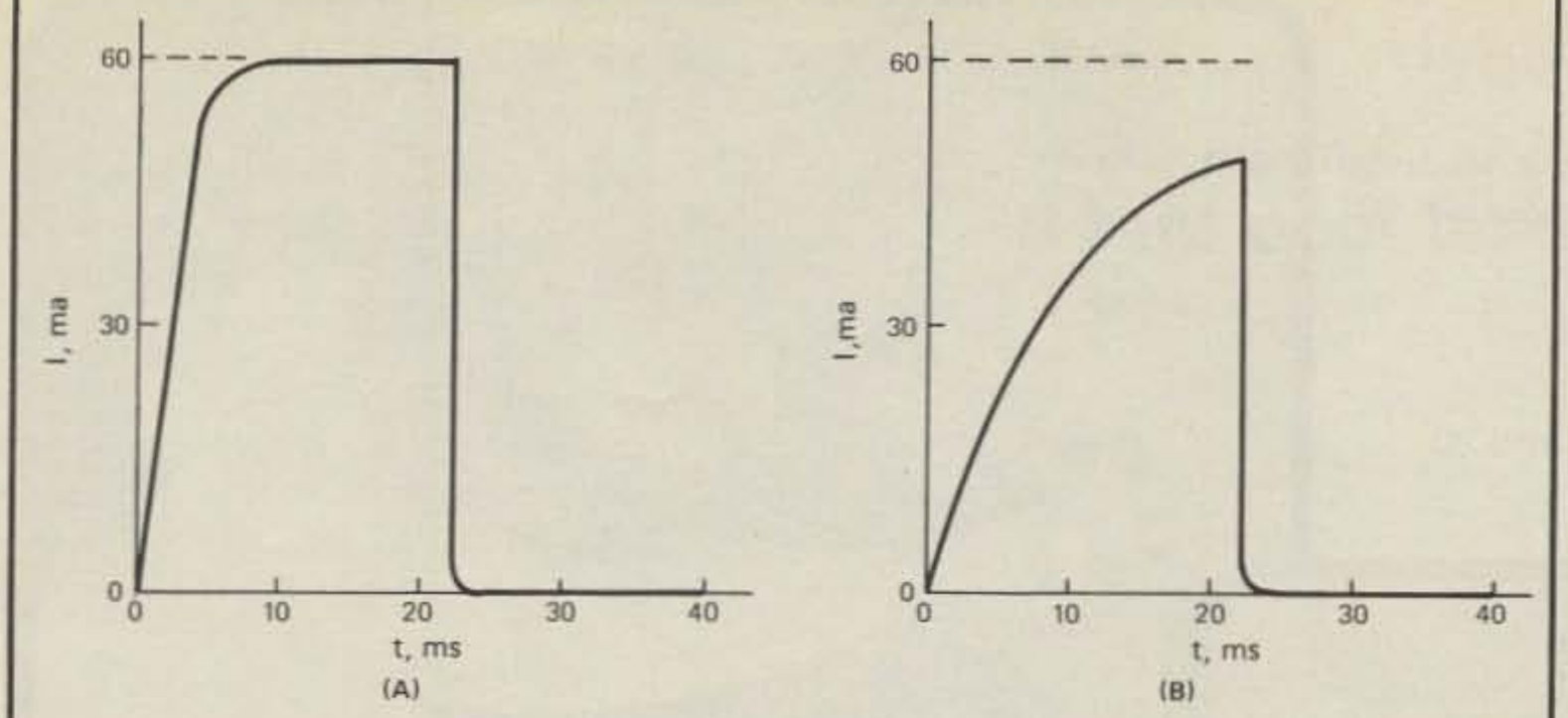


Fig. 3– (A) The loop current with a 120-volt battery during one Mark pulse. (B) The loop current with a 12-volt battery during one Mark pulse.

cuit. Not much room for the pulse to move, is there? It isn't difficult to see why it just doesn't make sense to use a low-voltage local loop "Battery."

Some comments are in order to explain why a 5,000 ohm resistor is usually connected directly across the selector magnet in the machine. This resistor slows the decay of current in the selector magnet, at the start of a *space* pulse, giving a time constant L/R (4/5,000) of 0.8 ms, considerably shorter than the increasing time constant, and of negligible length compared to the 22 ms pulse. The resistor also partially absorbs the "back e.m.f." produced across the coil when the current is suddenly disconnected. This voltage is equal to the inductance (4 Hy) times the rate of decrease of current. This relatively high voltage, called "inductive kick," can cause an arc across the contacts of a polar relay if used. If a transistor is used to key the local loop, this high voltage appears across the transistor and could have a catastrophic effect.

Fig. 4 is the equivalent circuit of the local loop with the TU switching transistor, or relay contacts, represented as *SW*. Now, according to circuit theory[3], when *SW* is opened (time t = 0), the "back e.m.f." voltage *v* which appears across the selector magnet is

$$E\frac{R_1}{R}.$$

For our chosen parameters this is

$$12\left(\frac{5000}{200}\right)$$

or 300 volts. Because this "back e.m.f." is of reversed polarity, in respect to the original voltage applied, the peak voltage across *SW* is 300 plus the 120 volts of the "Battery," or 420 volts! Without the 5,000 ohm resistor the "inductive kick" could be dangerously high. If polar relay contacts are used at *SW*, they will badly arc, damaging the relay. A transistor could be destroyed.

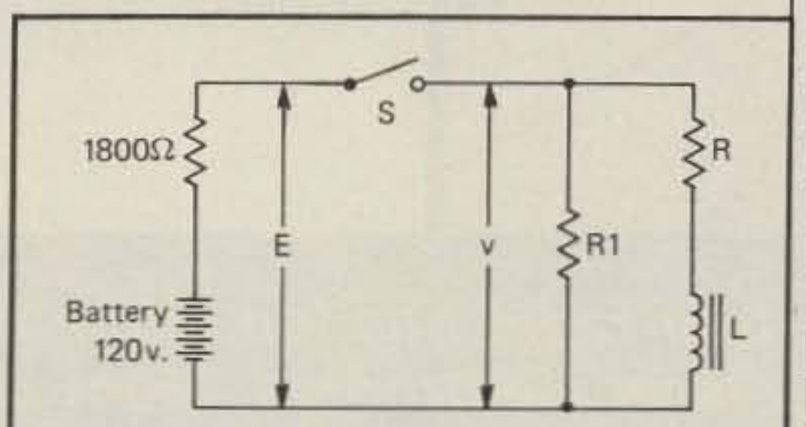


Fig. 4– The equivalent circuit of the local loop.

Suggestions

In order to provide as much margin as possible for the selecting interval, use a local loop power supply that gives you 120 volts under a 60 ma load. It needn't be super-regulated – a simple bridge rectifier and choke input will suffice. (Do *not* use the a.c. line as a source – use a transformer!) The series resistor (1,800 ohms in our circuit) should be of the adjustable type so that you can set the loop current exactly to 60 ma even if your loop supply is not exactly 120 volts.

Make sure that the 5,000 ohm resistor is connected directly across the selector magnet at all times. If you use a switching transistor to key your local loop, be sure that it will withstand the peak voltage encountered.

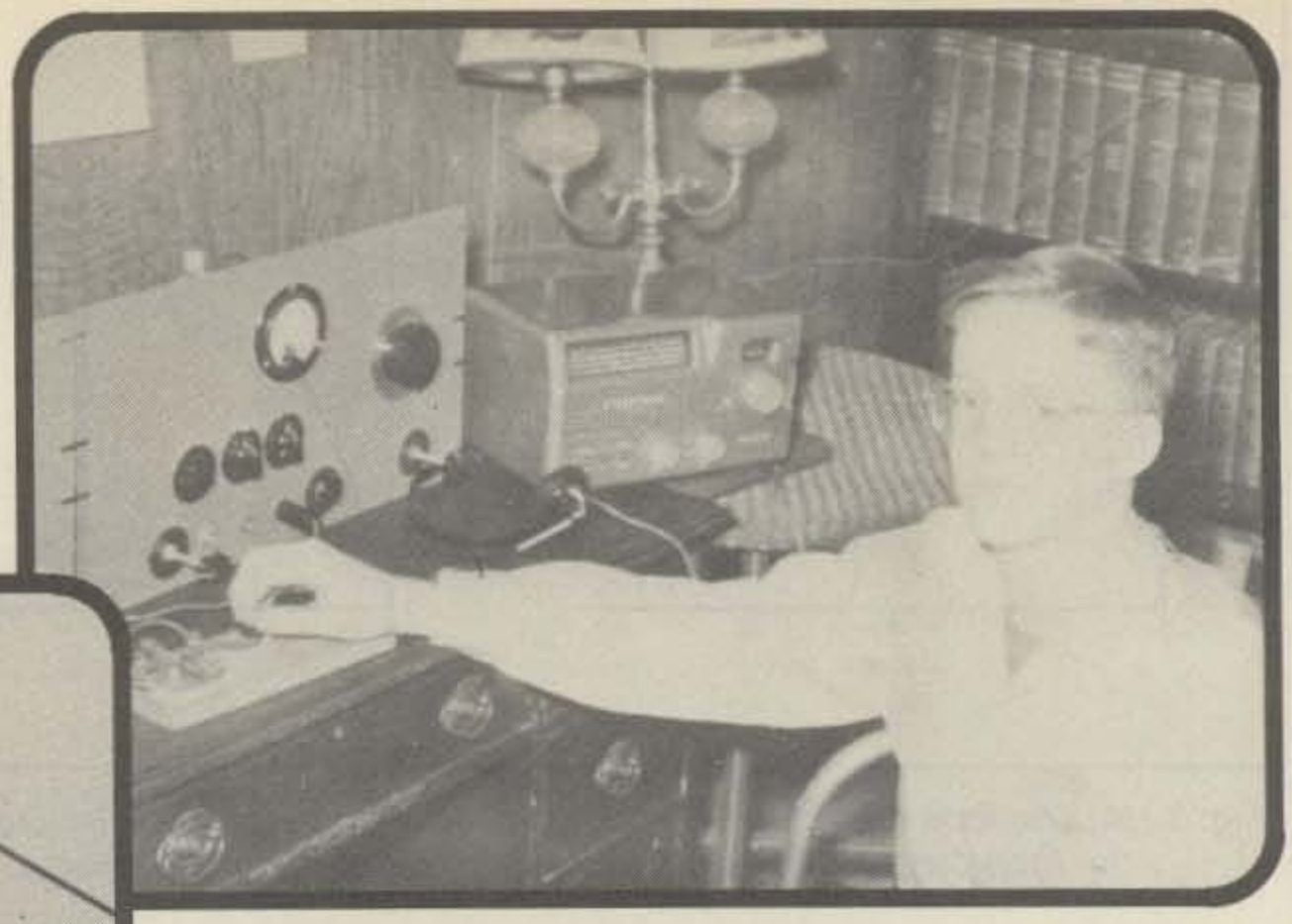
As a last suggestion, in the interest of keeping down radiated noise from the loop keying, use shielded wire and *don't* ground any part of the actual loop circuit.

References

[1]Kretzman, B. H., "An Improved RTTY Converter," *CQ*, April 1958, p. 42.

[2]Mueller, G. V., "Introduction to Electrical Engineering," 2nd Edition, McGraw-Hill, p. 413.

[3]ibid, p. 421.



The author with his first amateur rig, a National SW-54 all-band receiver and a homebrew 807 transmitter, in 1953.

The author on a tower with 10 and 20 meter beams in 1955.

Amateur radio has led some of us into very active careers in electronics. Many of us can relate to W1FK's start in amateur radio and many newcomers today are experiencing a form of it now . . . all with the same excitement.

Amateur Radio . . . A Hobby For All Seasons

BY C. STEWART GILLMOR*, W1FK

I first became interested in radio about 1947 as a Cub Scout, when I got a Morse Code buzzer and built a crystal set. Later, as a Boy Scout, I built a three-tube regenerative receiver and earned a radio merit badge. While working on the Scout badge I learned something about the existence of amateur radio. It seemed very exciting to be able to talk to other persons around the world from your own room. One day my dad told me that his cousin Charles, who lived in Independence, Missouri, was an amateur operator (W0HKC). I was an eighth grader at the time and my first visit to cousin Charles' shack was like a fantasy vision. His car had a mobile rig, and his basement study seemed to be full of exotic gear, including a "bug" key, a chrome-plated microphone, and several radios with more meters and dials than I had ever seen.

The result of this visit was that one Saturday morning I went from my home in Grandview, Missouri down to Burstein-Applebee Radio on McGee Street in Kansas City. There I bought the ARRL "how to" manuals—"How to Become a Radio Amateur," "The Radio Amateur's License Manual," and "Learning the Radiotelegraph Code"—which cost 25¢ and 50¢ in those days. Armed with these I studied the code and radio theory and tried to listen to code on our RCA Victor record player and radio console. Unknown to me, one Fall day in 1952 my dad went over to Burstein-Applebee on his lunch hour and talked to a salesman, Clyde Fritz, W0DXE about an amateur receiver for a beginner. So on Christmas Day 1952 my folks surprised me with a National SW-54 all-band receiver. This fixed me for good and within six weeks I went to the Federal Building in Kansas City, went up to about the 2000th floor, and stepped off the elevator into a large, nearly deserted room. I remember the floors were highly polished, there were several long tables with chairs, lots of ceiling lights, and offices off to the side. I

* *Spencer Road, Higganum, CT 06441*

GRANDVIEW, MO.

WNØODE

Radio _____ Receiver _____

Confirming QSO

Xmtr _____

On _____ Remarks _____

_____ S. T. _____

Sigs RST _____ Pse QSL Tnx Vy

STEWART (STEW) GILLMOR, JR.

The author's first QSL card, circa 1953, with the Ø printed from a linoleum block.

for a Novice radio license and that I thought maybe..."Well," he said, "You're here at the wrong time, but sit down anyway, put on these earphones, and listen to this code." He played it through once; the paper tape slowly ran off the machine and onto the floor. Then he said, "Now, this time, write it down." A few minutes later, after looking at my scribbled words, he said I'd passed and could take the written test. (I was later to learn that this wonderfully kind man was Clarence Bloss.) When Mr. Bloss told me I'd passed the Novice test I skipped out of the Federal Building and ran to the Greyhound bus station, so excited that I could hardly wait to get home to tell my folks. In those days, you had to wait about four months for your ticket to come through, and there was no such thing as instant upgrading.

In the meantime, I poured over catalogs and wondered what kind of transmitter I could afford to build. Finally, it appeared that my cousin Charles had a homebuilt 807 rig with an output of about 50 watts. It needed some modifications, and crystals and coils for bands other than 80 meters, but it worked. It was a three-tube rig built on an old TV-set chassis, with oscillator tube, buffer-multiplier, and final tube. So I was all set. I put my station up in our attic and ran 65 feet of 600 ohm open-wire tuned feeders out the window to a 130-foot-long end-fed wire about 25 feet off the ground. This antenna was known as a half-wave Zepp because it had been used on the German Zeppelin airships. I was now all set, with r.f. ready to spray all over our property, since I had no decent r.f. ground. The transmitter chassis and key jack were always good for an r.f. burn, helped no doubt by the 52 ohm coax piece I ran from the 807 output to the antenna switch and open-wire feeders. Doubtless this scenario is familiar to many of you—that is, the probable consequences of a 14-year-old who knew all about d.c circuits and nearly nothing about r.f.

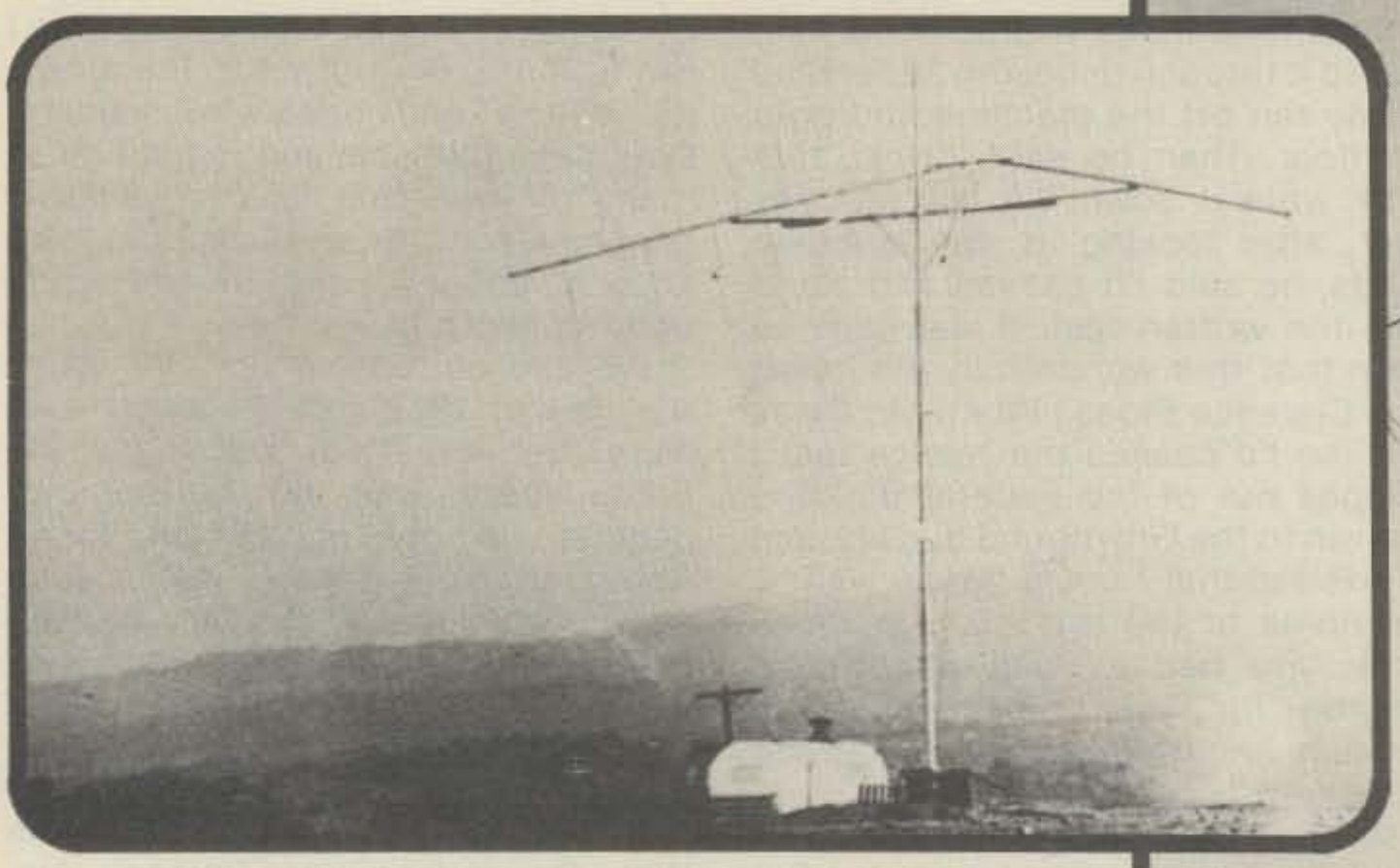
We had gotten our first TV set in the Fall of 1952 and its rabbit ears were just one floor below my rig. Since there was no bottom nor cabinet on my rig except for a fibreboard front panel, I was a good source of local TVI. Our nearest neighbor was about 200 yards away, and no one seemed to be bothered save for my own family. No operating during "I Love Lucy," "Mr. Peepers," and the Saturday night "Rassling With Russ" from the Chicago Amphitheatre!

I had great respect for OOs (Official Observers) and for FCC Inspectors, who I suspected monitored each amateur's every word. I scrupulously kept the rig off the air until the day in May 1953 when I received my Novice call, WNØODE. Once 80 meters opened up at night, the little National SW-54's quarter inch of Novice band on the dial kept my beginner's ear from being able to read anybody, since I heard about six signals at a time. My first several evenings were a great disappointment, since I didn't succeed in working anybody. I then decided my best chance was to get up at dawn and try early mornings. This paid off; my first QSO was with "Red" (WØANK) in Diagonal, Iowa. I was so excited I barely got any of the QSO, but Red sent me a card saying I was 589. Red was using a Harvey-Wells TBS-50 transmitter with 40 watts out of a single 807, and a Hallicrafters S40B receiver to a half-wave off-center fed wire.

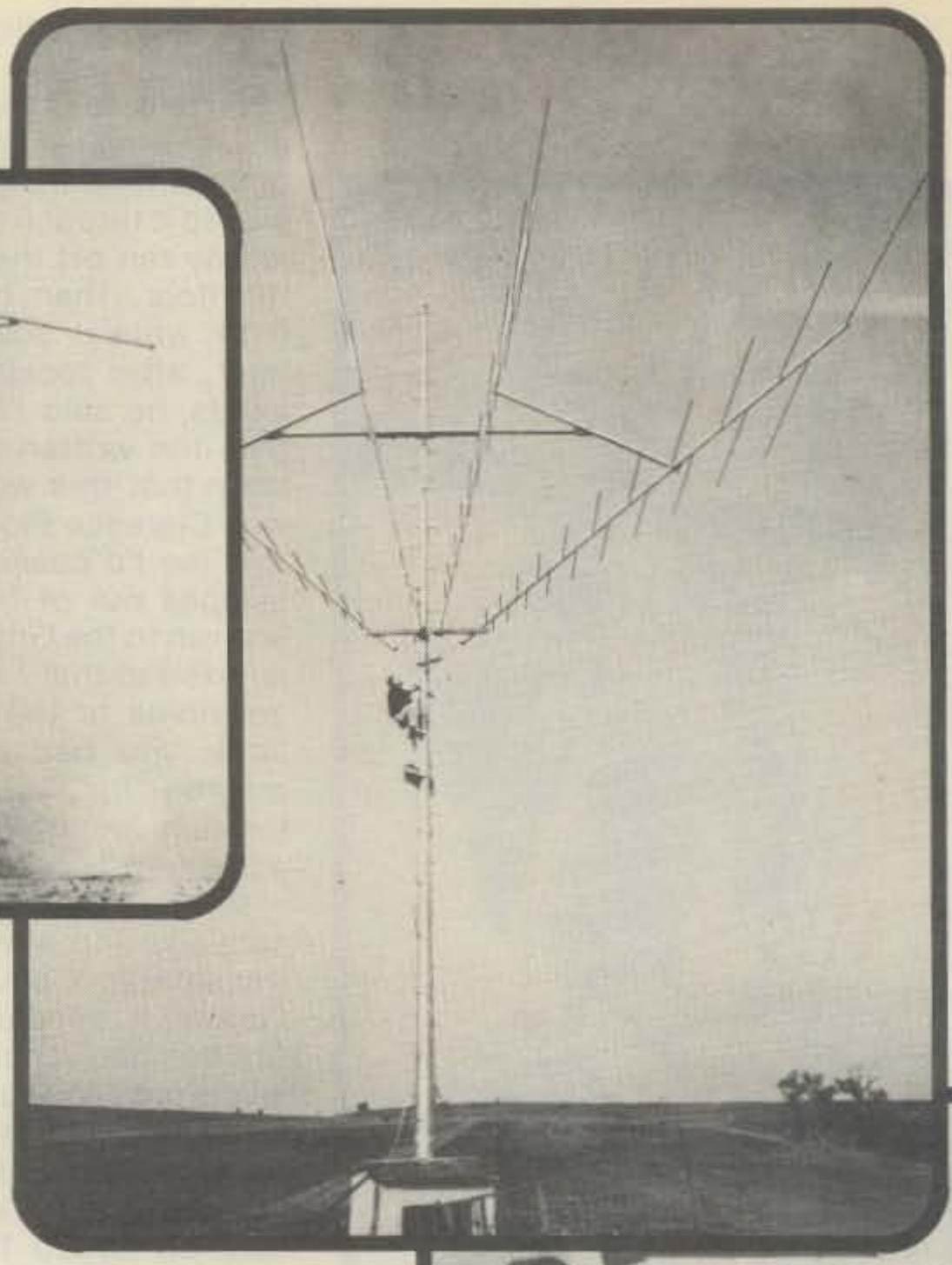
I hadn't received any QSL card samples through the mail and I didn't realize there were commercial QSL printers, so I got our grade school principal to print some QSL cards for me on a little press in his basement, but I had to carve the zero-slash (Ø) sign out of a piece of linoleum block for him. In an attempt to improve my reception, my cousin loaned me a receiver he'd built, but it worked no better for me than it did for him and I went back to the SW-54. I put in a Summer working mostly 80 meters, although I occasionally tried 40 meters, the only other h.f. band available at that time to Novices. Novices were, however, allowed phone privileges on 2 meters. For a few days at a Boy Scout Jamboree I got to use

was in the Kansas City District Office of the FCC, I was there on the wrong day, and I was terrified!

A man appeared after a few minutes and asked me what I wanted. Since I had the ARRL code and license manuals in my hand, it was pretty obvious why I was there. I said I had heard that one could take the test



The 84 element, 4 boom log periodic array and trailer, with the antenna in operation, 1960.



The log periodic array with the antenna in the storage position.

a 2 meter Gonset Communicator, but talking over two or three miles didn't seem too exciting. So in the Fall I planned to get ready for my General Class exam.

To prepare for the General Code test I debated whether or not to enroll in the Candler Code System course. Ted McElroy was the world champion at receiving c.w. (75.2 w.p.m. in a 1939 test in North Carolina, so the ads said) and he endorsed the Candler System. I figured that I was okay at the code, and so instead of the Candler course I rented a spring-wound paper tape machine for one month from the Instructograph Company of Chicago. This machine could produce code at from 3 to 40 w.p.m. Now this was probably a pretty good idea, but it took so long for the machine to arrive that I used it only one day before I went down again to see Clarence Bloss at the FCC office. I remember Mr. Bloss really had to stretch to find 13 words in a string. In fact, I lacked one letter of having the minimum 13 word string. I had the word "BE—R." Bloss said to me, "Well, what letter do you think might go there?" I first thought of BEER but then decided the government probably wouldn't put the word beer into an exam, so I said "BEAR." Fortunately, I was right! I barely snuck by the code but I did okay on the written part, except that I think I missed all the schematic questions. (In those days, about 10% of the questions involved actually drawing circuit diagrams on the exam sheets.)

I had been earning money working as a soda jerk at Lyons Drug Store in a nearby hamlet called Hickman Mills. One day, while goofing up on his order for a cherry coke, no ice, I met Bill, (W0ZZV), who invited me over to see his shack. The result was that Bill loaned me a homebrew single-band 807 rig for 40 meter phone. Bill usually operated a beam on 20 meters but he also loaded his steel tower and got onto an evening farmer's net on 160. I never worked 160 in those days, but daytime 40 meter AM phone was about the same as nighttime 160 and I really enjoyed gassing away on 40. Bill's loaned rig was crystal controlled.

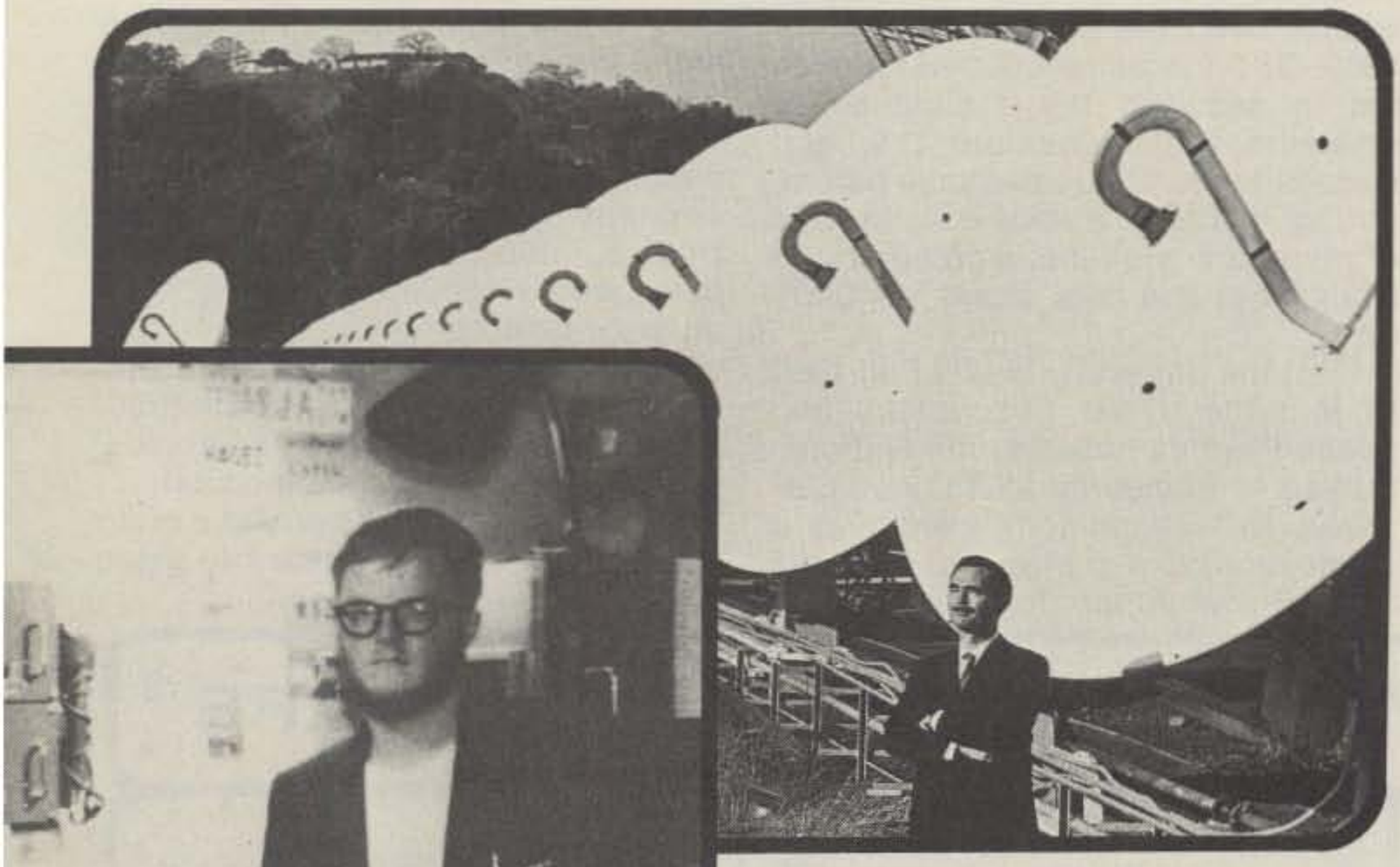
For those of you new to amateur radio it might seem difficult to believe today, but 25 years ago not only were Novices required to operate crystal-controlled rigs, but most other amateurs operated with crystals also, regardless of license. V.f.o.'s were sold separately, almost the way "linears" are sold separately today. Along the way I tried to build two v.f.o.'s, but neither ever worked quite right. At least part of this was my fault. I saved my money and the Viking Mobile V.F.O. Kit was the least expensive I could find. The trouble was that the mobile v.f.o. was about one-half as big as other v.f.o.'s and the only soldering iron I owned was a 200 watt job that was almost as big as the v.f.o. box. I *really* made a mess of it trying to solder the miniature tube sockets. Also, I had never heard of tools such as "solder suckers," etc. But it didn't matter all that much for, living in Missouri, I was not far from the center of the quartz crystal industry. Dozens of little outfits sold surplus crystals that oscillated in fundamental mode at frequencies up to about 10 MHz. Most amateurs purchased them in FT-243 holders, either

playing safe and ordering them several kHz inside the band edges, or regrinding them.

Fooling around with crystals was fun and you had less than a buck to lose if you ruined one. Several methods of crystal grinding existed but most people followed instructions in the ARRL handbook. First you unscrewed the three screws on the cover of the little crystal holder, removed the crystal blank, and marked one corner with a pencil. Then you placed some grinding powder, or even toothpaste, on a piece of glass. Next you placed the crystal on the glass, put your index finger on a corner of the crystal, and proceeded to make several "figure eight" motions with each corner of the crystal. After doing the four corners on each side, this would suffice to raise a 7 MHz crystal, for example, several kHz in frequency. You could even lower the frequency a little by rubbing the corners with a lead pencil. Too much of this fiddling, however, and you would end up having a crystal with uneven edges and corners and it would stop oscillating. 80 meter crystals doubled into the 40 meter band. 40 meter crystals doubled into 20 meters and sometimes tripled into 15 meters. Some people used 10.5 MHz crystals to double to 15 meters. Being "rock-bound" wasn't too much of a handicap since most people called CQ and then listened up and down the band 10 kHz or so. Transceivers were almost unheard of, and nearly everyone was working "split," as we say today.

My family later moved to Kansas City, and I eventually upgraded to a used National NC-183D receiver and a Globe King 400 watt transmitter. I put up 3-element beams for 10 and 20 meters. I caught antenna fever about then and my beams were the first in a long series of h.f. antennas which I would build over the years. I worked mostly 40 and 20 meters in those days. I totaled a meager 16 countries in confirmed DX but I was more concerned with getting all 48 states. I still had three or four states to go for WAS when I sold my gear to go to college.

Once I got to Stanford University in California I started to hang around a part of the electrical engineering department called the Radio Propagation Lab (later called the Radioscience Lab). Several of the professors there were amateurs, the most famous being Mike Villard, W6QYT. Villard was instrumental in putting the first hi-power amateur s.s.b. transmitter on the air and was the inventor of the famous "Select-O-Ject" audio filter circuit, which the National Company sold as an accessory and also put into some of their receivers. Owen Garriott, the first amateur/astronaut, was a graduate student there when I was a student. Besides Villard, there were several other interesting professors. Ronald Bracewell was in the midst of constructing a 32-dish cross-shaped interferometer antenna array on centimeter wavelengths to measure microwave radiation across the sun's disk each day. I worked for Bracewell for a time helping clean earwig insects out of the waveguides with a long pole and a rag.



The 32-dish solar radio antenna array at Stanford University in California in 1968. Professor Ronald Bracewell, the designer, is in the foreground.

The author (center) and two Soviet friends in the shack, UA1KAE, at the Soviet Antarctic station in Mirnyy in 1961.

The secret to Bracewell's 32-dish array was transmission line theory and the use of Fourier analysis, a fascinating but difficult mathematical technique that is part of all engineering and physics majors' curricula today. My work, though conceptually not too difficult, was important, since an apparent change in signal from the array could be, for example, a change in noise from the sun or noise interference from a local ground source. Or, it could be due to a change in the dielectric constant within the waveguide caused by a family of earwigs strolling down the inside on their way to a nest!

The experience of being an amateur put me in good stead with Bracewell as it did also when I got a part-time job at Stanford Research Institute, where Professor Allen Peterson of Stanford was a consultant. At SRI I got to build lots of gear and antennas, including 10 meter yagis flown on a large airplane, v.l.f. antennas, and other interesting projects. While working for SRI one summer as a student I was sent to the Azores Islands. While there I noted strange (to me) noise phenomena on the h.f. bands. Upon my return to Stanford, Professor Peterson suggested I had observed some solar radio bursts and said I should look into it further. To make the story short, Professor Bracewell and a colleague, Professor Von Eshleman, helped me with advice and materials when I decided to build a radio astronomy telescope for solar and Jupiter radio studies in the frequency range 20-60 MHz. Villard loaned me two 50 foot towers and I started to build a large 50 foot by 100 foot corner reflector at Bracewell's solar astronomy field site. I designed the corner reflector feed to receive circularly polarized waves, so my corner reflector mesh had to have both horizontal and vertical wires. I didn't have any mesh so I started to solder copper wire, joint by joint, to make a

mesh with squares about one-half meter on a side. (Reflecting surfaces on such antennas, if not solid, should have mesh no larger than 1/16 to 1/10 wavelength to keep losses low and front-to-back ratio high.) When the mesh was well along in construction, it was destroyed by dairy cows which were allowed to roam over the Stanford field sites. I can still remember coming up one morning and seeing a giant tangled ball of copper wire which a cow had dragged all over the field.

Professor Eshleman bailed me out of this by offering me the use of an old trailer and a rotating steel pole which had formerly been used for meteor radar studies. Since I now had the possibility of building a moveable antenna, I designed a log periodic array to go along with my sweep receiver—oscilloscope—film camera setup. I cajoled various student friends to help me. These were usually amateurs who simply couldn't resist helping on antenna projects. Somehow the chance to help cut off the top of a 6-inch steel pipe with a welding torch while 40 feet in the air seemed irresistible. Professor Eshleman mentioned that, instead of my making a large array from scratch, he would loan me some extra parts left over from a big log periodic string array he was constructing for solar radar studies. I gladly accepted his offer. I extended the steel pole from 40 to 60 feet in height and added a large crossbar. I then joined four aluminum booms each with 21 elements to form a vertically polarized, 84 element log periodic array moveable in azimuth by motor and in elevation by hand pulley and ropes.

This array received well except near 26 MHz. This was attributed to coupling of the 26 MHz quarter-wave element sections, which were positioned extremely close to the steel pole. The antenna had approximately a 13 db gain from 20 to 100 MHz, and beamwidths of 40 degrees in the E-plane and 60 degrees in the H-plane. Each of the four booms was 40 feet long. This tied in with amateur radio again when I used the array in the Fall of 1960. *QST* magazine cooperated with me in securing the assistance of amateurs in the western U.S. and Canada to monitor radio noise before, during, and after a solar eclipse. One of my fellow students worked on the analysis of this data after I left Stanford.

I left the university in late Fall 1960 to join the Upper Atmosphere and Space Physics group at the National Bureau of Standards at Boulder, Colorado. In this capacity I went as a guest ionospheric physicist with the Sixth Soviet Antarctic Expedition to Mirnyy, Antarctica, where I measured cosmic noise absorption at 30 MHz with a self-balancing receiver called a Riometer (See *73* magazine, June 1979). As in my previous jobs at Stanford University and at Stanford Research Institute, I am sure that my years of experience as an amateur helped me. There are many technical areas in which actual field experience is quite valuable. And amateur radio is a hobby in which one can gain this experience. For example, no one wanted to hire geologists in 1960, difficult as that may be to believe in 1980. Two of my friends, geology graduates, succeeded in getting good employment primarily because they were amateurs.

Young readers today might feel that ionospheric radio propagation and antennas don't offer the excitement they once did. Quite possibly true...but think of the other exciting areas into which you can be led by amateur radio: Solid-state electronics, micro-electronics design, noise and information theory, computers, environmental design (including consideration of TVI and other electromagnetic pollution problems), medical and space electronics, energy storage and transmission.... The list is *very* long and amateur radio can help you gain entrance into these areas.

K3WBH has come up with a winner on six. With a little bit of effort with simple tools and a spare weekend you too can be burning up the ether on six meters.

A Stacked Log Periodic Yagi For Six Meters

BY T.E. WHITE*, K3WBH

Now that the FCC is requiring better RFI-EMI techniques in TV set design, and good low pass filters are commercially available for transmitters, amateurs no longer have to fear 6 meters. Six has a lot of good E_s openings these days and it's a shame to miss the DX on account of your neighbors.

Here is a band-burner beam which will punch your signal out FB. It isn't small, and requires some experience in erecting skywire that will stay up, but the results are worth the effort.

This log periodic Yagi requires much less boom length for the same gain than a "straight" Yagi, is non-critical in dimensions, and will take power and show good performance over the whole band. It is designed to take advantage of standard lengths of material and can be assembled without a crew of professional riggers. There is nothing kinky about the feed system and no "tuneup" is required. The enter-

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Fig. 1- The 6 meter log periodic Yagi. Two of these are required to construct the antenna.

prising op can fool around with slight dimensional changes for a particular center frequency if he wishes, but it's not really necessary.

The array consists of 2 log periodic Yagis, each on a 23'6" boom, stacked 14' or so for good low wave angle, capture area, and convenient feeding. To make for easily handled lengths of material, the booms are made up of a central 5' piece with 10' lengths inserted into each end. Elements are telescoping so that pre-assembly of the inner sections on the boom can be done first, with these lengths held to 6'

Rather than a harness of wire, stacking tubes of telescoping diameters are used for ease of assembly and adjustment. A simple balun connects the feed line. Boom braces from above, not

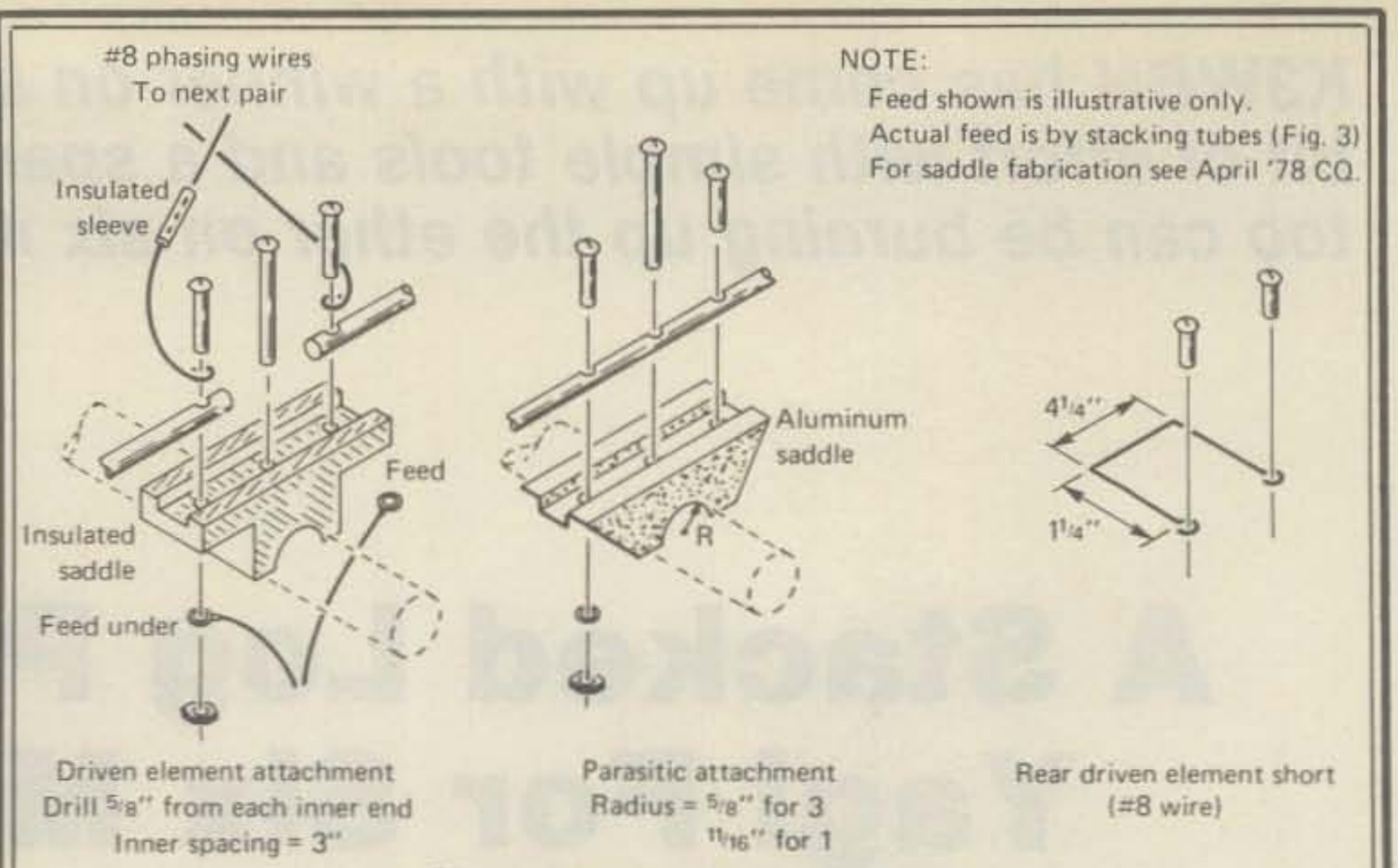

Fig. 2- Element to boom details.

BILL OF MATERIALS

REQUIRED	DIAMETER	LENGTH	FOR
1	1 3/8"	5'0"	Boom center section
2	1 1/4"	10'0"	Boom outer sections
4	1/2"	6'0"	Parasitic element center sections
8	1/2"	3'0"	Driven element inner sections
16	3/8"	2'0"	Outer sections – all elements
4	3/8"	4'0"	Stacking bars
4	1/2"	4'0"	Stacking bars
2	3/4"	8' and 9' approx.	Boom braces
4			Parasitic element mounting blocks – metal
4			Driven element mounting blocks – plastic

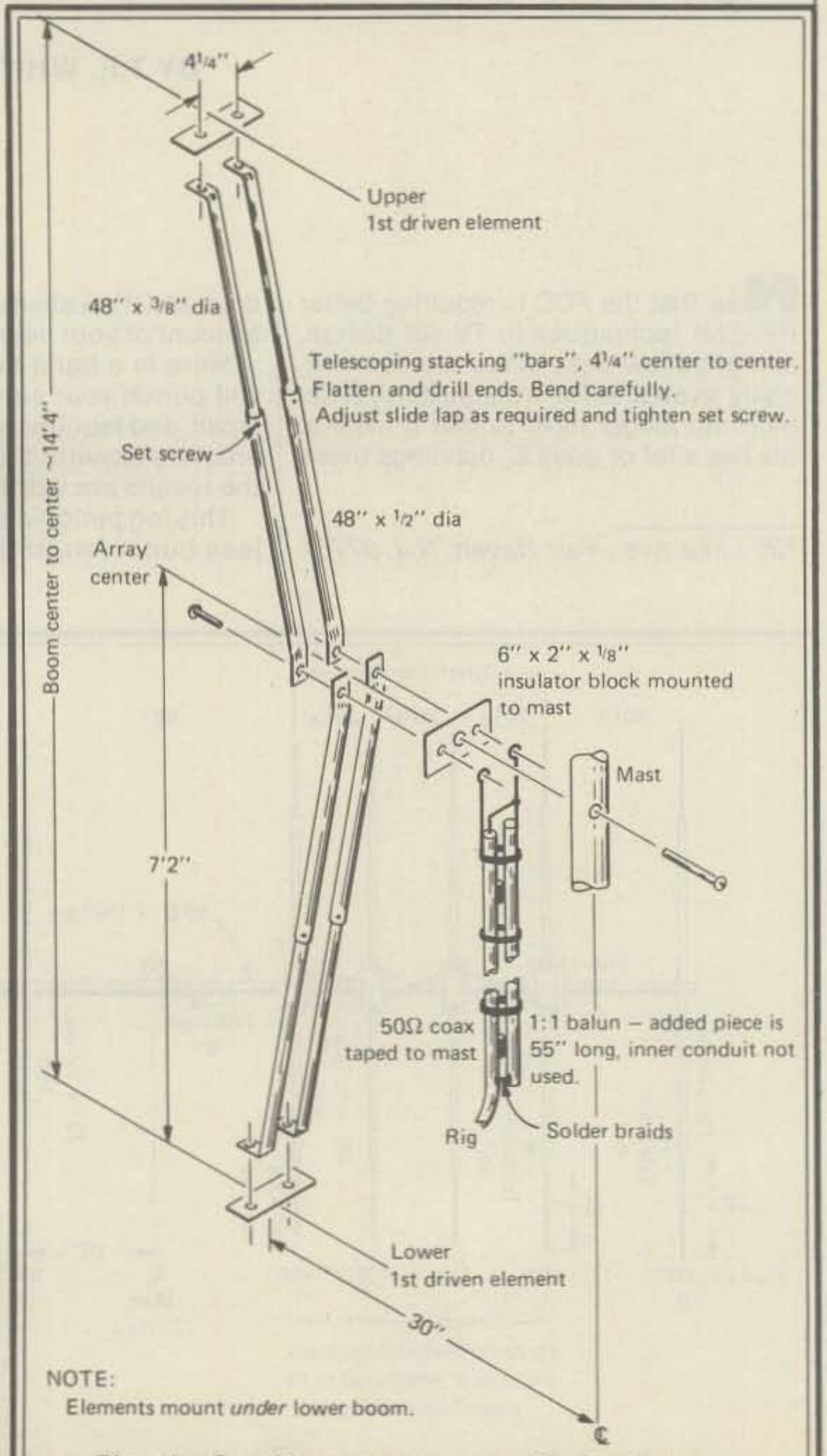

Fig. 3- Stacking details and feed system.

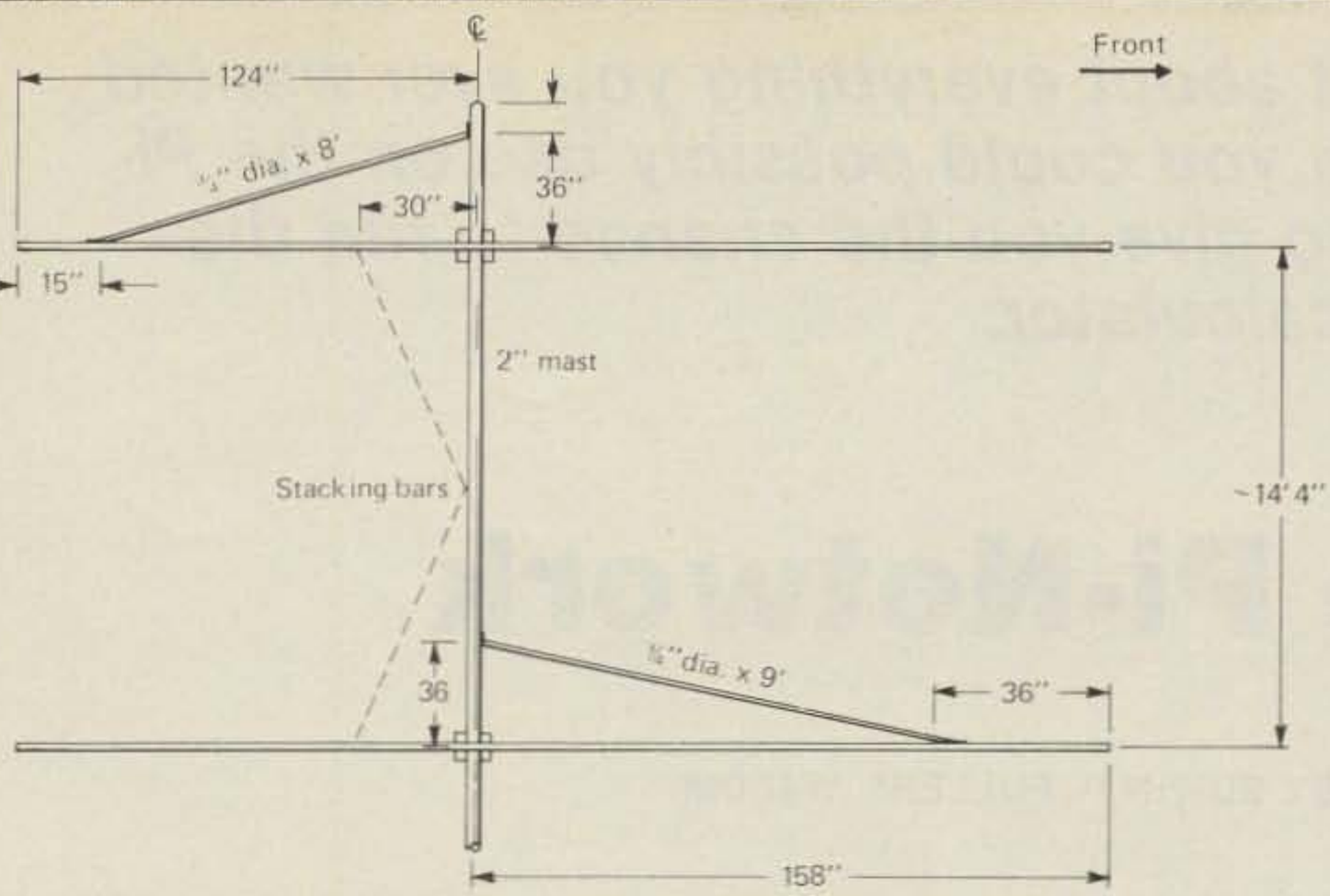

Fig. 4- Boom support system.

beneath (tension is always stronger than compression), support each bay.

Since this looks like a large TV aerial, you can tell your neighbors you put it up to watch Canadian (or Mexican) TV. In point of fact, this beam will bring in the low channels very well.

Be sure to operate with a good filter, such as the Drake TV 5200 LP, in the line. This will handle up to 200 watts of power, which, fed to the Super Six-Shooter, will result in an ERP of 4500 w, plenty for even not-so-good band openings.

Note that groups of tubing can be cut en masse to the same lengths. Don't stint on quality. Get 60-61-T6 seamless drawn, with wall thickness that accepts slip fit telescoping of the next 1/8" smaller diameter. And use stainless hardware exclusively, and large-diameter coax.

W4EDM presents just about everything you ever wanted to know or everything you could possibly use on the Pi-network. This will also give you the chance to run the parameters off your calculator.

The Pi-Network

BY EDWIN P. FULLER*, W4EDM

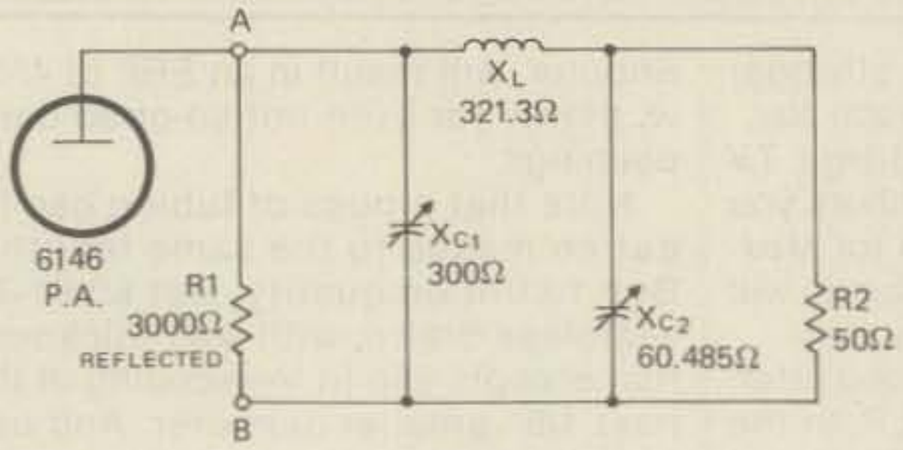

Fig. 1– The universal configuration for the pi-network in r.f. amplifier schematics.

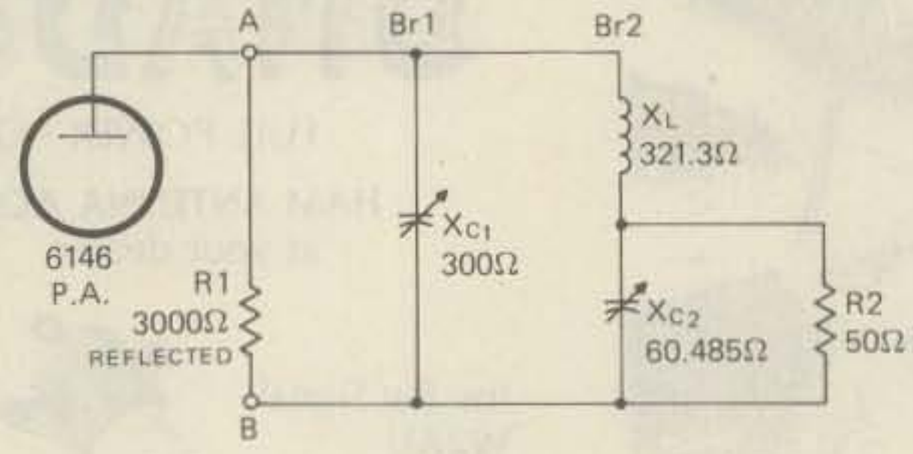

Fig. 2– Fig. 1 is redrawn to emphasize its parallel configuration.

While idly tuning across the forty and twenty meter phone and c.w. segments I was impressed by the number of operators in contact whose conversations indicated more than a passing interest in the workings of the pi-network. Quite obviously, these OM's were interested in technical talk. In fact, so heated did some of the discussions become, that verbal blows almost became the order of the day.

So, from the above beginnings, born from my eavesdropping on fellow amateurs, came the decision to write this article on the mysteries of the much used pi-network.

As an aid to the discussion, refer to figs. 1 through 5. Fig. 1 is the universal configuration for the pi-network in r.f. amplifier schematics. Fig. 2 is a redrawing of the first figure to show clearly that the pi-network is actually an a.c. parallel circuit consisting of branch 1, Br1, with a single capacitive reactance identified as X_{C_1}, whereas branch 2, Br2, consists of an inductive reactance, X_L, in series with capacitive reactance, X_{C_2}, and resistance R_2, which are in parallel. A parallel circuit, with at least one branch including series circuit elements, is called a *combination circuit*. Furthermore, in this instance, the circuit is also described as a parallel resonant circuit.

R_1, a reflected resistance, represents the load, R_L, that the tube's plate "sees" and R_2 represents the pi-network's output load, which is the transmission line/antenna impedance. In this case, R_2 represents 50 ohm coaxial transmission line. Ideally, both R_1 and R_2 are equivalent pure resistances containing no reactive components. We say *equivalent* because there are no physical resistors placed in the circuit.

For the purpose of illustration, assume that the tube symbol is that of a 6146 beam-power pentode operating with a d.c. plate voltage of 600 volts and a d.c. plate current of 100 mA (0.1 ampere). In computing the value of reactances X_{C_1}, X_{C_2} and X_L an N factor of 10 was used. Formulas for computing the reactance values of a pi-network include a factor N and are given on page 54 of The Radio Amateur's Handbook, 1977 Edition. The formula for R_1 appears on page 157, same source. This paragraph is for the benefit of those readers who would like to dig out pencil, paper and calculator to compute these reactance values for their own satisfaction. Newer editions leave this information out.

Now to get on with the main point—the mystery of the pi-network. Just how does it "step-up" the output impedance of 50 ohms (R_2) to 3000 ohms (R_1), the load that the tube's plate must see for maximum output power. Here is where figs. 3, 4 and 5 swing into action. And, of course, to bring it all to full light will require application of a few simple conversion formulas.

It should be noted that the resistance, R_1, has been removed from its position between terminals A and B in figs. 3 and 4. Why? Because in solving the mystery, we must determine the impedance between terminals A and B. (Note: R_1 will reappear in our solution

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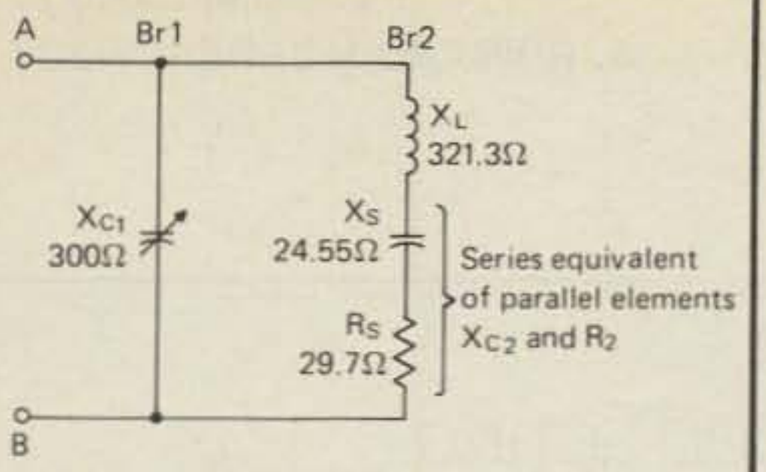


Fig. 3- Parallel elements X_{C1} and R_1, of fig. 2 are redrawn to series equivalents, X_S and R_S, to aid in solution of the network.

of fig. 5. Since fig. 5 is the equivalent of figs. 3 and 4, the impedance between A and B of fig. 5 will also appear between terminals A and B of figs. 3 and 4.)

We do know the value of this impedance. Our target is 3000 ohms (resistive). The formulas and figures will show mathematically how the values of X_{C1}, X_{C2} and X_L in fig. 1 will make the output load, 50 ohms, look like 3000 ohms to the tube's plate.

Next, refer to fig. 3, illustrating parallel elements X_{C2} and R_2 of fig. 2 reduced to their series equivalents X_S and R_S. The values of X_S and R_S are computed below.

Series equivalent of a parallel circuit—see fig. 3.

$X_P = X_{C2} = 60.485$ ohms and
$R_P = R_2 = 50$ ohms.

$$X_S = X_P R_P^2/R_P^2 + X_P^2 = 60.485 \times 50^2/50^2 + 60.485^2 = \frac{60.485 \times 2500}{2500 + 3658.4352}$$

$$X_S = \frac{151212.5}{6158.4352} = 24.5537 \text{ ohms.}$$

$$R_S = R_P X_P^2/R_P^2 + X_P^2 = 50 \times 60.485^2/50^2 + 60.485^2 = \frac{50 \times 3658.4352}{2500 + 3658.4352}$$

$$R_S = \frac{182921.76}{6158.4352} = 29.7026 \text{ ohms.}$$

Fig. 4 is a redrawing of fig. 3 to show the net reactance in branch 2 of the circuit. This net reactance values of fig. 4, branch 2, is computed by taking the reactance values in branch 2 of fig. 3 and finding the difference. Thus, $X_{net} = X_L - X_S$. Therefore, $X_{net} = 321.3 - 24.5537 = 296.7463$ ohms and is inductive because the larger reactance is an inductance.

Finally, refer to fig. 5 where we have converted the series elements X_L, X_S, and R_S of branch 2, fig. 4, to their parallel equivalent R_P and X_P. The values of R_P and X_P are computed below.

Parallel equivalent of a series circuit—see fig. 5.

$X_S = X_L = 296.7463$ ohms and
$R_S = 29.7026$ ohms

$$R_P = R_S^2 + X_S^2/R_S = \frac{29.7026^2 + 296.7463^2}{29.7026} = \frac{882.2444 + 88058.366}{29.7026}$$

$$R_P = \frac{88940.61}{29.7026} = 2994.3711 \text{ ohms.}$$

$$X_P = R_S^2 + X_S^2/X_S = \frac{88940.61}{296.7463}$$

$X_P = 299.7193$ ohms.

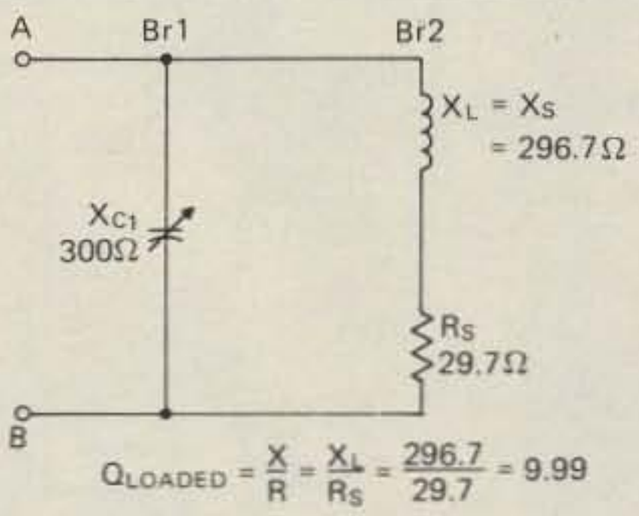


Fig. 4- By redrawing fig. 3, we indicate the net reactance in branch 2 (Br 2), of the circuit.

Fig. 4, by inspection, should immediately be recognized as the classic two-branch parallel resonant circuit. Although X_{C1}'s reactance is 3.2537 ohms greater than the inductive reactance X_S, for all practical purposes they may be said to be equal, therefore constituting a parallel resonant circuit.

Again, in fig. 5, we have developed another circuit configuration that is classic—that of a three-branch parallel resonant circuit. So there you have it! The R_P of fig. 5 is the "stepped-up" 50 ohm R_2 of fig. 1. R_P is R_1.The plate of tube will see 2994.3711 ohms. Our target for R_P, R_1, is 3000 ohms; the difference of 5.6289 ohms is negligible. Also, resonance is defined as occuring when $X_C = X_L$. X_P, or X_L here, is only 0.2807 ohms less than the X_{C1} of 300 ohms. The difference is so small that for all practical purposes X_L, or X_P, is equal to X_{C1} is equal to 300 ohms. We have matched the 50 ohm load to the plate load of the tube.

Now we shall bring all of the forgoing into perspective. With the aid of the parallel-to-series and series-to-parallel conversion formulas, aided by the figures, it has been demonstrated how an X_{C1} of 300 ohms, X_L of 321.3 ohms and X_{C2} of 60.485 ohms, as given in fig. 1, were able to transform an R_2 of 50 ohms to a $R_1(R_P)$ of 3000 ohms.

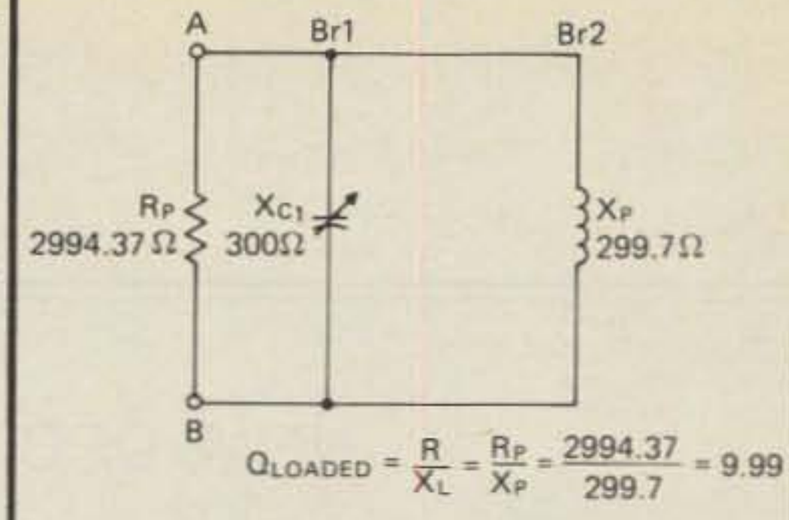


Fig. 5- The final equivalent circuit. Series elements, X_S and R_S, of fig. 4 are reduced to parallel equivalents, R_P and X_P.

The conversion formulas used have been around for many years and their derivation is a lengthy procedure. It should be noted that there are other methods to arrive at our target value. However, I opted for application of these conversion formulas due to their relative brevity compared to other methods. For any given impedance matching situation, the reactance values of the pi-network must remain the same when changing frequency or bands; this necessitates, of course, that the inductors and capacitors are made variable to meet this requirement. Refer to fig. 1. So far as knob twisting is concerned X_{C1} is a resonating capacitive reactance while X_{C2} is loading control. A change in X_{C2} requires a change in X_{C1} to restore resonance. If an increase in loading is desired, the capacitance of C_2 is decreased which increases X_{C2}. Since X_{C2} is across R_2, more current will flow through R_2 and less through C_2. More current through R_2 causes more power output developed in R_2, since $P = I^2R$. If a decrease in loading is desired, then C_2's capacitance is increased which reduces X_{C2}. More current will flow through X_{C2} and less through R_2. Less current through R_2 causes less power output developed in R_2. Power can be expended only in resistive ohms, R, not in reactive ohms, X. In a concluding remark to this summary, an attempted solution of the formulas given by hand would prove most tedious. The acme of ease, in solving this and much more detailed electronic problems, is achieved by using the small hand-held electronic calculator with capability of performing the operations indicated. ▣

a monthly feature by
A. EDWARD HOPPER, W2GT

Awards

NEWS OF CERTIFICATE AND AWARD COLLECTING

The "Story of The Month" for July as told by Jim is:

James Michael Carroll, W1UYL
All Counties #257, 12-3-79

"I received USA-CA-500-#1012 on 8-23-74, so you can see it has taken me quite a few years to work them *all.*

"I was first licensed in 1952 as a Novice, but did not really become active until 1968 when I received my Advanced Class license.

Many, many County Hunters have helped me - especially Bob, KL7IAA, who went way out of his way to get me my last one in Florida (Gadsden) and the same in South Dakota (McCook) as well as Gene, N4ANV (now All Counties #270), who drove many extra miles for my last (Pamlico) North Carolina and also Bill, K7JJ/M5, who unselfishly went in the opposite direction to get me #254, Collingsworth, Texas.

"I particularly want to thank Arnie, K9DCJ, who guided me to my last two -Lee in Arkansas and Oliver in North Dakota. I hope that someday I can repay in kind to others what I have received from hams similar to those mentioned above.

"I am a broker for Merrill Lynch in Boston and have been for 27 years. Four of our seven children have ham licenses, but none are active at the moment.

"The age here is 56 and I guess the next two challenges will be Worked All Zones (WAZ) and the Extra Class license (I already have 5BWAS), but in the meantime I just intend to relax.

"Again - to all on the net - thanks, you are a wonderful warm group of people and I value all the friends I have made on the net over the years."

Jim Carroll, W1UYL and his terrific layout.

Awards Issued

Tom Duderstadt, W0LRH added All Counties (Mixed) to his fine collection.

Leonard Pray, W1ORV waited until he had them All and acquired USA-CA-500 through USA-CA-2500 endorsed All S.S.B., All Mobiles, All 14 MHz. Also USA-CA-3000 endorsed All S.S.B., All Mobiles and All Counties endorsed Mixed.

Bill Wallace, K7JJ also waited until he had them All and then received USA-CA-500 through All Counties endorsed All S.S.B.

John Irwin, K7SE (ex K6SE, K6SE/W2) who just returned from operations from three countries in the Carribean, quickly checked his QSLs and rushed the data to me for USA-CA-3000 endorsed All S.S.B., All 20, All Mobiles; and All Counties endorsed All S.S.B.

Bill Grubbs, K5IW, who has been very busy mobiling and giving out *many* Counties, got back from a trip to send me paper work for USA-CA-500 through USA-CA-3000 endorsed All S.S.B., All 20, All Mobiles and All Counties endorsed All S.S.B.

David Allen, WA2JFL, with much needed help, grabbed USA-CA-2500 endorsed All S.S.B.

Special Honor Roll
All Counties

#271 Thomas B. Duderstadt, W0LRH 3-11-80.
#272 Leonard C. Pray, W1ORV 3-17-80.
#273 William L. Wallace, K7JJ 4-4-80.
#274 John B. Irwin, K7SE 4-4-80.
#275 Albert B. Grubbs, Jr., K5IW 4-5-80.

USA-CA Honor Roll

3000		2000		1000	
W1ORV	299	WA2AKJ	413	WA7YID	588
K7JJ	300	W1ORV	414	WA2AKJ	589
K7SE	301	K1YRP	415	W1ORV	590
K5IW	302	K7JJ	416	K7JJ	591
2500		K5IW	417	K5IW	592
WA2JFL	361	**1500**		**500**	
W7ULA	362	WA2AKJ	469	JA3WBK	1449
W1ORV	363	W1ORV	470	KA0CLS	1450
WD9BCG	364	K7JJ	471	LA7AH	1451
K7JJ	365	K5IW	472	WA7YID	1452
K5IW	366			WA2AKJ	1453
				W1ORV	1454
				SM6DYK	1455
				K7JJ	1456
				K5IW	1457

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

Don Skaife, W7ULA keeps plugging away and this time got USA-CA-2500 endorsed Mixed.

Pat Creapo, WD9BCG keeps c.w. and s.s.b. busy to get her USA-CA-2500 endorsed Mixed.

Marcia Baulch, WA2AKJ had me send her USA-CA-500 through USA-CA-2000 endorsed All S.S.B., All Mobiles.

Robert Garceau, K1YRP added USA-CA-2000, endorsed Mixed, to his collection.

Buddy Mael, WA7YID qualified for USA-CA-500 endorsed All S.S.B., All 14, and USA-CA-1000 endorsed All S.S.B.

Takashi Tabata, JA3WBK worked hard for USA-CA-500 endorsed All 28 MHz.

USA-CA-500 Certificates went to:

Buster Boatman, KA0CLS endorsed All A-1.

Kjell Duna, LA7AH, endorsed Mixed.

Kenth Johansson, SM6DYK, endorsed Mixed.

Awards

Worked All Maine Award: This Award will be issued to any amateur radio station submitting confirmation of two-way radio contact with all sixteen (16) Counties in Maine any time after 0001 EST, January 1, 1955. Contacts must be made from one fixed home location (definded as home residences, no two of which are more than 25 miles apart). Contacts may be made with fixed, portable or mobile stations within Maine. Contacts made through repeaters will not count. Confirming QSLs or participating logs for any Maine QSO Party will be considered satisfactory evidence of two-way contact. A seal will be placed on the award indicating that all contacts were made by c.w., phone, or combination of both. Applicants will receive additional seals upon producing evidence of sufficient additional c.w. or phone contacts. The type of seal will be determined by the type of transmission used by the applicant. Return postage should accompany QSL cards. Inquiries and applications should be sent to: WAM Award, c/o Portland Amateur Wireless Association, P. O. Box 1605, Portland, Maine 04104. Note: There is a Maine QSO Party in July; see "Contest Calendar" by W1WY, Frank Anzalone, for full details. Thanks to Joe, K1JB for all this data. Oh yes, the Party is from 1600Z July 19 to 2000Z July 20.

Worked All Vermont: This Certificate of Achievement has been reactivated. (The former trustee became a silent key, and it took a while to get all the material he had back to the club). The award is sponsored by the Central Vermont Amateur Radio Club to encourage communication between amateur

The revived Worked All Maine Award

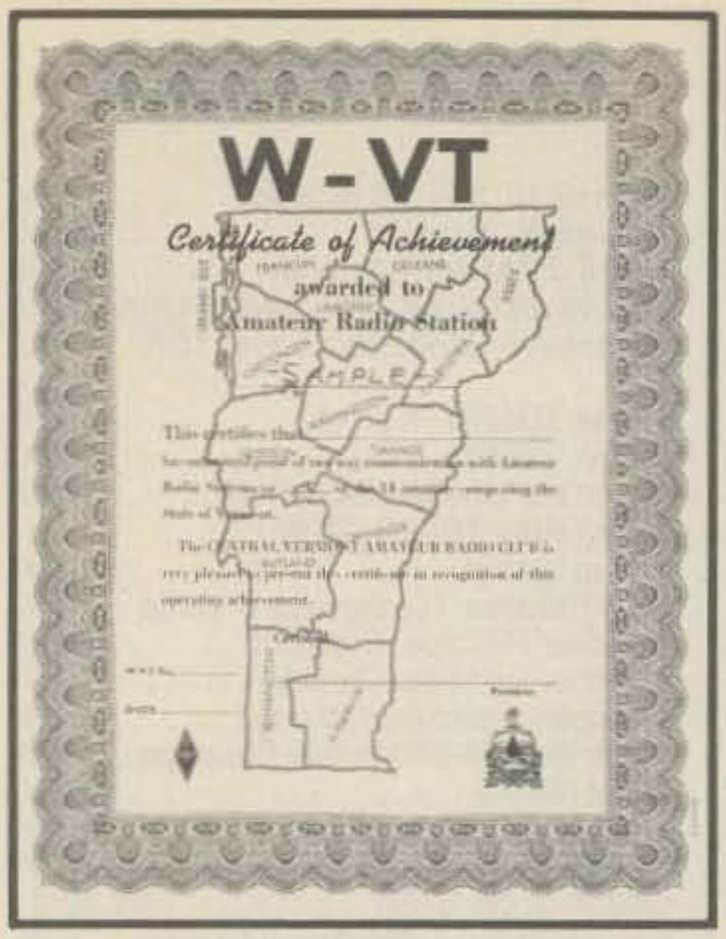
radio operators outside of Vermont, and amateurs in all counties of Vermont and to encourage a high level of technical and operating skills from other amateurs in working all Vermont counties.

Rules: Work 13 out of the 14 Vermont counties. Any band or bands, modes or combination thereof, except repeaters. No restrictions on time limits. (VT amateurs may qualify if they remain in one county).

Verification: Send list of calls, dates, and counties worked, verified by two licensed amateurs that they have seen the QSLs, *or,* include a photocopy of the front and back of the QSLs along with the list. The cost is $2.00 to cover postage and handling. *Apply to:* Central Vermont Amateur Radio Club, c/o Grant Taylor, RFD #1, Box 150, Cabot, Vermont 05647.

150 Years Of Kingdom Belgium: This award is organized by the U.B.A. (Union Belge des Amateurs-Emetteurs) (Unie van de Belgische Amateurs-Zenders) to celebrate the 150th anniversary of the Kingdom Belgium and is available to all licensed amateurs and SWLs. QSOs from 10 January to 31 December are valid. A list showing full details of the contacts should be certified by the Awards Manager of the National Society; for Belgium a GRC list certified by 3 licensed amateurs with at least one District or City Manager (QSLs are not required). The Fee is 10 IRCs or 4 US dollars; for Belgium 100 BF or equivalent in post stamps. Deadline is 31 March 1981.

The same station may be contacted only once per band. No cross band, satellites, transponders, nor repeaters are valid. Endorsement possible for: all bands, one band only, only c.w., s.s.b.,



Worked All Vermont Certificate

mixed mode, RTTY, all 5 prefixes (6 prefixes for v.h.f. and up). Only the prefix **OR** is valid; ON, OT prefixes do *not* count for this award; available prefixes OR4, OR5, OR6, OR7, OR8, (plus OR1 for v.h.f. and up). The provinces available for this award: AN, HT, BT, LG, LM, LU, NR, OV and WV.

HF Award:

Bands: 80, 40, 20, 15, and 10.

Outside Europe: 10 different **OR** stations, no further limit.

European stations: 25 different **OR** stations with at least 4 different prefixes and contacts into 5 provinces.

Belgian stations: 50 different **OR** stations with at least 4 different prefixes and contacts into 7 provinces.

The address for HF award is: ON4GO, Le Bon Michel, Traffic Manager, P.O. Box 537, B-1000 Brussels, Belgium.

VHF-UHF-SHF Award:

2m and 70 cm: Rectification: A total score of 5000 km with **OR** stations must be totalized. If all QSOs are more than 500 km, only 2000 km must be totalized.

23 cm: Contacts with 2 **OR** stations more than 100 km.

13 cm and up: 1 QSO with **OR** station more than 100 km.

The address for VHF-UHF-SHF Award is: ON4ZN, Walter Empsten, VHF Manager, Beatrijsstraat 110, B-2580 St Katelijn Waver, Belgium.

Aerospace Corporation Twentieth Anniversary Award: A free certificate is being offered by the Aerospace Employees' Association (AEA) Amateur Radio Club of El Segundo, California, to celebrate the 20th anniversary of the incorporation of the Aerospace Corporation.

To be valid, contacts must be made during the period April 1, 1980 through September 30, 1980. Los Angeles and North Orange County amateurs must work five (5) AEA Amateur Radio Club Members; all other amateurs must work two (2) club members during the six-month period.

Logs must show band, mode, date, time in UTC (same as GMT or Z time), and stations worked. Send an s.a.s.e. to receive complete list of club members and to receive a certificate, send logs with letter-sized s.a.s.e. to: Aerospace Employees' Association Amateur Radio Club, P.O. Box 92957, Los Angeles, California 90009, before November 15, 1980.

PACW Award: The PACW Award is issued by the "PARA CW GROUP" to all amateurs who have worked 2 different members of the group, c.w. mode only, and who have valid QSOs after 1 January 1980. Do not send QSLs, only GCR and your QSL card. Give log data: Call, date, time, signal report. Fee: 10 IRCs. Same rules apply for S.W.Ls. Send to: PACW, P.O. Box 203, 66.000 Belem Para, Brazil. PACW members include PY8AA, PY8ACR, PY8ACS, PY8AFH, PY8BI, PY8DP, PY8EL, PY8FI, PY8HP, PY8JS, PY8ZLC. Thanks to Fred, WD4RAF for this data.

Notes

A nice letter from K4BUF who would be glad to start a 21 MHz C.W. CH Net, and he feels he is the only active signal in Randolph County - so if you need that one and/or you are interested in such a Net, write to Billy G. Suit, K4BUF, Route 4, Box 330-M, Asheboro, N.C. 27203.

Also a nice letter from Joe, K1JB who operates a lot in Maine but has short trips/time to check into the net, so let him know any Maine County you need. Joe Blinick, Juniper East #D-17, Yarmouth, Maine 04096.

Nice letters from George, WB0ODS who made a list of confirmed (C.W., unless marked M) contacts as of 1-1-80. Congratulations to all.

W8RSW	All	W2MEI	3050
W9VEN	3022	WB4CCK	3000, All(M)
W3ARK	2925	W2RPZ	2893
N2RT	2845	W9WR	2822
WA4EBE	2706	W1AQE	2678, All(M)
W3BT	2468	W1SBU	2395
W8WVU	2319	W8YL	2308
K3ZMI	2214	W7GHT	2183, All(M)
K3LK	2020, All(M)	K6CR	1982
W1JTD	3041	N9DR	1735
K1ZFQ	2993	W8RYP	1432
KA5A	2867	WA0NZA	1275
WA9WIF	2782	K7EQ	1073
WB0ODS	2639	W3PYZ	1629
K3DEJ	2333	N9TN	1100
W0FBB	2300	W5VGF	1061
W4POA	2100	W2EZ	927
N5QQ	1903	N9AG	862

As this is being written, we have beautiful weather and I'm sure it will be that way when you read this. So, hurrah for the Mobiles and hope they do *not* use *wet* County Lines. 73, Ed., W2GT

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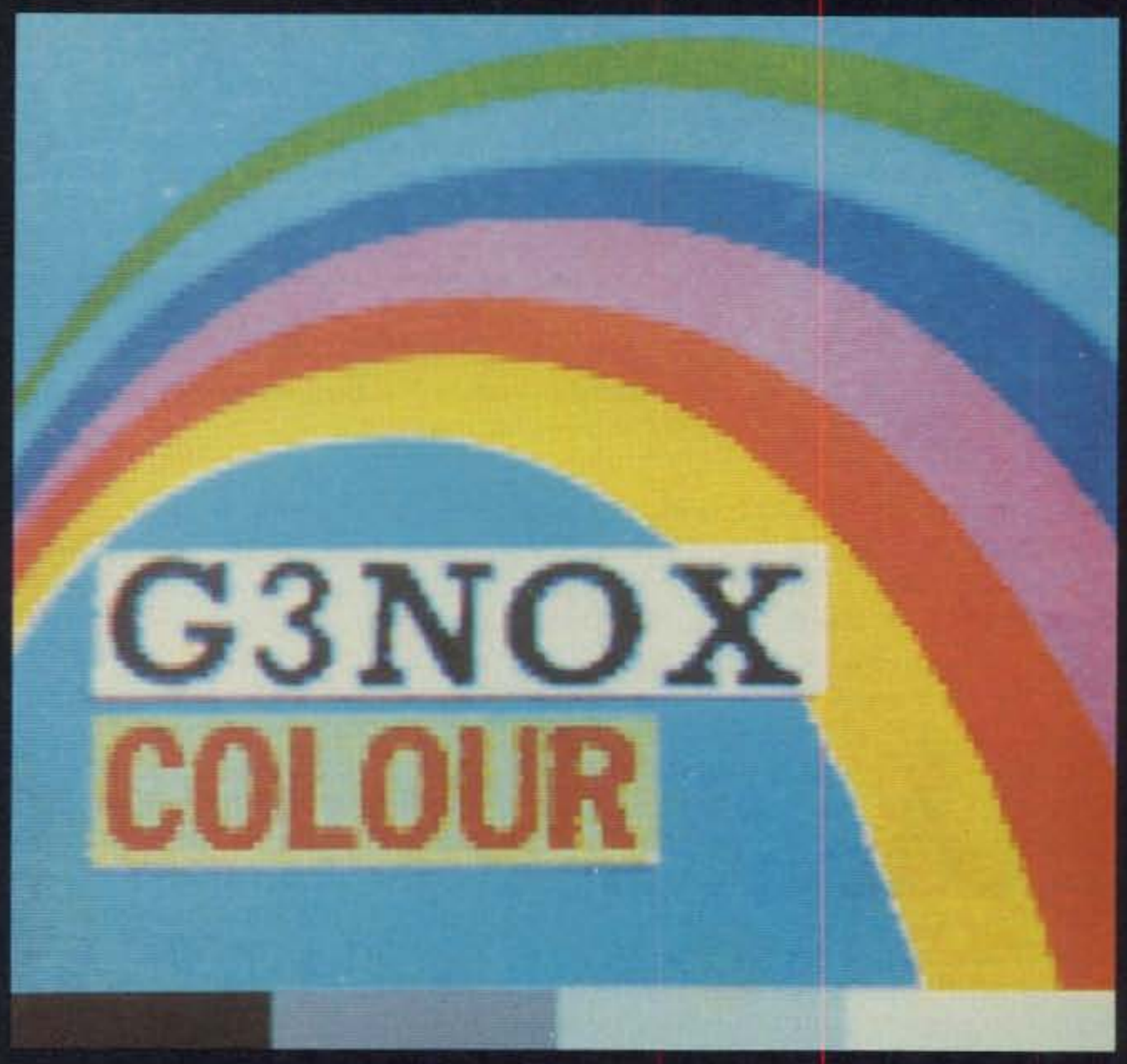
The following is part correspondence and part report filed by Richard Thurlow, G3WW. Richard has been described by Radio Communications magazine as probably the most active British SSTV operator.

The "View" From Here

SSTV As "Seen" From The European Side



Color or colour, whichever you prefer, it's still a giant leap from those little green pictures a few years back.

BY RICHARD THURLOW*, G3WW

Richard Thurlow, G3WW, and I have been exchanging letters for some time now about his favorite pasttime, SSTV. To be perfectly honest about it, Richard's letters have out-weighed mine about 2 or 3 to one. He's been after me to have more SSTV information in CQ to let people know what's going on. My usual reply to such requests is to ask the writer what he's been doing or to supply material on the subject. Most of the time nothing comes of these requests, but I'm glad to say that Richard took me at my word and penned the following activity report from across the pond. I hope this will help to "prime the pump" whereby some of you other SSTVers will let us know what you've been doing and the latest goings on. **- K2EEK**

**North House, 2 Church St., Wimblington, March Cambs., England*

K2EEK de G3WW Richard Thurlow.

Dear Alan,

So "the biter is bit" and as your "slightest wish is my command" I have sat at this typewriter and enclose the results plus the photo.

I've written it from a UK perspective to let your readers know what we are doing on SSTV, what we've seen, heard and read about.

I hear (and see) and work most of the European SSTVers almost on a daily basis. I have been fully retired since January 1972 and at almost 75 do not now operate much before 0800 gmt or after 2300 gmt. I have 315 phone confirmed for DXCC and 101 confirmed on SSTV for your *CQ* DX Award. The exchange of pictures is still exciting but we do experience some difficulty with the language barrier. Nevertheless, one common theme I find is the request for information on the W0LMD SSTV keyboard which you ran in *CQ* several years ago.

The Europeans are always very active in contests (though comparitively few in number compared to the US). We have commercial equipment available from Italy and Germany and some US equipment is used.

A quick look at my records shows that I have had over 1500 two-way SSTV QSOs. Outside of the U.S., some of the prefixes I have worked are: AP2, CT, CP, CR, CN8, C3, CX2, Western Germany, DU, EA, ET3, E1, EP2, F, FC, FG7, FK8, FP, FR7, G, GD, GC, GI, GM, GW, HA, HB, HC, HH2, HK, HM, HR, HZ, Italy, IS0&IT9, Japan, JY, KH6, KL7, KP4, KV4, KG6, LA, LU, LX, LZ, OA, OD, OE, OH, OK, ON, OX, OY, OZ, PA0, PJ, PY, SM, SP, SV, TA, TJ, TR8, VE/VO, VK, VP, VQ, VU, XE, YU, YV, ZD8, ZF1, ZK1, ZL, ZS6, 3A2, 4X4, 5N0, 6Y5, 9G1, 9H1, 9K2, 9V1, 9X5, and 9Y4.

At the present time, no USSR sta-

tions (including UP2, UQ2, UR2, YO and ZA) are permitted to transmit SSTV either directly or to replay tapes received. Many do however have monitors and "see" our SSTV pictures and request that we send more video. QSLs received from these stations are marked s.s.b./SSTV QSO, meaning that although I used s.s.b. to transmit my SSTV video to them they only used s.s.b. to me and this makes it quite clear that it was not a two-way SSTV contact.

This point is worth mentioning in regard to other amateurs who operate on SSTV. Many of them mark their QSL cards in much the same fashion as the amateurs from the USSR whereby s.s.b./SSTV supposedly indicates a two-way SSTV contact. They should be marking their cards two-way SSTV or 2× SSTV to clearly indicate the mode of contact. This eases the burden of people who check these cards for awards and certificates and leaves nothing to question.

I highly recommend SSTV operation to DXCC hounds in the 250+ countries class to help pass the time between DXpeditions. I started on SSTV 7½ years ago and am now at 315 + 3 for that very reason.

73,
Richard Thurlow, G3WW

March 1980 was a really big month for SSTV. Dwight Raddatz, WA9EUN, and Bob Blackstock, WB5MRG, transmitted in color using the Don Miller, W9NTP two memory Robot 400 method on the Saturday SSTV Net (14230 kHz). Real color SSTV was demonstrated by Jeremy Royle, G3NOX, of Keeper's Cottage, Duddenhoe, Saffron Walden, Essex, England. Jeremy, operating on 28,680 kHz, used an IC-701 with an old Pye TV studio black and white camera with three color filters into the memories of three 400s. Martin Emmerson, G3OQD, designed the necessary circuitry with excellent results. Robert Suding, W0MLD, has stated that he considered color transmission a waste of space at this time since three different black and white pictures could be transmitted in the time it takes to transmit one color picture. Nevertheless, those who have seen this picture in its original 13 colors (in relation to a gray scale) photographed directly from the screen of G3NOX's color monitor or like W9NTP himself, at the other end of a transatlantic transmission, are convinced that the "waste of space" is very worth while. Using the above method, Jeremy made the first transatlantic two-way color SSTV QSO with K2RZ, who taped the entire transmission and played it back to G3NOX who received it back "as sent," viewed it on his color monitor and taped it for posterity.

Jeremy is no stranger to amateur television. As G6NOX/T, he and his father Ralph Royle, G2WJ, transmitted some of the first amateur television signals on 436 MHz. Ralph was first licensed in 1922 and took part in the early transatlantic test on 200 meters. He is still fully equipped for and active on ATV.

Here And There

W9NTP reports that many stateside SSTVers are busy building and completing the 2nd Memory pc board that he provided to convert the Robot 400 to color. Don also recently sent me the negatives for the pc board for use by UK amateur. It is mainly for those SSTVers who have not yet obtained the boards directly from him. He also reports that he has a three memory converter working and that he will display a new scan converter capable of both MSTV and color at the Dayton Hamvention this year.

It seems that Don's existing two memory system will be the one used by many amateurs on SSTV for the while. The basic cost of three 400s is beyond the amount most amateurs are willing or able to pay.

Jouko Nurma, OH5RM, (Ontontie 4, 46860 Anjalankoski, Finland) has been able to get a pc board made in Finland for the Japanese SSTV Club's 400 type converter. The board costs about $40.00 US. He has provided about 25 boards for OH amateurs and should be able to provide further boards. (Send a s.a.s.e. and enough IRCs for airmail return if you are interested.).

Several home-brew 400s are in use here in the UK as well as the WB9LVI s/f & f/s scan converters. G3OQD has designed a light-pen for the 400 with three line widths and has almost completed his computer for SSTV. Grant Dixon, G8ACK, is using a Triton computer but is only licensed for v.h.f. SSTV operation. Gordon Sharpley, G3LEE of Urmoston, Lanes, should have his MSTV 10 meter f.m. transceiver ready soon as the 29150 MSTV Updating Bulletins are very well received in the UK each Saturday. Ron Johnston, G3GRJ, of Waltham Cross, Herts., is adding a second memory to his LVI with many locals standing by for the results. Several SSTVers still consider the LVI picture quality supreme.

As this is written primarily to give the SSTV picture as seen from Europe, it is germane to comment that if any country wants support for any contest organized and/or sponsored by that country's amateurs or amateur radio magazine, then they must give any contest adequate in-time advance publicity worldwide if any other country's amateur support is desired. Nothing seemed to have been known of the 1979 US SSTV Contest outside the US until one lone Italian station was "seen" and "heard" calling "CQ Contest." Only the date of the similar 1980 US Contest was known (from the November 1979 issue of *73* which was received around Christmas) prior to the Contest. The rules, starting times and duration followed in the next issue received after the Contest. The same thing happened to the first SSTV Contest sponsored by the German Amateur Radio Teleprinter Group earlier this year. Most of the magazines need two to three months lead time prior to the cover date to run the information plus you must allow enough extra time to take in postal transportation.

Eddie Collins, W4MS, of Pensacola, Florida, reports that Ahmed Ebrahim, AP2AD, in Pakistan gave him his 112th two-way SSTV country (he gave me my 104th).

To wrap up this report let me add that I have certificate number 3 (*CQ* DX Award, SSTV Endorsed) with 101 countries confirmed. I also have over 1500 individual two-way SSTV contacts logged in here at G3WW.

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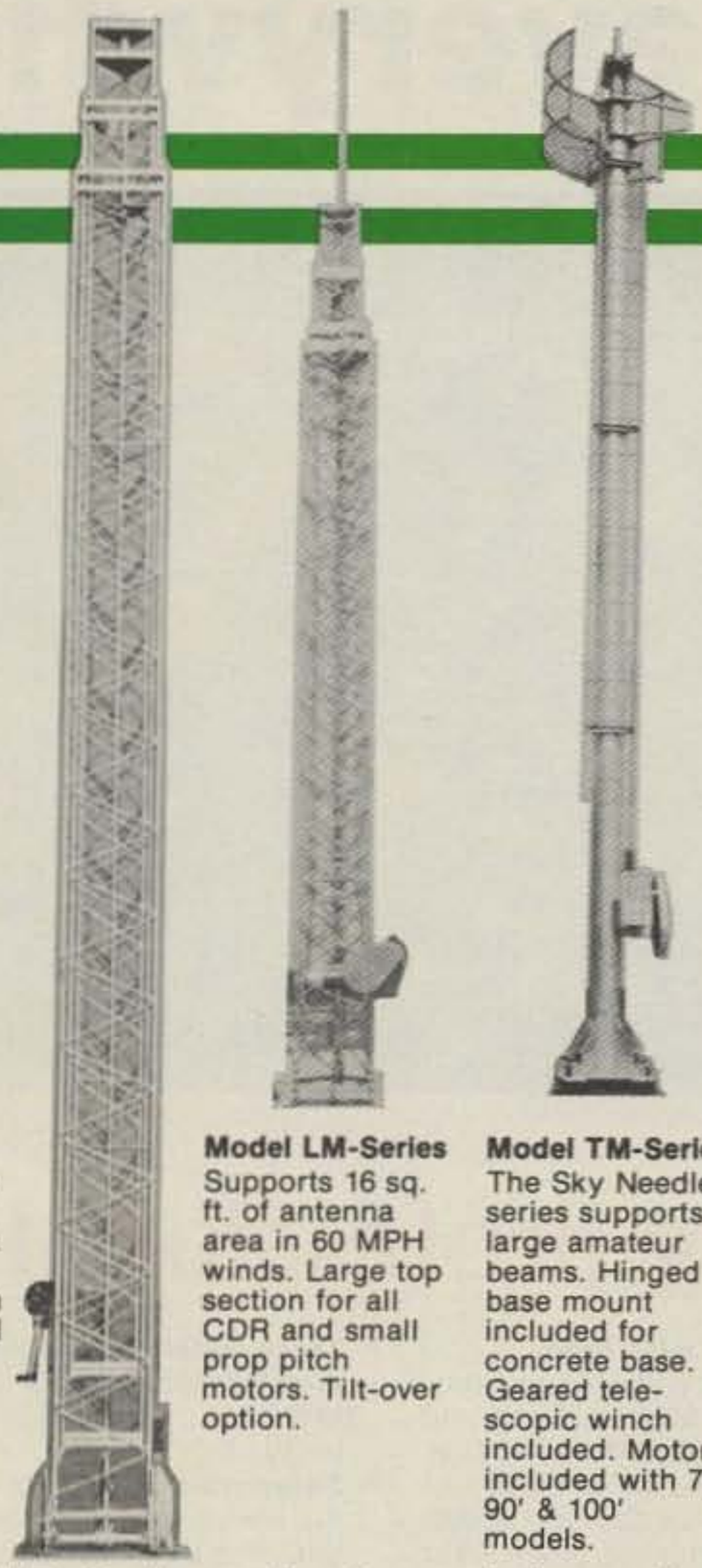

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MW 50**	20' 10"	50'	8.6 Sq. Ft.‡	668.00
MW 65**	21' 3"	65'	5.0 Sq. Ft.‡	913.00
W 36**	20' 6"	36'	9.0 Sq. Ft.	546.00
W 51**	21' 0"	51'	9.0 Sq. Ft.	844.00
WT 51 **	21' 0"	51'	9.0 Sq. Ft.	923.00
W 67**	22' 0"	67'	9.0 Sq. Ft.	1,816.00
LM 237**	20' 6"	37'	16.0 Sq. Ft.	1,064.00
LM 354**	21' 0"	54'	16.0 Sq. Ft.	1,537.00
LM 470**	23' 6"	70'	16.0 Sq. Ft.	2,826.00
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- SP-100 external speaker
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Other accessories not shown:

- HS-4 headphones
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  The optional DG-5 provides easy, accurate readout of the actual operating frequency while transmitting and receiving
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  Provides extra audio punch on transmit, while suppressing sideband splatter
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  Built-in 20-dB attenuator activated by front-panel push-button switch
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  Receiver incremental tuning, or "clarifier"
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  For excellent selectivity
- **Built-in 25-kHz calibrator**
  To maintain frequency accuracy. Adjustable to WWV
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  Improves quality of transmitted signal
- **Front-panel carrier level control**
  To adjust CW output power
- **Semi-break-in CW with sidetone**
  Keying delay adjustable with VOX delay control
- **VOX/PTT/MANUAL operation**
  Suits all operating requirements
- **TUNE position for low-power tune-up**
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  Extends life of components
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  Ideal for net or MARS operation
- **Rugged die-cast front panel**
  Very attractive design

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- DG-5 digital frequency display/counter
- VFO-520S remote VFO

Other accessories not shown:

- CW-520 500-Hz CW filter
- AT-200 antenna tuner/SWR and RF power meter/ antenna switch
- SM-220 Station Monitor with BS-5 pan display module option
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- TL-922A linear amplifier
- MC-50 dynamic desk microphone
- HS-5 and HS-4 headphones
- PC-1 phone patch
- HC-10 world digital clock

The Heathkit SA–2040 Antenna Tuner Kit

BY ALAN M. DORHOFFER*, K2EEK

One great toy that I had as a kid was my erector set. I'd dig out that red metal suitcase full of struts, screws, nuts, little tools and assorted plates and fabricated steel parts, and spend hours building all sorts of things. However, as time passes it starts to look a little strange to be playing with an erector set, and other things become more important in the process of growing up. The erector set is long gone but the memory lingers on.

Heathkit in some moment of inspiration or accident has realized a basic truth. A lot of us are still kids at heart and what separates us besides age is the price and sophistication of our newer toys. The principle is still the same. If it's at all possible to recapture some of that old feeling you can do it with Heath's SA-2040 antenna tuner kit, for within the kit are the very same "struts," screws, nuts, little tools and assorted plates and fabricated parts. Instead of building bridges and other items of fantasy, however, you build your own variable capacitors. I don't know if it's a gimmick or a true labor saving device on Heath's part, but it was fun to do and a fascinating experience to assemble a big variable.

The antenna tuner is basically an adjustable r.f. transformer designed to take an unknown load that the antenna represents and match that to a nominal 50 ohm impedence that the transmitting device needs to "see" in order to function properly. The SA-2040 is a basic no-frills antenna tuner. It neither has nor are you paying for the goodies that one finds on other models. What it does and does well is provide a matching device for a wide range of output impedances to a 50 ohm input impedance.

The SA-2040 is designed to operate from 3.5 through 30 MHz. It will handle 2000 watts p.e.p. on s.s.b. and 1000 watts on c.w., input of course. It has a 4:1 (balanced-to-unbalanced) balun that you wind yourself and that is composed of two cores interwound with glass tape. I suggest that you heed their instructions about hooking the folded end of the toroidal wire around a door knob when winding the toroid. The first time I tried to wind it I thought I could just pull it tight and fit all of the turns. Well, I couldn't, and the only way to get the right amount of tension on the wire was to use the door knob.

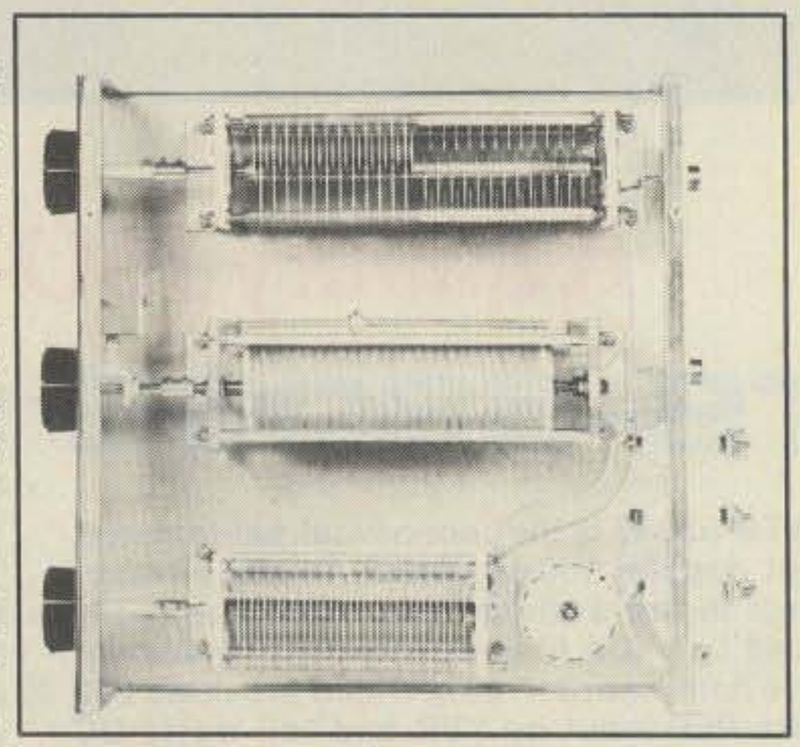
* *Editor, CQ*

Front view of the SA-2040 antenna tuner. From left to right the controls are: Transmitter Matching, Inductor, Antenna Matching. The erasable logging scale is at the upper left.

There is no band switching feature, since Heath uses a roller inductor coupled to a turns counter to vary the inductance to achieve resonant impedance. The roller inductor is pre-wound but you construct the mechanical connections for it and the turns counter. The roller inductor offers a wide variety of impedance settings and makes the SA-2040 a continuous tuner from 3.5 to 30 MHz.

An interesting feature of this tuner is its erasable logging scale on the front panel. Using their preset chart in the instructional manual or developing your own, you can plug in your favorite operating frequencies and read the tuner settings at a glance. This is also helpful in operating contests or checking out new antennas, plus it's a good place to make operating notes. As you can see from the picture it's about as simple a device as you can get with only three basic controls. The internal view bears out the simplicity. From top to bottom you can see the transmitter matching capacitor, the roller inductor and the antenna matching capacitor is at the bottom. To the rear of the antenna matching capacitor is the toroid.

The mound of capacitor hardware you start out with is very reminiscent of the erector set I mentioned earlier and is of sound quality. The strapping is all silver plated, and there are ceramic endplates and extra hardware included should there be an accident in construction. Besides the normal coaxial connectors on the back, there are large ceramic feed-through insulators for balanced feedline and single-wire antennas.



Internal view of the antenna tuner as described in the text.

The tuner took me about 8½ hours to build, which includes checking the parts list and rewinding the toroid. The finished tuner measures 5 5/8″ × 14 13/16″ × 13 15/16″ and weighs about 10 pounds. The supreme test came when the tuner was completed and checked. Jack, W2LZX, was anxious to get his hands on it so he could get something going on 40 and 80. Well, a few days later he brought it back smiling and said that he had used it and picked up two new countries on 80 and that it did indeed handle the legal limit (with a little to spare).

The Heathkit SA-2040 antenna tuner kit sells for $139.95 plus shipping from Benton Harbor, Michigan. It is available from their stores or by contacting Heath Company, Benton Harbor, Michigan 49022. DQ

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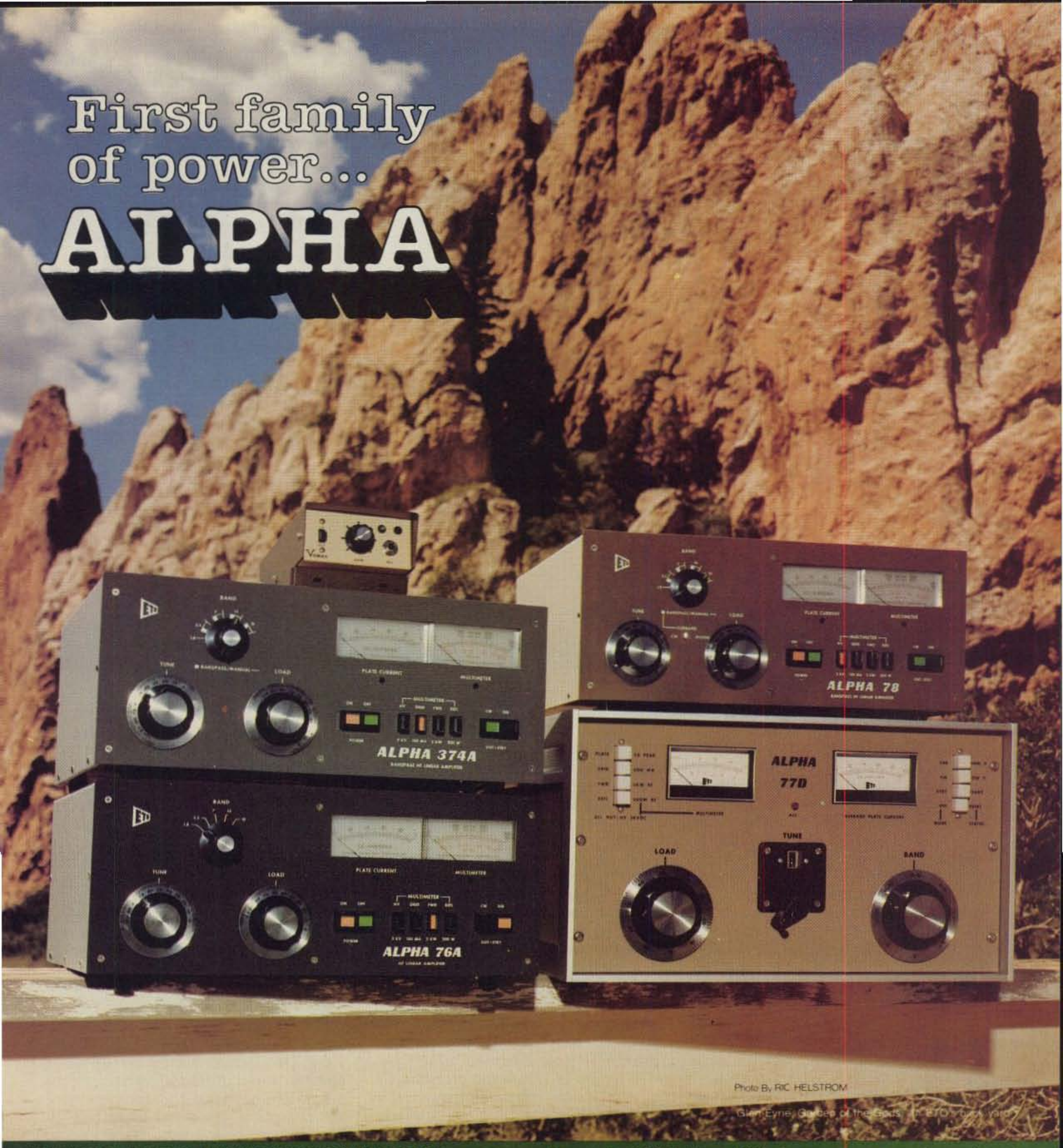

Photo By RIC HELSTROM

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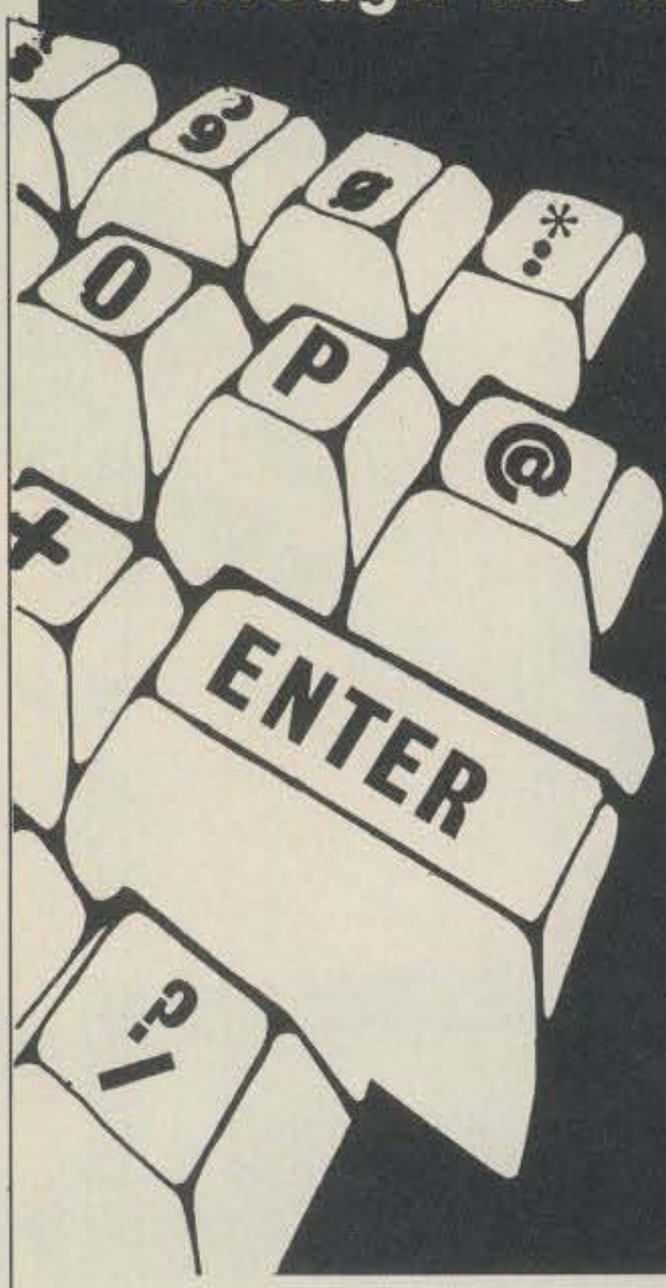
CIRCLE 20 ON READER SERVICE CARD

In this installment we digress for a moment from the nuts and bolts of programming and wend our way through the thought patterns of creating a program.



INTRODUCTION TO BASIC

A Computer Programming Language

Part VII - The Philosophy Of Programming

BY BUZZ GORSKY*, K8BG

This segment of our introduction to BASIC will be the least factual and the most philosophical. I fear that if anyone asked five programmers how to write a program, it would be easy to obtain at least six answers. Although the program statements are immutable, they can often be combined in several ways to achieve the same end. I have tried to demonstrate this in other installments by showing how the same job could be done in various ways. We will see this even more in the section on program debugging and testing and that on machine language. Program writing is a creative process and therefore a somewhat personal one. Therefore what I describe can be nothing more than *my* approach to the programming task. While I am sure that other experienced programmers may disagree with some of what I will say, I hope you will find it useful.

On occasion a program can be written immediately; that is one can just sit down and write out the program steps. For example, you could write a program to print "HI I AM YOUR COMPUTER" on the screen without much thought. Obviously how complex a program you can produce in this fashion depends on programming experience. However, for the experienced programmer, the temptation to begin writing too soon is one which must be fought. It is always best to have some period of analysis before actually writing a program.

Usually a programming job is accomplished by several steps. First the programmer *must* understand the task to be accomplished and must recognize all of the possibilities which may arise. Next the programmer must consider the outline of the logic which the program will follow—that is, what will be done first, what comes next, and where must choices be made. This can be done by writing out a program outline, or flow diagram which provides a map of where the program will go. While working on the logic, it is helpful to begin writing a list of variables which will be used. On this list each variable is indicated along with a brief description of what the variable represents, what type of variable it is, and what the dimensions will be for a subscripted variable.

After the logic is roughed out, it is usually wise to let the project sit for a day or two to think about what major flaws or omissions exist in the plan for the program. Such major errors are easiest to correct before the actual coding into program steps has begun. After the program is revised I then look through it to see if I know how to do all of the steps indicated. For example in the contest call letter duplication program which I presented in Part V, the last step in the logic diagram said "put calls in alphabetical order." While that is a single logical action from the standpoint of the entire program, it is not a single or simple (as we will see in a future installment) task. Therefore, I would now break down that step into a logic diagram which would discuss in stepwise fashion how that will be done. After that is done, I then look at that logic diagram to see if there are steps there which need further expansion. This process may be repeated several times during a particular program depending on the complexity of the program. Once the logic has all been described in detail, I then look to see if the program can be divided into sections which can be written and tested independently. In the contest program for example there are two obvious parts; the first for entering calls and checking for duplications, and the second for alphabetizing. When this is true the program can be written and tested in two sections which makes the task smaller and therefore more manageable.

2449 Derbyshire Road, Cleveland, Ohio 44106

At this point if I really do understand how each part of the program is to function I can begin the actual writing or coding. On the other hand if the job is quite complex I might want to do one more step in which I do what I call "pseudocoding." That is I begin writing a version of the program in very rough form. I put in the FOR/NEXT loops and have statements in the general form in which they appear but I do not worry about any of the details of programming syntax. For example if I want the calls printed on a lineprinter I might have a statement such as:

100 For I 1 to N printout C(I)

While that is not an acceptable programming statement it tells me how the task is to be done. Then in the final step of the process that line will be converted into correct form with all of the punctuation, and so forth, indicated properly.

With this background, let's take a look at a few of the simple programs which I have presented in other parts of this series and see how they were written. We will first consider the program which transforms hexadecimal into decimal numbers (presented in Part V). Before writing that program I had to consider how the task would be done manually. I knew that there were sixteen acceptable "numerals" and I found out how each is converted to a decimal value. Then I saw that the position of each numeral in a hex number relates to a power of 16 just as the position of each numeral in a decimal number relates to a power of ten. Once I knew how the arithmetic is done I began to make a step-by-step outline for the program. It would look like this:

1. Enter hexadecimal number
2. Identify and list the digits, keeping track of order
3. Get the decimal value of each digit
4. Multiply each digit by correct power of 16 and add the products to get decimal value
5. Display the result
6. Permit the process to repeat for another number

With that done, I now examine each part to see if I know how to do it. The first is straightforward with an INPUT statement, but the second is more complex so I will work on that. I see that I will need a list of the 16 possible hex characters and I will then have to compare each numeral of the hex number with each of the 16 possibilities until I find the right one. I know that if I list the 16 characters in order and keep track of how many comparisons I make, I will automatically get the decimal value I am looking for.

So I set up H1$ = "0123456789ABCDEF". I know that with the MID$ statement I can evaluate each of these characters in the H1$ string independently. If I do it in a loop, the loop index will effectively keep track of how many characters have been evaluated. When I find a match, the loop index minus one will equal the decimal value. The minus one is required since the first character is zero. That will be true if the loop index begins with 1 as is common. I could of course begin the index with 0 and then the index would be the correct decimal value. Quite frankly I did not think of that at the time, and so I did not do it that way. At this point then I know I need statement 20 of that program to put in the value of the H1$ string. I then need statements 40-60 to compare each numeral of the hex number to each character of H1$. When there is a match D(I) is set equal to J-1. I is the loop index which tells which numeral is being evaluated and J is the loop index telling which character of H1$ is being compared. In this way D(1) will get the decimal value of the first hex digit and D(2) will get the value of the second, and so on.

Item 4 in my logic list says that each decimal value must be multiplied by the correct power of 16. Now I need to consider how to do that. I know that the decimal value for the last digit, that is the digit on the right, must be multi-

plied by 16 to the 0 power (any number to the 0 power equals 1) and that the next to the left will be multiplied by 16 to the 1 power and the next by 16 to the 2 power, etc. I thus establish a loop where I let an index K run from N-1 to 0 where N is the number of digits in the hex number. K will be the exponent of 16. I let that index go down, so that as I go from the first digit to the last, the value of the exponent will be decreasing. Then I put another index, P, into the loop. I let P increase each time K decreases. I can then let P be a subscript for D(I) so that each digit will be connected to the correct exponent. In this way program statements 60 and 70 were written to establish a correct decimal value. Notice that in 70 the sum is built up by adding D to itself each time through the loop.

The remaining logical steps of the program are quite straightforward and did not require any further work before the final program was written. At this point the program was written, and then debugged and tested. I will explore these two processes in another installment.

Part V of this series also presented a program to search for duplicate calls. Let's consider how that program was generated. Again, I first begin by understanding the task. Here it is quite simple: I want to know if a given station has already been contacted. So I go right ahead with a logic map for the program.

1. Enter a station call
2. See if the call is already in list
3. If so indicate already worked, if not add to list

At first it seemed that that would be all that would be required, but when I thought about it some more I realized that some nice pieces were missing so I developed another logic map:

1. Enter call
2. Display call to see if correctly entered
3. Check to see if call is already in list
4. If so indicate already worked and prepare for next call
5. If the call is not in the list let operator indicate if call has been worked and if so add to list. If not prepare for next call.

After considering that for a while, I decided to add a part between 4 and 5 which would check to see if the call has the same suffix (part after numeral) as another call in the list and thus might be confused with a call already in the list. That revised logic map then became the working design for the program. Some of the statements are quite easy to implement while others took a bit of thought.

Basic comparison of a new call with the list is quite easy. If the new call is C(N) and the other calls run from C(1)

up to C(N – 1) then a single string comparison such as that in line 150 is all that is required. However the suffix comparison is not quite so easy since the numeral is not always in the same place in a call. So I then considered how to identify the numeral. I could do a string comparison just as I did in the hexadecimal program. I would have a string such as A$ = "Ø123456789" and I could then compare each character of the call with each character of A$ until a match is found. However, I decided to use a faster approach which would do the same job and require only two comparisons for each character of the call letters. Since the ASCII values of the numbers lie between 47 and 58 I can just check to see if the ASCII value of each character of the call lies between 47 and 58 as is done in line 1Ø1Ø of the program. In this way I save a good bit of time. Once I know where the numeral is, I then do a string comparison between the RIGHT part of the call, that is the part to the right of the numeral with the same number of characters on the right of each of the calls in memory. If any are the same, I display those calls so that the operator can consider if the new call has really been worked already.

The remainder of that program is fairly simple except for the alphabetizing section. Since I will deal with the alphabetizer in the testing and debugging part of this series, I will not explore the construction of the program here.

Don't despair if this process sounds hopeless. Program writing like anything else requires experience. You begin by writing very simple programs to do very simple things. You progress to more complex programs by writing them yourself and by looking at programs written by others to see how they did certain things. You then make modifications in those programs to see how new twists will work. Little by little you run into the same problems again and again, and you know how to solve those problems, because you've either written or seen solutions in other programs. So the process gets easier and easier and the tasks you can accomplish become larger and more useful.

Next time we will take a look at program testing and debugging. These are two processes which never interest the perfect programmer but will always interest us mere mortals. ▣

Corrections For Part V

We made a few mistakes in Part V of this series (May issue *CQ*), so here are the corrections for those of you who had problems with the program:

Page 73: Middle column DIM zc)500) should be DIM C(500)
Above that in line 20 PRINT C(1) should be PRINT C(I)

Page 74: The blank space in the right hand column near the bottom should say "Line 120 now prints out the call"

Page 75: (in the main program)—(the corrections ONLY are below)
In line 100, 120, 530, 1000 the periods should not be present following N C(N) K N C K I J1 respectively

```
100 Z = "":N = N + 1: PRINT CHR$(23): INPUT "ENTER CALL"; C(N):
  IF C(N) = ZZ THEN 500
```

In line 20 the **#85** should be **HIT**

```
230 Z = "": PRINT: PRINT "HAS ";C(N);:INPUT "BEEN WORKED";Z
530 FOR K = I + 1 TO N
550 IF RIGHT$(C(I),J3)<RIGHT$(C(K),J4) THEN 560 ELSE Z = C(I):
  C(I) = C(K):C(K) = Z:GOSUB2000:GOTO510
```

When you fire up the linear do you have to take 3 salt tablets and a bucket of water into the shack with you? Is your shack great in the winter but a Kalahari Desert in summer? Relax and cool off as K5QY gives vent to an age old problem.

Cooling It Down

BY DICK SANDER*, K5QY

The long-term efficiency of final amplifier tubes is greatly enhanced by installing a ventilation system. Amateurs who operate their linear amplifiers for extended periods of time with increased average power should add additional cooling.

The simple approach of placing a fan on top of the amplifier has two drawbacks. The noise is objectionable and all the heated air still remains in the operating area. I use a ventilation system that cools efficiently, is quieter, and removes the exhaust heat out of the operating area. It can be either temporary or permanent. It uses clothes dryer vent-tube components to exhaust air to a near-by window. Construction and parts are easily obtainable. The parts include a muffin fan, a piece of 1/4-inch plywood, a dryer vent-hose flange, a clamp dryer vent-hose, and duct tape. The fan can be obtained surplus or at an electronics flea market, the clothes dryer vent components from a local hardware store.

See fig. 1 for a pictorial and additional details. Construction begins by cutting the 1/4-inch plywood to fit into a nearby window. A 4-inch diameter hole is cut at the bottom of the plywood. A small 1/4-inch hole is cut to allow the power cord to feed through. The muffin fan is mounted on the outside of the plywood, and positioned so the air blows to the outside. The vent-hose flange is mounted on the inside of the plywood, and both are secured with 6-32 by 3/4-inch screws, washers, and nuts. The power cord is fed through the hole and soldered to the muffin fan. The complete fan assembly is installed into the window and duct tape seals any air leaks. The vent-hose is clamped to the hose clamp and is run to the amplifier. A small cardboard box for the vent is used over the amplifier. The vent-hose is mounted into the cardboard box by cutting a 4-inch diameter hole and pushing the vent hose through. Duct tape secures it in place and seals air leaks. The vent hood should perform like a vent hood over a kitchen stove, allowing both the ambient room air and exhaust air from the amplifier to be pulled out.

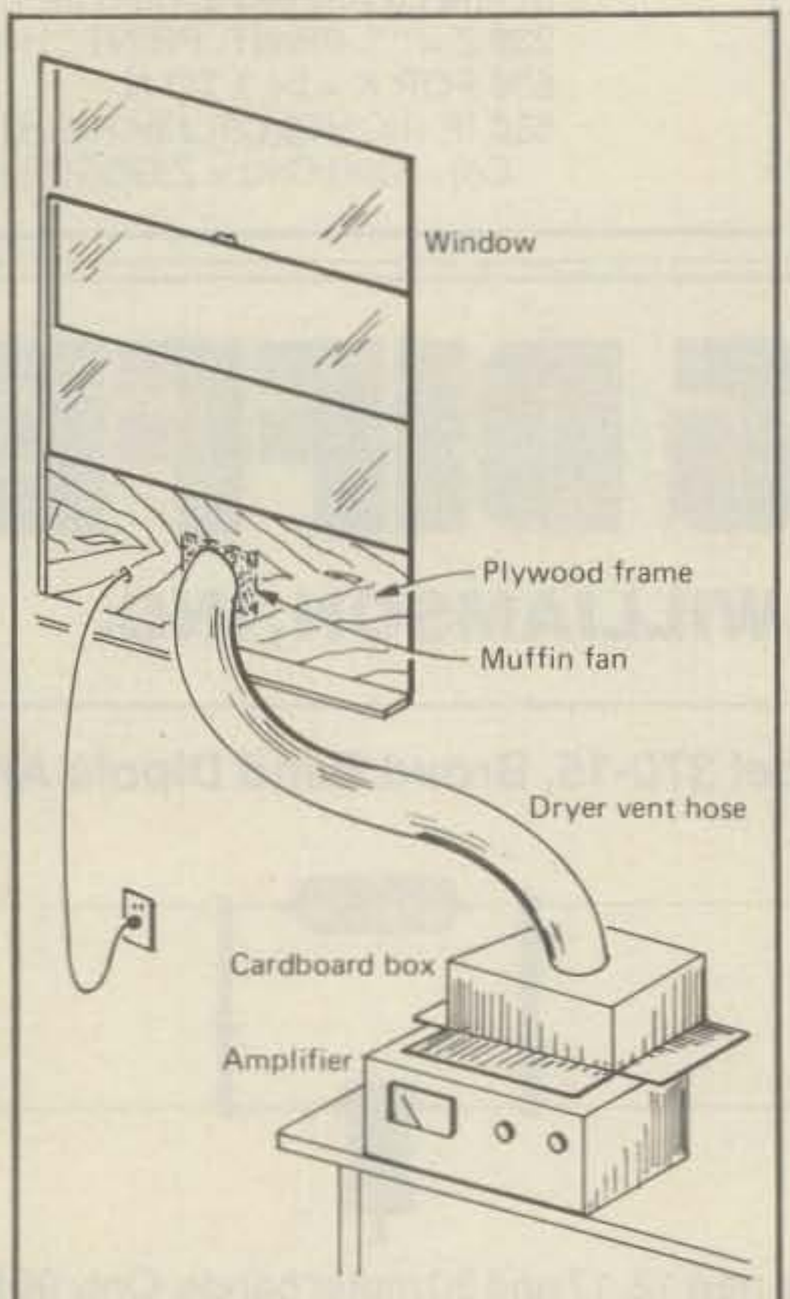


Fig. 1- The simple yet effective amplifer cooling system.

I secured the box to the amplifier with duct tape to avoid damaging my amplifier. Most of the noise is outside, especially with the drapes pulled shut. The room stays cool along with my amplifier. The cost was approximately $12.00. When heavy use is not required, I remove the vent hose and compress it in the window sill. (Twenty feet compresses to about two feet.) If you are contest oriented, and use a speech processor, a vent system such as this offers a practical approach to cooling it down.

Editor's Note

In these days of rapidly increasing fuel costs it might be worthy of consideration to vent the extraneous heat into an adjoining room. Even the smallest amplifier can heat up an average room in short order. You could even rationalize how you are doing your bit to conserve fuel by staying on the air 8-10 hours per day inorder to heat the house. *I'd* believe you.

* *110 Starlite Dr., Plano, TX 75074*

a monthly feature by
BILL WELSH, W6DDB

Novice

"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Guidelines for Conducting Amateur Radio Shows – Part III of IV

This is the third in a four-part article about running amateur radio shows. The first part covered people, planning, and location considerations. The second part detailed the banquet, communications, contests, and exhibit factors.

Publicity

Responsibility. All show publicity is the responsibility of the publicity coordinator. If show publicity is handled well, a successful show is just about guaranteed. This is the toughest assignment on the show committee, but it is one of the best ones because this person is the only coordinator who is reasonably free to enjoy the show.

Exhibitor Contacts. As soon as the show date, location, time, and costs have been determined, all potential exhibitors should be provided with this information in writing. This first announcement should be brief, but it must be sent several months in advance of the show, and it must include the usual who, what, when, where, and why information. All show correspondence must include the name, mailing address, and telephone number of at least one cognizant show official who is easy to reach. Both work (day) and home (evenings and weekends) telephone numbers should be included on all correspondence, complete with the area code. It is advisable to list at least two show contacts on all show correspondence sent to potential exhibitors; these two are preferably the publicity coordinator and the exhibits coordinator, with the show chairman a third possible contact.

Exhibitor List. A simple and effective way to compile a list of possible exhibitors is to extract their names, addresses, and telephone numbers from the major American amateur radio publications, *CQ*, *Ham Radio*, *QST*, *Worldradio*, and *73*. Print or type this information on file cards and include a very brief description of their product line or service. Arrange these file cards in alphabetical sequence and retain them in a suitable container. Produce a set of file index cards listing all advertisers shown in a current issue of a major publication such as *CQ*. Arrange these cards in alphabetical order and refer to them as you check advertisers in a current issue of another major publication. Produce file cards for different advertisers picked up from the second publication and merge these new cards into the original set. Repeat the preceding process with each major publication. The job gets easier each time because there are less different advertisers to pick up each time you go through another publication. It is important to check all of these publications because very few companies advertise in all of them and some companies just advertise in one publication. This task is simplified by using the advertisers index printed on one of the last pages of each issue. It is much easier and faster to compare these alphabetical listings against your file cards than to individually check each page of each publication. Your resultant file card index can be easily updated for use during subsequent shows. It is beneficial to list the names, callsigns, and positions of key company people on your index cards, and show correspondence should be addressed to specific people to improve chances of favorable responses. If you do not have a specific contact in a company, it is reasonably effective to send show announcements to the president or sales manager.

Rod Lopez, KA5DVO of Raton, New Mexico, has his rig set up under the eaves in the log house he built last year. He is a farmer who raises dairy goats and other livestock, and he likes to contact other amateurs who produce their own food supplies. Rod has worked all states except Nevada and North Dakota with his Drake TR-4C and HFSV-II antenna. He operates on 15 meters most evenings. KB5GZ helped Rod get started, and Rod picked up his Novice license in February 1979. Rod got stuck in Colorado Springs in a blizzard when he tried going to Denver to upgrade.

Auxiliary Groups. Remember to send show announcements to local groups that do not advertise in the major amateur radio publications. The yellow pages of local telephone directories usually include electronics stores and electronics respresentatives that should be contacted.

Exhibitor Announcement Written Follow-up. The initial show announcement should be followed up in writing within a month, but it should only be sent to those companies that are most likely to participate in your show. Maintain up-to-date information on your file cards to avoid asking an outfit to participate which has already confirmed with your show. This second written announcement should be more detailed than the initial one; it should include information about advertising in the show's printed program, exhibit shipping data, exhibit-related costs (tables, chairs, electricity, etc.), booth locations layout, plus any other data you can provide.

Exhibitor Announcement Telephone Follow-up. The second written notice should be followed up within one month by telephone calls to the most probable exhibitors. Do not be surpris-

2814 Empire Ave., Burbank, CA 91520

ed if you are told that a company does not know about your show despite the two written notices you sent. Some companies receive so much mail of this sort that it is ignored.

Free Exhibits. Many groups are unable to pay for exhibit space but they should be welcomed because they can add a lot of interest to your show. Space costs money, and you may not be financially able to allow as many non-paying exhibits as you would like. Invite as many of these groups as your show can afford. Some of these worthwhile organizations are Amsat/Oscar, CD, DX clubs, MARS, Mobile, MTC, NBVM, OOTC, QCWA, QSL bureau, RACES, Red Cross, Repeater, RTTY, SOWP, SSTV/ATV, Ten-X, and YLRL.

Attendee Contacts. The publicity coordinator is responsible for the preparation and distribution of printed flyers intended to bring the show to the favorable attention of licensed amateurs and other local people who are interested in amateur radio. Attendees can be attracted to the show in several ways.

Magazine Ads. Paid ads in amateur radio (only) publications reach some potential attendees, but it has been my experience that this is not one of the most effective ways to attract attendees. Nevertheless, the cost of such ads is low enough to make them worthwhile. It is best to run an ad including a drawing or show logo and to keep your ad out of the for-sale section.

Flyers. Show flyers should be prepared as early as possible for use in answering early requests for information. These flyers should at least contain the dates, days, opening times, closing times, pre-registration cutoff date, mail address, location, travel directions, sponsoring group, theme, grand prize, pre-registration prize, banquet prize, pre-registration and regular ticket prices, prices for banquet/breakfasts/luncheons/dinners, ticket order form, known show highlights (contests, speakers, exhibits), and line drawings or cartoons to provide improved eye appeal. Do not mail flyers more than two months before the show if you are going to make just a single mailing. If you have a list of past attendees, mail show flyers to them before you send flyers to others. All flyer mailings should be completed at least two weeks prior to your show and one week before the pre-registration cutoff date. A simple way to obtain a list of past attendees is to sort the ticket stubs into callsign sequence at the conclusion of your show and retain them for use prior to your next show. You can save money by checking each address against the current callbook and/or supplement information. You will learn that amateurs frequently change callsigns and locations. If you can afford to do so, it is much easier to just mail flyers to addresses shown on ticket stubs and to mark "address correction requested" at the lower left corner of the addressing surface. If the amateur has moved, the flyer will be returned with the correct address noted on it, permitting you to send a flyer to the new address. However, you pay for each returned flyer and this system is expensive.

Seventeen-year-old Andre Clay, KL7IXD from Delta Junction, Alaska, has done some operating from Fort Bragg, North Carolina and Fort Rucker, Alabama. He is back in Alaska now where he is a senior in high school. He runs a Heath DX-60B transmitter with a matching HG-10B v.f.o. and his receiver is a Realistic DX-160. Andre has worked all 50 states and 35 countries. He has passed the 13 wpm code receiving test to upgrade to General, but he advises that he will continue to operate the 15 meter Novice band a lot even after he upgrades.

League Member Addresses. If your show is being sponsored by an ARRL affiliated club, you can request a set of local League member gummed mailing address labels from the ARRL. This free service is available one time per year. Simply submit a sequential list of the zip codes for the areas where addresses are desired and state your League affiliation.

New, Renew, and Modify Licensee Addresses. If you provide *Worldradio* with regular (#10) business envelopes, they will send gummed mailing labels for new licensees in the zip code areas you request. Each envelope should have first-class postage attached and should be addressed to the publicity coordinator. These labels are for local amateurs who have recently modified their licenses, upgraded, or who are new licensees. Naturally, these labels do not include just ARRL members.

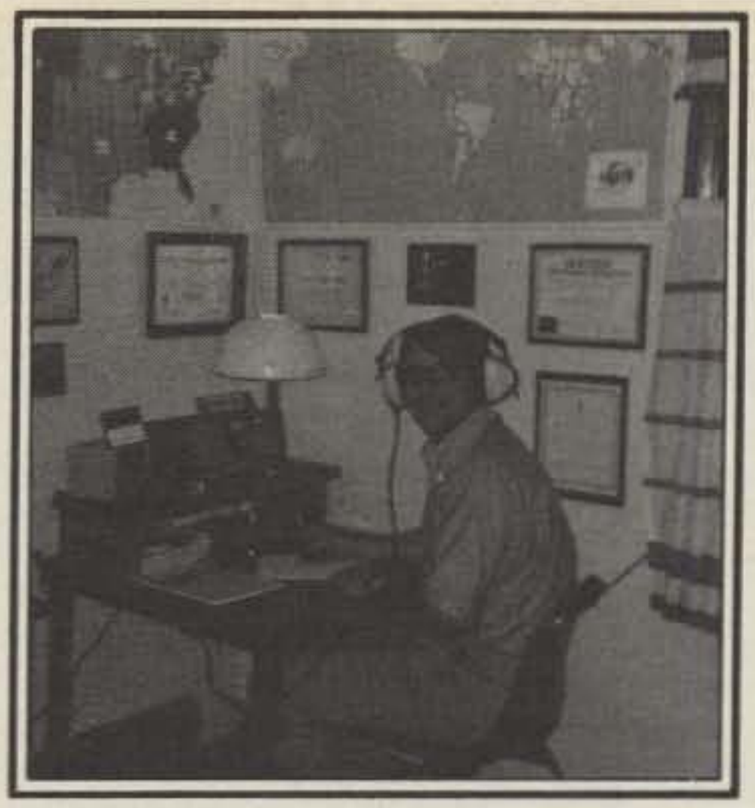
Callbook Addresses. The simplest and most effective way to obtain addresses of all amateurs in your area is to buy a set of mailing labels from the Callbook. Simply send a sequential list of the zip-code areas you want to reach and you will be provided with a quote for the labels. These labels can be purchased with self-adhering backs which allow them to be peeled off the master sheet and applied to the flyers. I advise you

not to use self-adhering labels if you plan to mail more than 1000 flyers. It is much easier to get their standard labels and to pay about $10 per thousand to have them automatically attached to the mailing page of your flyers by a local bulk-mail outfit. If you use this latter system, the last page of the flyer must be supplied with the labels before the flyer has been assembled.

Club Bulletins. The most cost-effective way to advertise your show is to send single-page flyers to all local amateur radio clubs that are willing to insert your flyer in their bulletins. It is easier to coordinate this effort through a local council of amateur radio clubs, but it is not very difficult to separately contact each club, if that is required. It is advisable to enclose about four free show (not banquet) tickets with flyers sent to a club and to allow the club to use these tickets as they wish. Simply require that the filled-in stubs be returned prior to the show. The club editor can tell you how many flyers he needs for insertion in a single issue of his bulletin. It is wise to just send your show flyer in one issue of each club's bulletin, and it is best to select bulletins mailed at least one month prior to the pre-registration cutoff date. It is quite likely that area amateurs will receive more than one show flyer if they are active in clubs. Despite the fact that mailing costs are a major show expense, do not worry about how many flyers any amateur receives; just do your best to be sure they get at least one flyer. Repeat flyers just serve to remind them about the show, and they can always pass along extra flyers to non-amateurs. Incidentally, one of the best possible ways to reach non-amateurs who are interested in amateur radio is through club bulletins.

Repeaters. Repeater groups have excellent local audiences and it should be easy to have your show mentioned by them. Naturally, care must be taken to avoid mentioning costs and prizes, which also should not be mentioned in free ads broadcast by commercial stations.

Newspaper Articles. It is effective to prepare a good news release about your show for use in your local newspapers. Include the basic who, what, when, where, and why facts about your show in the article, and submit your double- (or triple-) spaced typed copy to the newspapers one to two weeks prior to when your show will open. Most newspaper editors appreciate receiving good-definition, interesting black-and-white photographs that can accompany the announcement. Do not send the same picture to more than one newspaper and do not expect to have the photos returned. However, if you want to retrieve a photograph used with a printed item, it



Bill Shortz, KA9BZM of Franklin, Indiana, is a 32-year old disc jockey at f.m. radio station WIFN (95.9 MHz) in Franklin. He has been an amateur radio operator about one year, and he has worked 29 states and 2 countries so far on the 15 and 40 meter Novice bands. Bill uses a Century 21 transceiver and a Dentron tuner with a pair of dipole antennas. He is in communications in the Indiana Army National Guard, and he works with the Military Affiliate Radio System (MARS). His other hobbies include swimming and geneology.

is usually possible to pick it up at the newspaper office in the days immediately following publication. The preparation information detailed under commerical radio station ads generally applies to preparing newspaper show announcements.

Commercial Radio Station Ads. I recently updated a detailed explanation about preparing PSA's (public service announcements) for broadcast by commercial a.m. and f.m. stations. The original set of instructions was written in 1949 and it was quite brief. The current set of instructions is longer than this article. Consequently, just the basic facts are covered here.

Announcement Content. The opening line must grab the listener's attention or the remainder of the ad will be ignored. Include who, what, when, where, and why data. State the correct name of the show and include the name and address of the sponsoring group with the PSA, plus the telephone number of a cognizant show official. Use correct grammar and spelling and add phonetic pronunciations in parentheses following unusual words and names. Avoid abbreviations and coined words. Include start and stop airing dates.

Announcement Preparation. Check and recheck every fact stated in the PSA and cover letter. List facts in the PSA in their order of importance and exclude less important facts. Keep the PSA simple and interesting, remembering that it is intended to prompt the listener to do something he/she had not planned to do. Tape ads are submitted at 7.5 ips and record ads are at 33⅓ rpm.

Announcement Review. Read your proposed PSA aloud to others and accept valid criticisms. Each PSA must cover the major points and it should repeat the date and location. Rewrite your PSA as often as is necessary to produce a natural-sounding announcement.

Fund Raising. Each fund-raising PSA that is 30 seconds long (or longer) must include the statement, "This solicitation is made in compliance with the (your city/town) Department of Social Service." Naturally, the statement must be true, and your local Social Service number must be typed at the lower left corner of the PSA sheet. This requirement is seldom of interest to an amateur radio show, but it could apply in certain situations.

Unacceptable Material. Do not mention prizes, ticket prices, or prize drawings in the show PSA. When soliciting donations of material, do not use a commercial place of business, because they will not be mentioned in a PSA. Fund raising ads are not accepted from unincorporated organizations. PSA's are not accepted for events sponsored by ideological, philosophical, political, or religious groups; nor are they accepted from professional or trade groups.

Word Count and Time. Time is worth money in the broadcast industry. There is a dollar value to each PSA and it is important to keep ads short. Typical announcing times for word totals of 20, 50, 75, and 150 are 10, 20, 30, and 60 seconds, respectively.

Paper and Typing. Use standard 8½" × 11" letterhead or white bond paper when typing your PSA. Do not type a PSA on tissue paper, or onion-skin paper. Double or triple space between each typed line and leave a 1¼ inch editing margin on all four sides. Use normal upper- and lower-case letters, not all capital letters. Include simple punctuation marks to make it easier to read. Address your PSA cover letters to the public-affairs director at each local a.m./f.m. station you want to air your ad. Do not separate sentences with a series of dots (periods) or dashes (hyphens). Do not hyphenate any word; type it uninterrupted on the next line. Do not combine two or more ads; submit separate PSA's on each subject. Do not separately fold several sheets of a long PSA and do not staple them. Typed announcements are much preferred, but neat printing is usually accepted. However, longhand writing can cause errors and it should not be used.

Lead Time. Unless otherwise stipulated by a specific broadcast station, PSA's must reach them at least 15 days before the first date they are to be broadcast.

Television Ads. All a.m., f.m., and television public broadcast stations are required to donate time to free broadcasts that are in the public interest. Some stations have a sincere desire to fulfill this obligation, whereas it appears that other stations make little effort to even meet the minimum legal requirements. Station logs must be made available for public viewing at reasonable times, and it is easy to determine which stations are best (and worst) in regard to broadcasting public service announcements. It is in your best interest to support license renewals of cooperative stations and to oppose those of uncooperative ones. Send such letters to the FCC Washington office with copies sent to station managers. Broadcast station licenses normally expire at the end of calendar years, and it is easy to track expiration dates of local stations. The dollar values of PSA's aired by f.m. and a.m. stations range between $50 and $1500, whereas they are worth $500 to $5000 on TV. TV PSA's must be tailored to meet the specific requirements of each station. Contact the public affairs director at each TV station to ascertain precise requirements. Most TV stations require dual 2-inch-square glass color slides to accompany your typed or recorded announcement. Some stations require you to make the announcement yourself on videotape. The guidelines detailed under commercial radio station ads generally apply to TV PSA's.

Signs and Banners. Show announcement posters can be printed for display at local radio distributors, electronics stores, radio clubs, and schools. Small posters are generally more acceptable than large ones. If the show site has outside and/or inside announcement display provisions, use them.

Exterior Message Boards. Banks and other businesses sometimes have outside message displays. Personally contact the person in charge of each such display and make arrangements to have your show advertised. Groups sometimes check with each other to avoid running the same ad. Ascertain existing display policies before requesting such advertising in two or more locations.

Street Banners. Street banners are effective when they are strung across major intersections. Most towns and cities provide this service at low cost and can advise you which sign painters are familiar with their special requirements.

Signs. Prepare plenty of good show signs prior to your show. Some of the signs you may need are banquet, contest, exhibitor, flea market, food, lost and found, message center, mobile displays, parking, prize booth, QSL display, registration, restrooms, and seminars. It is better to leave room on these signs to attach directional arrows rather than preparing them with arrows painted on them. Attaching arrows is easy and this system provides good flexibility. Have add-on arrows painted on symmetrical stock so that one type can be used to indicate both left and right and the other type can be used to indicate both up and down. It is essential to erect plenty of good signs to help your attendees enjoy the show more.

It is generally illegal to attach signs or posters to utility poles and other structures. However, you will probably receive no adverse comment as long as you remove such material immediately after your show. It is helpful to erect temporary signs in the vicinity of your show site to direct attendees to your location and to approved parking areas.

Due to the amount of effort involved in obtaining, erecting, and removing signs and posters, the publicity coordinator should have an assistant who is responsible for this work.

Gifts. Have a supply of special giveaway items prepared for distribution to exhibitors, speakers, and show workers. Items should be suitably and permanently marked to indicate relationship to your show. Some of the more popular items I have used include ballpoint pens, calendars, cups, decals, drinking glasses, felt-tip pens, key chains, pencils, playing cards, QSL cards, and 3-ring binders. Obtain some special item to be given to each show worker at the wrap-up meeting. Each coordinator should personally distribute this gift to each person who worked for him/her during the show. The cost of gifts is a legitimate show expense, and it is important to select good items that will be used for several years.

Photographs. The publicity coordinator needs an assistant who is a capable photographer with good equipment. Many people have good equipment and consider themselves to be good photographers, but there is a knack to taking useful show pictures, and it may be wise to use two or more people operating independent of each other but responsible to the publicity coordinator. Black-and-white matte (dull but not silk-finish) photographs are most useful for show wrap-up articles in local newspapers and national amateur radio publications. Such photographs can later be used with newspaper articles when announcing the next annual show. Take a few pictures showing winners of major prizes, but most photographs should show a variety of activities. Useful pictures can be taken showing the banquet, contests, flea market, inside exhibits, mobile displays, parking area, and seminar activities. In most instances, it is good to have photographs with good contrast and the least possible amount of background clutter.

Basic Publicity Considerations. Every show feature should be mentioned in as many ads as possible. Provide as much information as possible about contests, displays, hospitality suites, technical seminars, and other show features. Each item is of interest to some potential attendee. All show flyers, posters, and signs should employ colors that catch the eye of the viewer. Even bumper stickers and self-adhering envelope labels can effectively advertise a show.

The publicity coordinator must conduct a thorough and systematic campaign to achieve optimum show advertising. Until lists of local broadcast stations and newspaper addresses have been developed, the best single source for this information is the telephone directory.

Single-page flyers in local amateur radio club bulletins provide the best response. Spot ads broadcast by local a.m./f.m. radio stations are more productive than either articles in local newspapers or magazine ads. Direct mailing to all local amateurs is the best way to get good attendance at your show.

This completes the third part of this four-part article.

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: Dick, KA1DBY, Manchester, NH; Tom, KA2DFO, N. Babylon, NY; Dave, KA3EDS, Landover Hills, MD; Ed, KA4LQD, Fayetteville, NC; Arthur, KA5DWI, Bedford, TX; Wade, WD6DTV, Burbank, CA; Tom, WB7UCS, Cody, WY; Danny, WD8BHE, Petersburg, MI; Chris, KA9FXB, Bloomington, IN; Scott, KA0DXR, Omaha, NE.

73, Bill, W6DDB

CQ REVIEWS

The Yaesu FT-207R Microprocessor Based 2 Meter Handie-Talkie

BY JOHN J. SCHULTZ*, W4FA

Considering all the features advertised for the Yaesu FT-207R, I expected a rather bulky handie-talkie to emerge as I unpacked it from its shipping container. What emerged, however, was a handie-talkie no larger than the FT-202 and weighing only somewhat over a pound. Since then the unit has been in use for several months and it really has proven to be a powerhouse in a small package. Handie-talkies will probably never be the same again and I, for one, would never be satisfied to go back to a conventional handie-talkie after using a unit such as the FT-207R.

General Specifications

The FT-207R is not palm-sized, but it is hardly much larger. Aside from the antenna, it measures about 70 × 180 × 50 mm overall. The small size plus the light weight of the unit make for a handie-talkie that can be held in one hand for long periods of usage without fatigue. It's quite a wonder that Yaesu could pack so much performance in such a unit. The major specs as Yaesu claims them for the FT-207R are:

Frequency Coverage: 144.000 to 148.000 MHz

Channels: 800 (basic channel spacing is 10 kHz but a 5 kHz "Up" switch allows for shifting any channel 5 kHz higher).

Sensitivity: 0.32 microvolt for 20 db quieting.

Selectivity: ± 7.5 kHz at – 60 db

R.F. Power Output: 2.5 watts (high power position or 200 mw low power position).

Audio Power Output: 200 mw at 10% THD.

Spurious Radiation: – 60 db.

Memory Channels: 4 plus provisions for a Priority Channel.

Scanning: Scanning of memory channels only or any desired portion of the entire frequency range. Scanning can be set to locate either active channels or clear channels.

Battery Requirement: Special Yaesu supplied NiCd battery pack, 10.8 v.d.c. at 450 mah.

Current Consumption: Receive mode: 150 ma (drops to 35 ma when squelched with the LED frequency display switched off). Transmit mode: 800 ma (high power), 250 ma (low power).

Frequency Display: 5 digit display with 3 digits to indicate frequency and separate digits to indicate which memory channel is being used and error modes.

Repeater Offset: Switch position for ± 600 kHz offsets plus two additional switch positions for any desired, programmable ± offset.

Keyboard: 19 keys with 12 keys active on transmit to act as a two-tone encoder for autopatch or control purposes.

Microphone: Built-in condensor type, 2 K ohms.

The FT-207R weighs in at only slightly over a pound but contains features not seen until now in a handie-talkie.

* C/O CQ Magazine

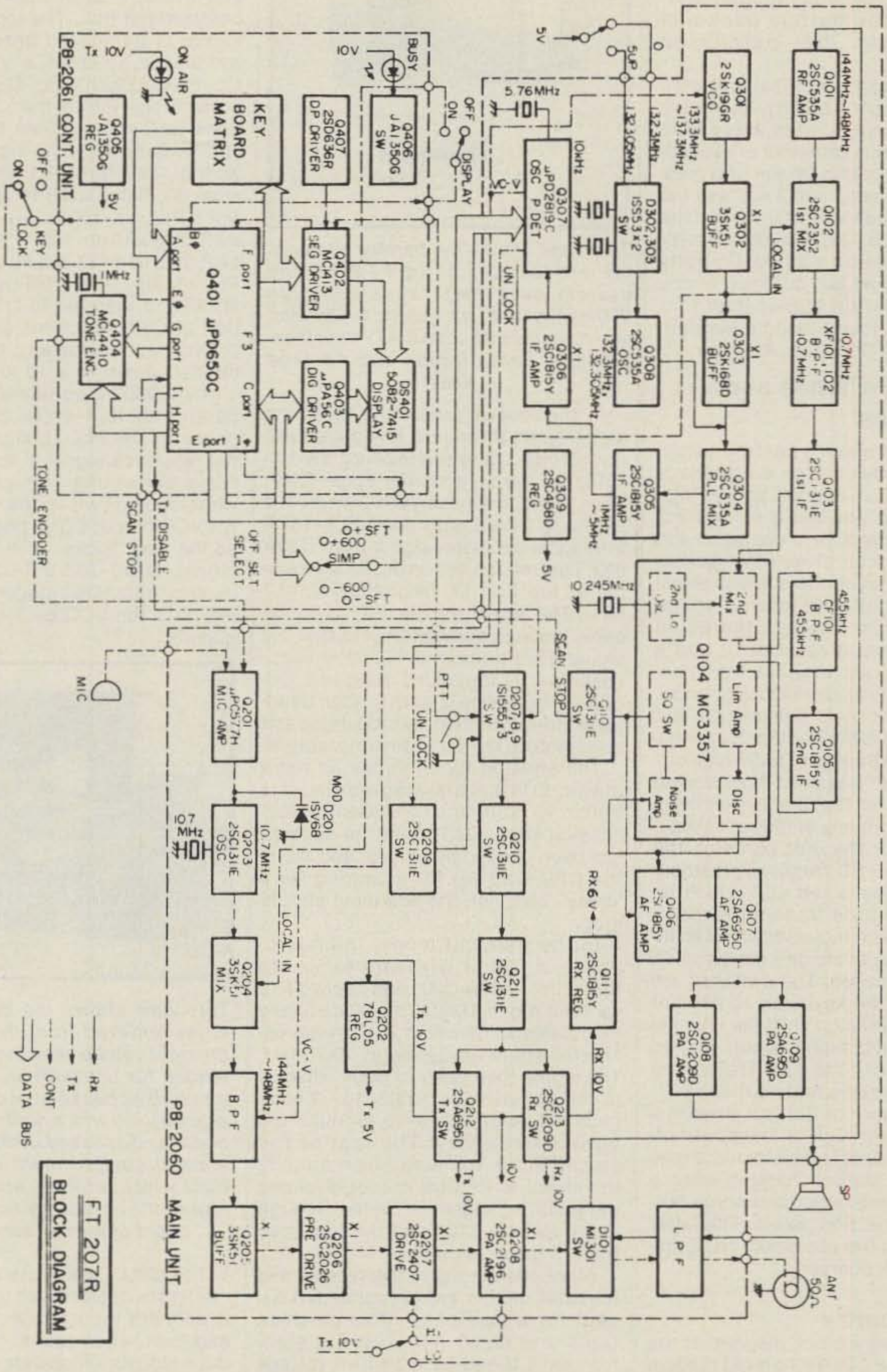


Fig. 1– Block diagram of the FT-207R. If it looks a bit complicated, imagine what the schematic diagram looks like!

Antenna Connector: Standard BNC type.
Accessories Supplied: Rubberized, flexible antenna and Instruction/Service Manual (the battery pack and charger must be purchased separately).

All of the major specifications were checked using good quality, laboratory grade instruments and in every case the specifications were met or exceeded. The power output on the unit measured, for instance, read 3 watts in the high-power mode and 300 mw in the low-power mode. The – 60 db claim for spurious radiation was particularly carefully checked but no trace of any spurious radiation higher than that level could be found using a Hewlett-Packard 8553B Spectrum Analyzer.

Controls, Switches and Connections

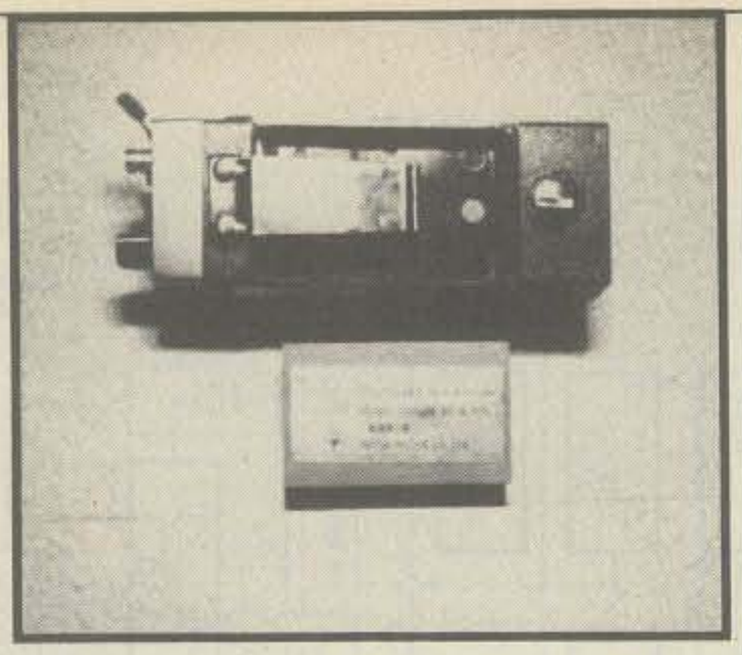
There is just about a control, switch or external connection on every side of the FT-207R. But, they all appear logically arranged and allow for a great deal of flexibility both in operation and in the connection of external accessories. The main controls and external connection points are located on the top of the unit. There is the usual volume and squelch control and a switch to choose whether the scanning (when activated) will lock to an active ("busy") or clear channel. On top there is also the BNC antenna connector, a standard transistor radio type earphone jack and a special 6-pin socket which allows for the connection of an external microphone and/or speaker.

The front of the unit contains the keyboard, the LED frequency/memory channel display, a red LED which indicates during the transmit mode, a green LED which indicates when an incoming signal overrides the squelch and three switches. The switches are used to lock the keyboard to prevent accidental entries, to shift the channel frequency 5 kHz higher when desired and to shut off the LED frequency display to conserve battery life.

On the bottom of the unit there is a switch to select high or low power r.f. output, a standard transistor radio type jack to allow battery charging using a wall-plug type charger and some button type connection points. The latter are used with the accessory NC-2 cradle type quick charger.

Basic Circuitry

Fig. 1 shows a block diagram of the stages in the FT-207R. To most readers it will probably appear to be a confusing maze of stages that bears little resemblence to a conventional transceiver. However, one can trace out the basic signal flow paths without too much difficulty.



This view shows the battery compartment in the back of the FT-207R. The battery pack that Yaesu supplies (NBP-9) is rated at 10.8 volts/450 Mah and measures 55 × 18.5 × 87 mm. It appears to contain nine sub-AA type cells.

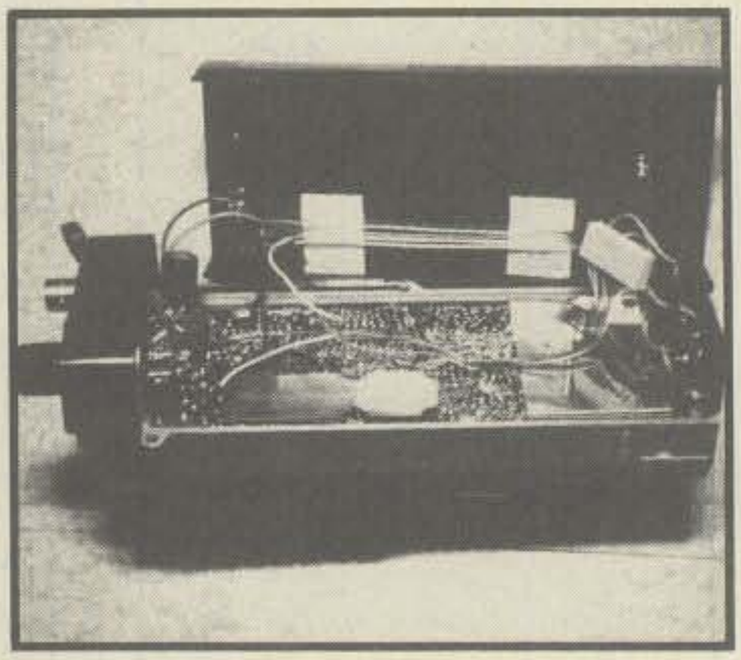
In the receive mode, the incoming signal goes through a low pass filter and diode transmit/receive switch (D101) to the r.f. amplifier stage Q101. Then to the first mixer, Q102 where the signal is mixed with the 133.3–137.3 MHz local oscillator signal from Q301/302. This mixing action produces a signal at the first i.f. frequency of 10.7 MHz. The rest of the circuitry in the receive mode is conventional in that the signal goes through a 10.7 MHz bandpass filter, is translated down to a second i.f. of 455 kHz and further bandpass filtered, limited, demodulated and used to drive the audio amplifier stages.

The squelch function has an extra stage, Q110. This stage acts as a switch to notify the CPU (Central Processing Unit), Q401, that the squelch has been opened by a signal and that if the CPU was set for scanning for a "busy" channel, the scanning should stop.

In the transmit mode, the microphone signal or keyboard tones are first amplified by Q201 and applied to a varactor diode, D201. This diode phase modulates Q203 which is a crystal oscillator stage operating at 10.7 MHz. The signal then goes to Q204 where it is mixed with the 133.3–137.3 MHz local oscillator signal to produce the output frequency. The rest of the stages in the transmit chain amplify the signal to its final output level and the resulting signal is routed through diode switch D101 and the low pass filter to the antenna.

All of the stages in the receive and transmit chains are broadbanded except for a bandpass filter between Q204 and Q205. The filter is electronically tuned by a control voltage derived from the circuitry which controls the 133.3–137.3 MHz local oscillator stage. The tuning of this filter to the operating frequency plays a major role in reducing spurious signals in the transmit mode.

The most elaborate part of the FT-207R circuitry involves the PLL (Phase Locked Loop) local oscillator circuitry and the CPU or micropressor which controls the PLL. The local oscillator signal is generated between 133.3–137.3 MHz by Q301, a VCO (Voltage Controlled Oscillator). Q302 acts as a buffer stage. Part of the output of Q302 goes to Q303 and then to PLL mixer Q304 where the VCO signal is mixed with a 132.3 MHz PLL signal coming from oscillator Q308 to produce a 1–5 MHz PLL i.f. signal. In the "5 Up" switch position, the Q308 oscillator switches to a 132.305 MHz crystal. The PLL i.f. signal is amplified (Q305 and Q306) and then fed to Q307. One section of Q307 functions as a 5.76 MHz crystal oscillator and the signal is divided down to a 10 kHz reference signal. Q307 also has a phase comparator section which compares the phase of the PLL i.f. signal to that of the reference signal. If there is any error, a correcting voltage is fed to a varactor diode within the VCO to cause the VCO output signal phase to change so the loop "locks" with the reference signal. Q210–213 act to prevent the receive or transmit stages from operating until the VCO is "locked" on frequency.



This view shows the complete back cover removed from the FT-207R. At the right can be seen the connector intended for use with an optional tone squelch accessory. However, it can also be used with a home-brew tone encoder as discussed in the text. There is a small compartment at the bottom right which provides enough space to mount the accessory tone squelch PC board or a small tone encoder.

The CPU, Q401, acts as the control center for operation of the transceiver. It accepts inputs from the keyboard and then sends data to the PLL to produce signals which determine the VCO frequency. It also produces signals to control the display circuitry and holds data for the frequencies entered into the memories. It contains stored instructions to prevent operation of the transceiver if one attempts to use fre-

quencies or an offset which would cause out of band operation. The memory channels are not lost when the transceiver is turned off. The CPU is normally constantly connected to the battery supply at a drain of about 4 ma. The frequency offset switch does, however, have an extra position so one can even disable the memory backup feature, if desired.

Operation

There is nothing complicated about the operation of the FT-207R but one can miss a lot of features if one does not take time to read the instructions carefully as to how the keyboard functions. In fact, what I ended up doing was making a summarized instruction card, much like the pocket type cards that come with some calculators, to keep with the transceiver as a reference.

Basically, one just enters the last three digits of a desired frequency, which must be a multiple of 10 kHz, on the keyboard and presses the ENT/DIL key to operate on the frequency. The frequency can be entered into a memory, if desired, by a further sequence of key depressions. The digital display will display the three digits entered on the keyboard. If the "5 Up" switch is turned on, the operating frequency will change but not the display. This is a slight weak point in the design of the unit. The fourth digit in the five digit display actually is used only to indicate E (error) if a frequency is somehow entered which is false or which will take one out of band. The fifth digit indicates from 1-4 when a frequency is called out of one of the four memories. The standard ± 600 kHz offsets are switch selected and any other ± split right up to the extreme limits of the band can be programmed from the keyboard by following the programming instructions. When an offset is used, the digital display will switch from the receive to the transmit frequency whenever the PTT switch is depressed. The priority channel feature allows one to check a designated channel for either activity or non-activity (busy or clear), depending on how the controls are set. The unit will switch every few seconds from the operating frequency to the priority frequency. If the desired state (activity or non-activity) is found on the priority channel, the unit will lock on the priority channel. Obviously, this feature is very useful if one is just casually listening on a channel but is really waiting for activity to develop or stop on another channel.

The scanning feature allows for manual scan or automatic scan and for the scanning of just the memory channels or for the scanning of the entire band. Also, the scanning feature can be set so it stops when it finds either an active or a clear channel. The UP or DOWN keys can be momentarily depressed to move the operating frequency up or down in 10 kHz stops. If either key is held depressed for more than ½ second, the unit will automatically start scanning in 10 kHz steps. It takes about 20-25 seconds to scan through the entire band.

Once one gets used to the key entry sequences, operation of the unit is very easy and one can have all sorts of fun searching out various repeater frequencies.

The unit was found to be very reliable and consistent in operation. The controls are easy to use and positive in their response. Although no formal tests were made, normal temperature such as when going from a heated room to a cold automobile during the winter did not affect performance. Reports on the transmitted audio were consistently good. The operating time for battery charge will, of course, depend on various factors such as the transmit/receive time ratio, whether high or low power operation is used and whether the LED display is left on or not. One has a tendency to leave the latter on just to see the digits displayed but it is not really necessary. If the display is turned off and one switches between memory channels, the display will automatically come on for a few seconds so one can confirm the chan-

nel which was recalled. Several hours of continuous operation was normally obtained from a battery charge and, using the wall plug type charger, the battery pack recharged fully overnight.

Tone-Encoders and Tone-Squelch

There is a bottom compartment in the FT-207R which provides space for the installation of various tone encoder units. A plug going into the compartment provides for the installation of a Yaesu supplied sub-audible tone squelch accesory which can be set to operate between 67.0-250.3 Hz. When this unit is used, the squelch control is rotated to a "tone" position and the squelch will not be opened until the suitable sub-audible tone is received. The accessory also provides for the generation of the sub-audible tone on transmit to open the squelch of other similarly equipped transceivers with tone squelch units. The schematic of the accessory is not presented here because it is highly unlikely that the average amateur could ever duplicate the one IC, four transistor accessory unit compactly enough to fit in the FT-207R.

However, those who need only simple tone-encoder or tone-burst functions will find enough space available to house many such circuits. The plug

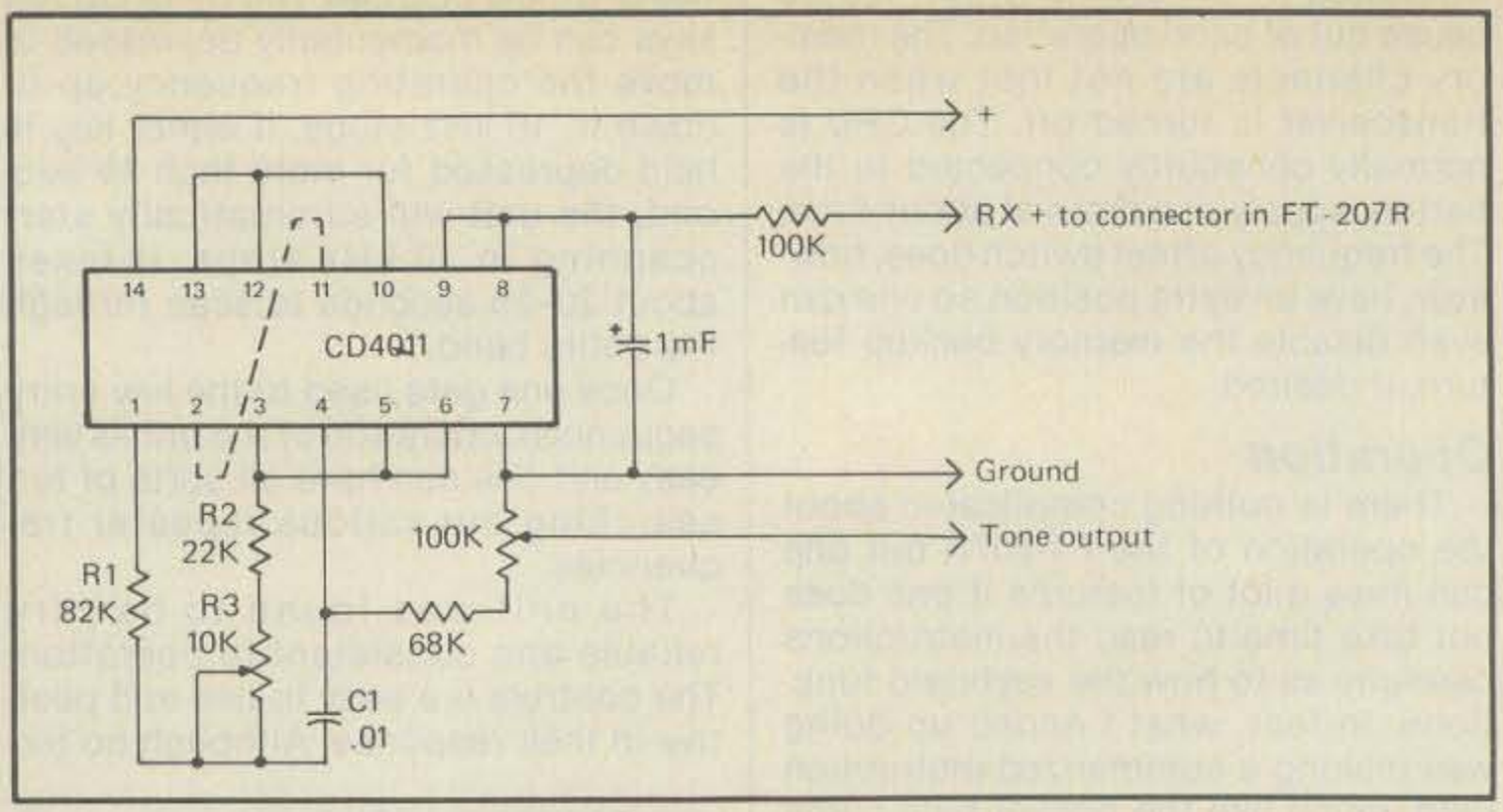
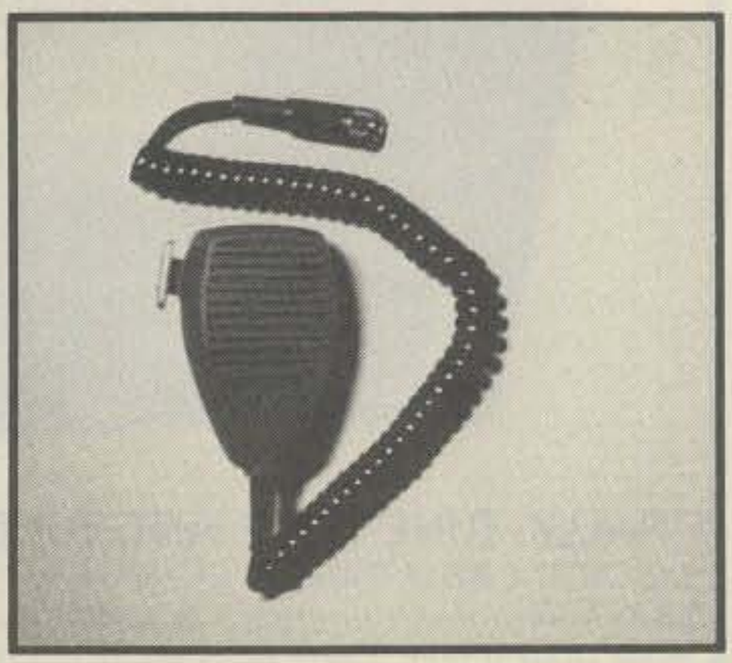


Fig. 2- A simple tone burst circuit which can be constructed on a small perf board and housed in the FT-207R. The circuit as shown is for a 1,750 Hz burst, but by suitable choice of R1-R3 and C1, it can be modified for any frequency. The 100 K fixed resistor and the 1 mf capacitor determine the burst duration.



The YM-24 accessory microphone/speaker contains a condensor-type microphone and a small 8 ohm, 200 milliwatt loudspeaker. It has proven to be a very handy accessory with good speech quality on both transmit and receive.

which is available provides for all the necessary interconnection points into the transceiver (e.g. tone-out line, ground, transmit + line, receiver + line, etc.). I used, for instance, the single IC circuit of fig. 2 to provide a tone burst of 1,750 kHz, which is the frequency needed for many European repeaters. The circuit can be modified to work on almost any radio frequency by the choice of R1-R3 and C1. These components should be temperature stabile and the use of 1% resistors and a polystyrene or metallized polycarbonate capacitor is recommended.

Other Accessories

The Nc-2 Quick Charger/Base Stand was not tried but apparently it provides for a full battery charge in several hours.

The YM-24 Microphone/Speaker was purchased and found to be a very handy accessory item. The unit can get lost in the palm of one's hand but still contains a 200 mw 8 ohm speaker and a 2 K ohm condenser type microphone. The YM-24 is very handy for mobile operation, if one wants to position the FT-207R in an elevated position or if one wants to operate with the FT-207R clipped on a belt. The audio quality using the YM-24 is the same as when using the transceiver alone. Power for the condensor microphone is taken from the FT-207R over the cable which connects the YM-24 to the FT-207R. The YM-24 is nicely constructed and undoubtedly will withstand rough usage. The same can be said of the special 6 pin socket/plug used to interconnect the YM-24 and the FT-207R. But, the plug is so special that no one stocks it! Two U.S. distributors and one European one could not supply the necessary plug so I could connect other external accessories besides the YM-24 (the latter, of course, comes with the necessary plug).

Operating Manual/Servicing

The operating manual is complete and well written. The explanations of all the keyboard functions, for instance, are well explained using numerous examples.

The diagrams supplied give one all the necessary information to follow the basic circuitry and, particularly, to understand all the external connections to the main PC board. There are some PC board layout diagrams and even basic alignment instructions for the receive/transmit chains. However, it is unlikely that most amateurs would want to attempt any self-repairs on the FT-207R, even if it is out of warranty, except for simple checks of the external PC board connections.

a monthly feature by
JOHN A. ATTAWAY, K4IIF

DX

NEWS OF COMMUNICATIONS AROUND THE WORLD

Nothing is more important to a DX awards hunter than a well-functioning QSL Bureau. Yet, few DXers fully understand the complexities of Bureau operation. Let's consider a few facts supplied by Art Nevins, WA4NTP, regarding the WA4/WB4 incoming QSL Bureau.

The 4th call area, with well over 60,000 licensed amateurs, is by far the most populous of the U.S. call areas, and requires 2 incoming Bureaus to handle its tremendous workload. An estimated 38,000 amateurs in the 4th district have 2-letter prefixes such as WA4, WB4, KB4, AA4, etc. This does not include DX calls such as KC4, KP4 and KV 4 which are handled by other Bureaus. However, only 5,200 of these 38,000 amateurs maintain envelopes on file at the Bureau. As a consequence, the volumn of unclaimed cards held in storage at the Bureau as of January 1980 would reach to the top of an average tower if placed in one stack, 46½ feet of cards.

The 2-letter prefix Bureau for the 4th call area is sponsored by the Sterling Park Radio Club in Sterling Park, Virginia, but the volunteer workers who make it function come from all parts of northern Virginia. There are almost 3 dozen Bureau volunteers and they process over 60 pounds of cards in a normal week. After major DX Contests such as the CQ Worldwide Phone or C.W. DX Tests in the fall or the CQ S.S.B. or C.W. WPX Tests in the spring, they may handle as many as 100 pounds of cards weekly. It takes 150 regular QSL cards to make up 1 pound, approximately 0.4 kilograms of cards.

The Bureau operates much like the Pony Express. The Bureau Manager or Deputy (presently an OM - YL combo) picks up the mail twice weekly. Cards are sent to three or four assistants who bulk sort them into 26 letter groups determined by the first letter after the numeral "4" in the recipients' call signs. This sorting takes from five to ten days for each shipment. The Manager handles correspondence and sorts file envelopes sent in by users.

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

Putting the last touches on the 3V8ONU station are AI, I0AMU, on the left and 2 unidentified Italian operators. This group, including operators from Denmark, Germany and Italy, operated from Tunisia Sept. 1-13, 1979 under the auspices of the International Committee of Radio Amateurs for UNICEF. Using a 2-element trap tribander and dipoles for 40 and 80 meters they made 13,000 QSO's in 109 countries.

Each week cards from the bulk sorters and the incoming file envelopes are sent to 25 assistants responsible for processing cards for each suffix letter group, such as KI4G, WB4GAA through WB4GZZ, etc. One assistant presently manages two letter groups. This process of getting cards and envelopes from the Bureau Manager to the letter managers may involve several "Pony Express" couriers as cards are moved up to 40 miles away from Sterling Park.

It is because each call sign suffix is managed by different volunteers that only one call sign may be used on each envelope filed with the Bureau. A family of amateurs or a radio club may be served by several different Bureau assistants, separated by many miles between them.

Bureau volunteers together contribute more than 100 hours each week to maintaining the flow of DX cards and users files. At the present rate for minimum wage, this free labor is valued at more than $16,000 annually.

The Bureau Manager for the two-letter prefix Bureau in the fourth call area reports that the three biggest problems involved with users of the Bureau are amateurs who fail to file

The WAZ Program

10 Meter Phone

43...I6ZJC
44...I0RIZ

15 Meter Phone

47...K8SQE
48...WD4KWI

20 Meter Phone

287...JA6AXD
288...W7KNT
289...XE1CI
290...VE3IPR
291...K0JSY

15 Meter C.W.

24...I5IRM
25...JJ1MHI

20 Meter C.W.

101...JA7DWM
102...SM5DBR

All Band Worked All Zones

Single Sideband

1870...W7KQH
1871...YV5DFI
1872...WB1DQC
1873...WD5GXI
1874...W0ULU
1875...IT9YRE
1876...W0UUE
1877...W0JIG
1878...WB0YIB
1879...W7EEF
1880...WD8BOM
1881...W4YH
1882...W9IFJ
1883...EA7AGO
1884...EA5ACA
1885...WD8ILW
1886...I3LBW
1887...I3BBZ
1888...EA6ET
1889...W0IZ
1890...PA0PCA
1891...XE1XF
1892...I3EGD
1893...KB8DB
1894...OK1AGN
1895...WB7RKE
1896...WB7PCJ
1897...WD5DBV
1898...WD3BAP

C.W. and Phone

4754...N4VA
4755...JR1GJP
4756...JI1QPU
4757...N0JW
4758...JA7AWZ
4759...JA6MPJ
4760...WA4CTA
4761...JA2ACR
4762...K7CU
4763...JA9SQO
4764...N4TJ
4765...WB4YHV
4766...K3AO
4767...YU2RQN
4768...WA8KEM
4769...WA4GIQ
4770...AG4L
4771...W1DMD
4772...VE4MF
4773...W7IHN
4774...DM2ARD
4775...DM2ADH
4776...DM4EL
4777...DM3UH
4778...JA2WGD
4779...IV3NCB
4780...IT9LMK
4781...OK1AUP
4782...OK3IF
4783...WB4SXX
4784...K0QQ

All Phone

559...W2NZG
560...I8KRV
561...K0QQ

Application blanks and reprints of the latest rules may be obtained by sending a self addressed stamped envelope (30 cents) size 4½ × 9½ to the WAZ Manager, Leo Haijsman, W4KA, 1044 S.E. 43 Street, Cape Coral, Florida 33904. Applicants forwarding QSL Cards direct to the WAZ Manager or to a check point should include sufficient postage for the safe return of their QSL cards.

Phil Hunsberger, K9PNT/DU2, received the first reciprocal license from the Phillippines in 1976. He will be active until the end of this year, and plans to spend a lot of time in the 15 meter novice band giving stateside novices a DU2 contact. QSL to his home address, 140 S. Western Ave., Kokomo, IN 46901.

Art Candell and his Kenwood 520 and Yaesu 2100B which put that consistently big signal out of Haiti with the call HH2A. Art is a former K2 and HR2 and is a foreign correspondent. QSL to Box 2443, Port-Au-Prince, Haiti.

envelopes, insufficient postage for envelopes on file, and incorrectly-sized envelopes sent to the Bureau. The ARRL incoming DX QSL Bureaus are free for use by *all* DXer's, without regard to League membership. Instructions for use are frequently included in *QST,* but each Bureau has specific supplemental instructions available for an s.a.s.e.

The Bureau at Sterling Park, for instance, prefers amateurs send envelopes which are end-opening, clasp-fastening, *approximately* 5 × 7½ inches in size (give or take a little). Letter-sized and legal-sized business envelopes will be returned. Users are cautioned that the U.S. Postal Service imposes a 7 cent surcharge for envelopes weighing one ounce or less which are 6 1/8 × 11½ inches in size or larger. One unit of postage should be affixed to each envelope; additional stamps may be paper clipped to the envelopes. The user's call sign should be carefully printed in the upper left corner. Each envelope must be addressed (including the full name) to the user. Do not put on a return address; the Bureau will stamp its own.

The two-letter prefix "4" Bureau does not sell envelopes or stamps.

Outgoing QSL cards must be sent directly to the ARRL Outgoing QSL Bureau at Newington, Ct. (see *QST* for details), or to some other service. Likewise, cards for domestic stateside contacts should not be sent to incoming DX QSL Bureaus.

Even Canadian, Puerto Rican, and Hawaiian cards come through the QSL Bureau system. So, if you work DX, even occasionally, you should keep a few envelopes on file with your appropriate Bureau.

Envelopes and inquiries for amateurs with two letters in front of the numeral "4" in their call signs should be sent to ARRL QSL Bureau, Box 599, Sterling Park, Va. 22170.

Contestpedition This Fall?

Are you planning a DXpedition for either the *CQ* Worldwide Phone Contest in October or the *CQ* Worldwide C.W. Contest in November? If you have determined the country in which you plan to operate, please advise K4IIF, P.O. Box 205, Winter Haven, FL 33880 so that it can be included in the special column on contest plans. This information will be held confidential and will not be disclosed until the October issue of *CQ,* but we need the info by July 10, 1980 if it is to make the deadline for the October issue.

Here and There

Congratulation to John Shean, K5DB, on his new DX bulletin *The Pile Up.* For the present time this bulletin is restricted to DXers in the San Antonio, Texas area.

Most Wanted Countries List during the early spring month showed the following order as seen by U.S. amateurs and reported in *QRZ DX*:

1. BY, China
2. XZ, Burma
3. VS9K, Kamaran Island
4. VU7, Laccadive Islands
5. VK0, Heard Island and FB8W, Crozet Island (Tie)
6. 3Y, Bouvet Island and ZA, Albania (Tie)
7. VU7, Andaman and Nicobar Islands
8. CE0X, San Felix Island and 3X, Republic of Guinea (Tie)
9. XU, Khmer Republic and 70, South Yemen (Tie)
10. TZ, Mali

With expeditions to China, Burma and Heard Island planned for the spring months, this order may have changed by the time this column reaches you.

Len, WB3HNK has a problem. His address in the *Callbook* is adjacent to that of DX Hall of Fame QSL Manager, Joe Arcure, Jr., W3HNK and consequently he gets a lot of Joe's mail. All QSL's for W3HNK should go to P.O. Box 73, Edgemont, PA 19028, not to Len's address.

Condolences to Nao Akiyama, JH1VRQ, on the loss of all his ham gear when his apartment was destroyed by fire in March. Nao escaped literally with only pants, shorts, shirt and bare feet.

Congratulations to W8CNL on winning the WPX Award of Excellence, one of

The WPX Program

Mixed

824...K0CN
825...W4BV
826...WB9GCU
827...JA1MNO
828...W0TT
829...IT9MTH
830...I1UNO
831...DK2UB

S.S.B.

1248...AC2J
1249...K2BQW
1250...YU5XAF
1251...WA9WGJ
1252...W2VHJ
1253...WB0PLY
1254...W0TT
1255...JH4PRU
1256...KA5ASD
1257...W1CRL
1258...DF4ZL
1259...XE1XF
1260...DL3EW

C.W.

1922...JH7BDS
1923...WD0AVG
1924...W0OGJ
1925...ON7EJ

WPNX

177...KA3BRO
178...KA3CGM
179...KA2CLQ
180...KA4HRD

Endorsements

Mixed: 400 K0CN, JA1MNO. 450 W0UBT, WDO/EPE, I1UNO, DK2UB. 500 W8LKG, K7AGJ, KJ6T, XE1XF. 550 W6DN, WB4FOT. 600 I1ZEU, N4TJ, WB8ZRL. 700 KL7AF. 750 IT9HLO. 900 W4BV, SM3EVR. 950 PY4OD. 1000 4X4FU. 1550 W4BQY.

SSB: 300 AC2J, K2BQW, YU5XAF, W2VHJ, W0TT, KA5ASD, DF4ZL. 350 AL7O, JH4PRU, W1CRL. 400 W0ULU, WB0PLY, W6DN. 450 WB8ZRL. 500 DL3EW. 600 I6NOA, WA4OIB. 650 PY4OD. 700 G4CHP. 750 YV1KZ. 850 F6DZU, W4BQY. 1000 W0YDB.

CW: 300 WD0AVG, W0OGJ. 350 JH7BDS. 450 K6ARE, JA6PWN, ON7EJ. 550 EA7OH, YU5FAM. 600 SM6AYM. 750 W1DMD. 800 PY4OD, CO2OM. 1200 W4BQY.

15 meters: I6NOA, WB8AAX, SM6AYM, WB0PLY.
20 meters: WB8AAX, AG0A, XE1XF.
160 meters: N4UU, WB9GCU.
Africa: 4X4FU
Europe: W8LKG, I1ZEU, KL7AF, JA6PWN, YU5XAF, 4X4FU, WA7OBH, DF4ZL, XE1XF.
No. America: WD0EPE, WB9GCU.

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

Ray Dawson, KB5AC, of 7308 Lancet Lane, Oklahoma City. Ray recently received his 200 country endorsement for his CQ DX Award.

the most difficult DX operating awards in the history of amateur radio. The requirements include 1000 prefixes mixed mode, 600 prefixes c.w., 600 prefixes s.s.b., all 6 continental endorsements plus band endorsements for the 5 bands 80 - 10 meters. For full details send s.a.s.e. to Mr. Bob Huntington, K6XP, *CQ* WPX Award Manager, 5014 Mindora Drive, Torrance, CA 90505.

Rare and Unusual Prefixes

Here are just a few of the good prefix catches mentioned this spring by devotees of *CQ's* WPX Awards:

A51 - Rare Bhutan was supplied by A51CG, 14016 kHz from 1200 GMT and A51PN, 7002 kHz, 1300 GMT on Mondays and 28075 kHz from 1000 GMT on Tuesdays. QSL to their *Callbook* addresses.

AH8 - Phil, AH8A, reported on 14225 kHz. QSL to WB6FBN.

GB4 - GB4DAA was a multi/single operation during the WPX s.s.b. contest by G3FXB, G3MXJ and G3ZQW.

IA5 - I5LXW and I5NSR operated from Montecristo Island from March 28 through April 1 using the IA5 prefix.

J4 - Is one of a new ITU callsign block issued to Greece. J4A was by SV0AE.

J5 - Was activated by Eric, SM0AGD. QSL to SM3CXS.

KH0 - KH0AC is the new call for Len Kaufer, ex-KG6SW.

OI6 - This one is a special prefix used by OI6JW/OH6JW during the *CQ* WPX s.s.b. contest in March.

PP0 - PP0MAG operated all bands from Trinidade Island.

RW1, RX1, and RZ1 - These are special Olympic prefixes for which QSLs may be sent to UA1DJ, Box 930, Leningrad, 196006, U.S.S.R.

T3 - Replaces the former VR1 and VR3 prefixes. T3K includes the Gilbert and Ocean islands, ex-VR1; T3P is the British Phoenix Islands, also ex-VR1 while T3L is the former British Line Islands, ex-VR3.

XZ0 - By the time that this is published we hope that Dr. George Collins, VE3FXT, will have given all of the deserving a rare country and prefix as XZ0ONU.

YV0 - This rare Aves Island prefix was scheduled for activity by YV5USB and others using the call YV0USB. QSL to YV1TO.

73, John, K4IIF

DX Quiz

The DX Quiz resumes this month with the following:

1. There are 12 amateur radio countries which may use prefixes beginning with the numeral 4. Name 6 of them.
2. What are the 6 *CQ Magazine* awards on prefix count?
3. Which country uses the prefix T4?

CQ DX Honor Roll

The *CQ* DX Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more active countries for the mode indicated. The ARRL DXCC Countries List is used as the country standard. Total number of countries on the DXCC list as of deadline is 319. Honor Roll Listing is automatic when submitting application or endorsement for 275 or more countries. To remain on the *CQ* DX Honor Roll, annual updates are required. Honor Roll updates may be submitted at any time, in any number. Updates indicating no change will be accepted to meet the annual requirement. The fee for endorsements involving the issuance of a sticker is $1. Other updates require an SASE for confirmation of total. The basic award fee is $5.

C.W.

W6PT 319	W3GRS 314	W2GT 304	W1NG 293	K3FN 283
ON4QX 318	N4PN 312	K9MM 304	WA8DXA 289	JH1VRQ 275
K6EC 316	K6JG 310	W4BQY 303	DJ7CX 287	
W9DWQ 315	W8KPL 308	K4CEB 303	JA1GTF 286	
W6ID 315	N6AV 307	N6FX 298	N4MM 285	
DL7AA 314	N6CW 305	DL3RK 294	W4OEL 284	

S.S.B.

WA2RAU 319	WA2EOQ 316	OE2EGL 313	W0SFU 301	OK1MP 289
W6EUF 319	K6YRA 316	EA4LH 312	WB6DXU 301	YV5DFI 289
W9DWQ 318	W4SSU 316	YV1KZ 312	DI6KG 300	VE7HP 288
K8DYZ 318	W3CWG 316	W6RKP 311	HP1JC 300	K5DUT 287
W3NKM 318	W3AZD 316	VE2WY 310	N6AW 300	WA4JTI 286
W6REH 318	W4UG 316	ZL1AGO 310	K8LJG 299	W7OM 285
XE1AE 318	I8KDB 316	DJ9ZB 310	I5WT 299	YS1O 285
W4EEE 318	K6JG 316	F2MO 310	K8PYD 297	N5FG 285
W2TP 318	ZL3NS 315	K5OVC 310	OE3WWB 296	K1UO 282
I0AMU 318	VE3GMT 315	I4ZSQ 309	I6PLN 296	VK4VC 281
K6WR 318	K4MQG 315	N4MM 308	DJ7CX 295	W6DN 281
K2FL 317	K9LKA 315	N6AV 308	F9MS 294	I0MBX 279
VE3MR 317	SM6CWK 315	W0SD 307	W9DQ 294	AI8S 277
DL9OH 317	K6EC 315	W9SS 306	VE3FJE 294	K3MWV 277
TI2HP 317	I8YRK 314	XE1KS 306	W1NG 293	JA6GDG 276
I0ZV 317	SM6CKS 314	W3GG 304	LU1BAR/W3 292	ZL1BIL 276
W3GRS 317	OZ3SK 314	W8ILC 304	JH1VRQ 292	I8KNT 276
W9JT 317	ZS6LW 314	VE7WJ 303	W0YDB 292	YU2RTW 276
I8AA 317	K9MM 313	I3LLD 303	K4LSP 291	XE1CI 276
W9KRU 317	G3FKM 313	DK2BL 302	K9RF 290	AA4A 275
W9QLD 316	N4WF 313	N2SS 302	9H4G 290	DJ2AA 275
VE3MJ 316	W4DPS 313	W6FET 302	VE7CE 289	K9PPY 275
F9RM 316	W6YMV 313	K6XP 301	WA4WTG 289	G4CHP 275

George Main-Baillie, ZE4JS, was very active from Rhodesia, now Zimbabwe, and qualified for WAZ last year. He was originally licensed in 1948 as G3FZN and flew African and Far East routes for BOAC for a number of years.

QSL Information

The following volunteers his services as QSL Manager for any interested DX or Contest station: Rick W. Todd, KA8AKL, 14470 Basslake Rd., Newbury, OH 44065.

A7XE - To DF4NW
C6AAQ - Via W3HNK
CT2CB - To KB5GL
CT2QN - c/o W2KF
CX5RV - Via G5RV
DJ1US/ST3 - To DF2RG
FG0FJD - c/o W2GHK
FG0AYO/FS - To W2KN
FH8CL - Via Gerard, Box 37, 97610 Mayotte Island, Indian Ocean
FH8CY - To Box 50, Dzaoudzi, Mayotte Island, Indian Ocean
FM7AV - c/o F6BFH
HH2BW - Via WD9GSO
HH2VP - To N4XR
HI3BEA - c/o Box 1214, Santiago, Dominican Republic
HI6XQL - To YASME
HI8XDF - Via K3SWZ
HP1XOJ - To WB3KGY
J6LOO - c/o YASME, Box, 2025, Castro Valley, CA 94546
J7DBB - Via YASME, Box 2025, Castro Valley, CA 94546
JY4MB - To WA4HNL
K1JDJ/DU - c/o C. Mitchell, P.O. Box 1003, Fairfield, CT 06430
K1JDJ/KC6, -/KH2, -/KH8, -/KH0 and -/KX6 - Via C. Mitchell, P.O. Box 1003, Fairfield, CT 06430
KH0AC - c/o K7ZA
KP2A - To WB2VFT
KP2B - c/o W3HNK
KP4EHP - Via KP4EHB
LA5YJ - c/o WB1DQC
RU2QD - To UA1OSM, P.O. Box 88, Moscow, U.S.S.R.
URQ2QD - To N6HR, P.O. Box 60611, Sunnyvale, CA 94088
SV0AA - Box 722R, APO, New York, NY 09223
TG9ML - c/o K5BDX
TU2IF - Via HB9APF
UA1PAL (Franz Josef Land) - To UA1OSM, P.O. Box 88, Moscow, U.S.S.R.
UR2QD - To N6HR, P.O. Box 60611, Sunnyvale, CA 94088
VE3BVD/ST3 - c/o VE3FRA
VK8AW - Via G8AX
VP1HE - To DL1JW
VP2KAJ - Via WB8LDH
VP2MFC - c/o K1ZZ
VP2MOC - To W2KF
VP2VEC - Via K0XU
VP2VEG - To W0DVZ
VP2VFI, VP2VFT, VP2VFU and VP2 VFV - Via Norman Peacor, K1IJU, Country Club Heights, Monson, MA 01057
W6BD/CE1 - c/o W6STQ
XE1RL - Via WD8NKT, 1103 South Jefferson, Bay City, MI 48706
XT2AW - c/o KN1DPS
ZB2EO - To K3MNW
3V8AA - To IS0LYN
5L2EV - c/o W3HMK
5W1CR - Via C. Mitchell, P.O. Box 1003, Fairfield, CT 06430
6Y5YM - c/o Guy Bourgie, VE2YM, Box 35, Dorion, Quebec, Canada J7V 5V8
8P6NX - W0SA
9K2DX - To W6LV
9Y4VU - Via W3EVW

4. Name an actual amateur callsign which has no suffix.
5. The prefix for Benin is _____?
6. Which 3 *CQ* zones contain parts of only one amateur radio country?
7. True or False: The land area in Zone 23 includes only JT, Mongolia and UA0Y, Tana-Tuva.
8. True or False: Zone 10 includes more amateur radio countries than Zone 6.
9. Which of the following prefixes is *not* found in Zone 36, the Equatorial Zone of Africa: TL, TT, TY, TJ, ZD7?
10. Which of the following prefixes is *not* found in Zone 40, the North Atlantic Zone: OX, OY, TF, JW, JX, UA1?
11. The Central Pacific Zone is Zone _____?
12. True or False: HB0 is in Zone 15, the Central European Zone.
13. Name 3 states in the 4th call area which are in Zone 4, the Central Zone of North America.
14. Abu Ail is located in the following body of water: _____.
15. True or False: Time zones of the world always differ by whole hours.
16. What do the following amateur radio countries have in common: 9A, 7P8, 4U1ITU, HV?
17. 8Z4A operated from a neutral zone between the following 2 countries: _____ and _____.
18. BV2A operates a.) only on c.w., b.) only on s.s.b., c.) on both modes, d.) none of the above.
19. Which of the following famous DXers did *not* go on the 1979 Desecheo Dxpedition: KP4Q, KP4AM, KV4AA, KP4DSD, KV4KV?
20. Which of the following is deleted from the amateur radio countries list: Singapore, Sarawak, Ceuta & Melilla, Zaire, Maldive Islands?

Steve Gregory, VK3OT, is one of the most active DXpedition operators in the Pacific. If you worked him from VK9XT, Christmas Island (Indian Ocean), QSL to P.O. Box 622, Hamilton, Victoria, Australia 3300. Steve donated his tribander to the club station on Christmas Island, VK9XX. Earlier, Steve made 6000 QSO's as YJ8OT and 10,000 QSO's as VK2ATZ/ Lord Howe Island. He hopes to operate from Norfolk Island as VK9NT in the 1980 CQ Worldwide Contest. Steve is also very active in CQ's WAZ program and has made single band WAZ on 10, 15 and 20 and hopes to complete 40 this year. He is QSL Manager for VK0PK, VK0GM, YJ8OT, YJ8PD, YJ8KM, VK2ATZ/LH, VK3OT/LH, VK9YT, VK9XT and VK9NT.

CQ DX Awards Program

S.S.B.

827	K0QMU	833	AL7O
828	WA4FRY	834	WD4CKS
829	XE1CI	835	JA1BN
830	K1VHS	836	WA7PDW
831	TG9AL	837	N7ASL
832	K0SE		

C.W.

418	WB7PKD	422	IT9QDS
419	K1VHS	423	JA1VDJ
420	W2XQ	424	W1BB
421	LA9EF		

S.S.B. Endorsements

310	I8AA/317	200	K1VHS/208
310	W9JT/317	200	KB5DN/200
310	K6EC/315	200	TG9AL/200
300	N6AV/308	200	I8KCI/200
300	W6FET/302	150	K1RB/171
275	VE3FJE/294	150	KB5AC/161
275	W1NG/293	28 MHz	K0QMU
275	W6DN/281	28 MHz	WB4QO
275	XE1CI/276		
250	W6MFC/250		
250	WA2FKF/250		

C.W. Endorsements

310	W9DWQ/315	200	K0LST/202
300	N6CW/305	200	K1VHS/200
275	W1NG/293	150	N6PV/154
275	N4MM/285	1.8 MHz	W1BB
275	JH1VRQ/275		

The total number of active countries as of deadline was 319. Complete rules and application forms for the CQ DX Awards Program may be obtained by sending a business size, No. 10 envelope . . . self-addressed and stamped to CQ DX Awards Manager, Billy Williams, N4UF; 911 Rio St. Johns Dr., Jacksonville, Fla. 32211 USA.

NO-71-72

Shown with optional touch tone pad

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* **Heavy duty battery pack.**
* **External microphone capability.**
* **The S-5's exciting low price...only $349.00**
* **With touch tone pad $399.00**

SPECIFICATIONS

Frequency Coverage:	144 to 148 MHz
Channel Spacing:	Receive every 5 kHz, transmit Simplex or ±600 kHz
Power Requirements:	9.6 VDC
Current Drain:	17 ma-standby 900 ma-transmit
Antenna Impedance:	50 ohms
Dimensions:	40 mm x 62 mmx 170 mm (1.6" x 2.5" x 6.7")
Weight:	17 oz.
Sensitivity:	Better than 5 microvolts nominal for 20 db

SUPPLIED ACCESSORIES
Telescoping whip antenna, ni-cad battery pack, charger.

OPTIONAL ACCESSORIES
12 Button touch tone pad (not installed): $39 • 16 Button touch tone pad (not installed): $48 • Tone burst generator: $29.95 • CTCSS sub-audible tone control: $29.95 • Rubber flex antenna: $8 • Leather holster: $16 • Cigarette lighter plug mobile charging unit: $6 • Matching 30 watt output 13.8 VCD power amplifier (S30): $89 • Matching 80 watt output power amplifier (S80): $149

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- **The first and most thoroughly field tested hand-held synthesized radio available. 800 channels in the palm of your hand.**
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- **External microphone capability**
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- ***The S-1T (With touch tone pad installed)...$339.00***

The Tempo line also features a fine line of extremely compact UHF and VHF pocket receivers. They're low priced, dependable, and available with CTCSS and 2-tone decoders. The Tempo FMT-2 & FMT-42 (UHF) provides excellent mobile communications and features a remote control head for hide-away mounting.
The Tempo FMH-42 (UHF) and the *NEW* FMH-12 and FMH-15 (VHF) micro hand held transceivers provide 6 channel capability, dependability plus many worthwhile features at a low price. FCC type accepted models also available.
Please call or write for complete information. Also available from Tempo dealers throughout the U.S. and abroad.

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Tempo is first again. This time with a superior quality synthesized 220 MHz hand held transceiver. With an S-2 in your car or pocket you can use 220 MHz repeaters throughout the U.S. It offers all the advanced engineering, premium quality components and exciting features of the S-1. The S-2 offers 1000 channels in an extremely lightweight but rugged case.

If you're not on 220 this is the perfect way to get started. With the addition of the S-25 (25W output) or S-75 (75W output) Tempo solid state amplifier it becomes a powerful mobile or base station. If you have a 220 MHz rig, the S-2 will add tremendous versatility. Its low price includes an external microphone capability, heavy duty ni-cad battery pack, charger, and telescoping whip antenna.
Price...$349.00 With touch tone pad...$399.00

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Drive Power	Output	Model No.	Price
2W	130W	130A02	$209
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30W	130W	130A30	$199
2W	80W	80A02	$169
10W	80W	80A10	$149
30W	80W	80A30	$159
2W	50W	50A02	$129
2W	30W	30A02	$ 89

UHF (400 to 512 MHz) models, lower power and FCC type accepted models also available.

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CIRCLE 31 ON READER SERVICE CARD

a monthly feature by
FRANK ANZALONE, W1WY

Contest Calendar

NEWS/VIEWS OF ON-THE-AIR COMPETITION

Sorry I cannot give you more positive information on the events noted as "Not Official," but I have no other alternative since I have not heard from these organizations. Written requests have been unanswered before the 10th of the month deadline. As I keep repeating, I must have the material before the 10th, three months before the date of the event.

I often receive reports complaining of the poor participation in a particular contest. The blame is on the shoulders of irresponsible contest managers who are derelict in their duties, or who fail to tell their successors of what is required.

Some of the listed events may seem of little interest to the majority. However, it is not up to me to pass judgment on the merits of a particular event. You get the material to me in time and I'll publish it and let the readers decide if they want to participate.

73 for now, Frank, W1WY

Canada Day Contest

0001 to 2359 GMT Tuesday, July 1

Sponsored by the Canadian Amateur Radio Federation, this contest was organized to mark the anniversary of the Federation.

Activity will be on all bands, 2 through 160 meters, phone and c.w. Single operator, single and all band, multi-operator all band only. The same station may be worked on each band and each mode for QSO points and multiplier credit.

Exchange: RS(T) and QSO number starting with 001.

Scoring: 10 points for each VE contact, 1 point if with others. The first contact with any CARF station with the TCA or VCA suffix is worth 20 points.

Multiplier: Number of VE provinces/territories worked on each band and each mode. (12 prov./terr. × 8 bands × 2 modes for a max. of 192 possible.)

Contacts with stations outside Canada count for QSO points but no multiplier. And VE1's must identify their province.

Frequencies: C.w.: 1810, 3525, 7025, 14025, 21025, 28025, 50100, 144100. S.s.b.: 1810, 3770, 3900, 7090, 7230, 14150, 14300, 21200, 21400, 28500, 50100, 146520.

Awards: Certificates to top scorers in each catagory and each VE prov./terr., U.S. call area and DX country. The Canada Day Trophy to the overall single operator winner.

Include a summary sheet and dupe sheet with your log, postmarked before July 31st to: Canadian Amateur Radio Federation, Box 76752, Vancouver, B.C. V5R 5S7 Canada. Include an s.a.s.e. for a copy of the results.

**14 Sherwood Road, Stamford, CT 06905*

Calendar of Events

July 1	Canada Day Contest
*July 5-6	Venezuelan Phone Contest
July 5-6	Ghost Town Expedition
*July 12-13	IARU Radiosport
July 19-20	10-10 Int. Net QSO Party
July 19-20	Maine QSO Party
July 19-20	SEANET C.W. Contest
*July 19-20	AGCW DL QRP Contest
July 19-20	Neil Armstrong Commemorative
July 20	RSGB WAB C.W. Contest
July 26-27	Venezuelan C.W. Contest
July 26-28	County Hunters C.W. Contest
Aug. 9-10	European C.W. Contest
Aug. 16-18	Rhode Island QSO Party
Aug. 16-18	New Jersey QSO Party
Aug. 16-17	SEANET Phone Contest
Aug. 23-24	All Asian C.W. Contest
Aug. 31	RSGB WAB VHF Contest
Sept. 14	North American Sprint
Sept. 13-14	European Phone Contest
Sept. 13-14	Cray Valley S.W.L. Contest
Sept. 13-15	Washington State QSO Party
Sept. 27-28	Delta QSO Party
Oct. 4-5	VK/ZL/Oceania Phone Contest
Oct. 11-12	VK/ZL/Oceania C.W. Contest
Oct. 18-19	Scouts Jamboree
Oct. 18-19	WADM Contest
Oct. 25-26	**CQ WW DX Phone Contest**
Nov. 29-30	**CQ WW DX C.W. Contest**

*Not official

Venezuelan Contest

Phone: July 5-6 C.W.: July 26-27
Starts: 0000 GMT Saturday
Ends: 2400 GMT Sunday

This is a world-wide-type contest, therefore work other countries as well as YV stations.

There are four categories: Single operator, single and all band, and multi-operator, single and multi transmitter. Also s.w.l.

Exchange: RS(T) plus a QSO number starting with 001.

Points: Contacts between stations in different countries 2 points. Between stations in the same country zero (0) but permitted for multiplier credit.

Multiplier: One for each country, each YV call area and each U.S. call district worked on each band.

Final Score: Total QSO points from all bands multiplied by the sum of the multiplier from each band.

Awards: There is a large variety of awards.

Plaques: To the top scorers in each category.

Medals: To the top station in each of the following areas: North, Central and South America, Caribbean, Bolivarian Countries, Europe, Africa, Asia, Oceania and s.w.l.

Certificates: To all stations having contacted the following totals: (a) 15 YV's plus 10 different countries, for stations in North, Central and South America, Caribbean and Bolivarian countries. (b) 10 YV's 10 countries for Europe and Africa, (c) 5 YV's plus 10 countries for Asia and Oceania. (d)

S.w.l.'s reporting 50 complete QSO's including at least 10 YV's.

Include a summary sheet with your entry and the usual signed declaration.

A remittance of $2 or its equivalent in IRC's is requested with each certificate application.

Mailing deadline is Sept. 15th for phone, and Oct. 15th for c.w. entries. Mail to: Radio Club Venezolano, P.O. Box 2285, Caracas 101, Venezuela.

Ghost Town DXpedition

1800Z Sat. July 5 to 1800Z Sun. July 6

A group from the Gallatin Radio Club will be on the air from Bannack, the first capital of the territory of Montana, which is now a ghost town.

They will be using the call W7ED and operating on 7235, 14285, 21360 kHz s.s.b. and 14060 kHz c.w.

Special certificates loaded with historical information will be sent to each entry sending a QSL card. Include an s.a.s.e. and a dollar to help defray printing costs.

It is planned to make this an annual event, working from a different ghost town each year, putting the comparatively rare state of Montana on the air.

Send your QSL cards to: Bannack DX-Pedition, 417 Staudaher St., Bozeman, Montana 59715.

Neil Armstrong Commemorative Operation

A commemorative operation and exhibition is planned on July 19 and 20 from the Neil Armstrong Air and Space Museum in Wapakoneta, Ohio, Neil's home town.

Look for special events station WD8RVZ from 9 a.m. to 8 p.m. Sunday. Operation will be mostly on s.s.b. on the following frequencies: 28600-28650, 21355-21385, 7240-7300, 3950-4000. There may be limited c.w. operation on 28450-28500, 21200-21250, 7120-7145, 3750-3770. No 20 or 160 meter operation is planned.

Visiting amateurs can check in on 146.52 simplex.

An s.a.s.e. with your QSL is required for a special commemorative card. Send it to: Garry Stolzenburg, WD8RVZ, 717 W. Benton St., Wapakoneta, Ohio 45895.

IARU Radiosport

Starts: 0000Z Saturday, July 12
Ends: 2400Z Sunday, July 13

This is a world wide competition, all bands, 160 through 2 meters, single and multi-operator.

There are three categories: c.w. only, phone only and mixed c.w. and phone. Multi-operator use mixed mode only. (Single xmtr only.)

Each station may be worked once per band regardless of the mode. Crossband contacts not permitted except via Oscar which counts as a separate band.

Single operator stations are limited to 36 hours of operating time. Off times must be at least 30 minutes and indicated in your log. There is no time limit for multi stations, but operation must remain on the same band for at least 10 minutes.

Exchange: RS(T) and your ITU zone.

Points: One point for QSOs with stations in your own zone, 3 points if station is outside your zone but on the same continent and 5 points if on a different continent.

Multiplier: Sum of different ITU zones worked on each band.

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

Awards: Certificates to the top scorers in each category, in each ARRL section, ITU zone and DX country. Achievement awards are available for making 250 and 1000 QSOs and/or contacting 50 or more zones. In case of multiple award levels achieved only the highest award will be issued.

U.S. and Canadian entries are requested to use official log and summary sheets which may be obtained from the ARRL. Also request forms CD-77, CD-175 and the ITU zone list. A large s.a.s.e. with at least 28¢ postage will get you a good supply.

All entries worldwide go to: IARU Headquarters, Box AAA, Newington, CT 06111 USA. Mailing deadline is August 30th.

The Pacific Radio Amateur Transmitting Society sponsored two trophies in the 1978 WW Contest, both for Oceania, 15 MHz Phone and C.W. Here is Lee Wical, KH6BZF, president of the Society, presenting Hawaiian Koa Bowels to Gary Belcher, KH6GMP winner of the Phone award (left photo) and Danny Eshenaze, K7SS operator of KH6XX on C.W. (right photo). (Photo via KH6JHM)

Ten-Ten Net QSO Party

Starts: 0000Z Saturday, July 19
Ends: 2400Z Sunday, July 20

This is the summer edition of the Ten-Ten International Net QSO Party. Activity of course is on 10 meters only. It is open to all amateurs, but only members are eligible for awards.

One may work 24 hours out of the 48-hour contest period. They need not be consecutive, but must be in a minimum of 1-hour increments.

The same station may be worked once only.

Classes: Single operator and QRP stations using 20 watts or less p.e.p. output.

Exchange: Call, name, city, state, and 10-10 number if any.

Scoring: One point per contact. Add an additional point if QSO is with a 10-10 member. Total QSO points is your score. There is no multiplier.

Scoring: First place certificates for each class in each U.S. and Canadian call areas, and to 11 continental and sub-continental areas including KH6 and KL7 and Pacific Islands.

Time on your log must be in GMT. Submit a summary sheet showing the scoring, hours of operation, chapter affiliation if any and other essential information.

Logs must be received no later than August 20th and go to: Robert Watson, 2 Suffolk Court, Oceanside, NY 11572.

Maine QSO Party

Starts: 1600Z Saturday, July 19
Ends: 2000Z Sunday, July 20

The Portland Amateur Wireless Assn. is sponsoring this one. The same station may be contacted once on each band and mode. Phone and c.w. count as same contest. Maine stations may work other in state stations for QSO and multiplier credit.

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

Scoring: Each complete QSO is worth 3 points. Main stations multiply total QSO points by sum of Maine counties, states, provinces and DX countries worked.

Out of state and DX stations use Maine counties worked for their multiplier (max. of 16).

Frequencies: C.w.: 1805, 3560, 7060, 14060, 21060, 28060. S.s.b.: 1815, 3930, 7280, 14280, 21380, 28580. Novice: 3735, 7125, 21125, 28125.

Certificates will be awarded to the top scorers in each area.

A Worked All Maine award is available to stations that work all 16 counties.

Logs and requests for information on the WAM award should be sent before Sept. 1st. to: Joe Blinick, K1JB, Portland A.W.A., P.O. Box 1605, Portland, Maine 04104.

RSGB WAB LF C.W. Contest

Sunday, July 20, 0900 to 2200 GMT

Rules are the same as the phone version that took place last month and given in last month's Calendar.

Logs go to: R. L. Senter, G4BFY, 27 Station Road, Thurnby, Leicester LE7 9PW, England.

SEANET World Wide DX Contest

C.W.: July 19-20 S.S.B.: Aug. 16-17
0001 GMT Sat. to 2359 GMT Sun.

The aim of this contest is to publicize the hosting of the 10th SEANET Convention in Manila on Nov. 28th-30th. (The NET meets daily at 1200Z on 14320 MHz.)

The same station may be worked only once per band, cross-band or cross-mode contacts are not allowed, and multi stations are limited to one signal at the same time.

Classes: Single operator, single and all band, multi-operator, all band.

Exchange: RS(T) plus a 3 figure QSO number starting with 001.

Scoring: For stations outside the SEANET area.

(a) Contacts with stations within the NET area with the following prefixes: DU, HS, YB, 9VI, 9M2, 9M6, 9M8. 20 points if on 160, 10 points if on 80 or 40, and 4 points if on 20, 15 or 10 meters.

(b) Contacts with stations in other NET areas. 10 points on 160, 5 points on 80 and 40, and 2 points if on 20, 15 or 10 meters.

(c) Contacts between stations outside the NET area have no value.

(d) A multiplier of 3 points for each NET country worked.

Final Score: Total QSO points from all bands times the sum of the multiplier points.

Awards: Commemorative certificates to all qualified entries. Trophies to top scorers will be presented at the SEANET Convention in Manila.

The usual disqualification rules will be observed and strictly enforced.

All entries must be received by October 31st and go to: "Eshee," 9M2FK, P.O. Box 13, Penang, MALAYSIA. Include one IRC for a copy of the results.

List of SEANET Area Prefixes: A4, A51, A6, A7, A9, AC3, AP, BV, BY, CR9, C21, DU, EP, HL/HM, HS, H44, JA/JE/JF/JG/JH/JI/JR, JD1, JY, KA, KC6,

European 1979 (WAEDC) Contest Results

C.W. - U.S.A.

* K1PR	1,051,264	
(Opr. K1TO)		
* N4BP	494,512	
* W5WMU	491,985	
* WB2SJG	355,712	
* K1UA	299,404	
* W7IR	272,475	
* W0SF	229,840	
K5TM	228,360	
(Opr. K5ZD)		
* N6AR	197,912	
N5JB	185,724	
* K8BCK	141,556	
N8BC	141,218	
K2XA	134,688	
* W3ARK	133,000	
* W9OA	107,352	
K3VW	98,160	
N6ND	97,461	
W4BV	93,100	
K1KI	62,976	
K4BAI	61,506	
AK4Q	55,970	
K9BG	42,840	
WA1FCN	41,820	
W3AP	41,448	
W2KHT	36,750	
K1BV	33,454	
W9QWM	31,556	
WA4QMQ	30,712	
N6AA	22,260	
WB6SHL	20,828	
K2POF	18,432	
W2NC	16,261	
AA8S	14,476	
WA1JGK	13,425	
N3KR	13,200	
W1OPJ	9,620	
K8LJG	8,880	
K6MA	8,250	
W4KMS	5,760	
W4YN	4,444	
W1CNU	4,290	
K6ZH	1,960	
WA1YVT	1,710	
W5NR	1,666	
W7QK	1,088	
N6SM	312	
W0QAU	8	
Multi Op.		
* N1NA	527,406	
* K2IGW	365,806	
* WD4ITK	301,688	
* N4OL	251,853	
* N6AV	171,990	
Canada		
* VE7DP	140,920	
* CZ6MP	92,916	
VE6DAP	61,000	
* VE2WA	23,136	
* VE3BR	17,404	
VO1AW	576	

Phone - U.S.A.

* W1ZM	1,258,443	
* N1GL	1,109,504	
* N2VW	302,450	
* AB8K	217,924	
* K5KLA	165,984	
* K3ZJ	141,282	
* WA4QMQ	127,820	
* N6AW	106,400	
KA1EP	85,760	
WB8ZRL	67,900	
W3CM	63,648	
W2FCR	58,995	
N6ND	51,480	
* WA0TKJ	51,246	
W4KMS	36,270	
W5CWQ/6	28,350	
N3RL	28,224	
WB1DLA	24,600	
K1KI	23,798	
K8EF	22,944	
WA2YLY	21,830	
WA5IYX	20,600	
K2QF	19,624	
DL7KX/W2	19,096	
K6NA	7,448	
W9QWM	4,320	
WB8WCA	1,329	
KB5DK	1,054	
Multi Op.		
* W1RR	939,214	
* WA4PYF	158,964	
Canada		
* VE2DU	458,118	
* VC3GCO	351,132	
* VE6MP	85,120	
* VE1MX	57,850	
* VE4RP	41,748	
VE2WA	25,410	
* VE3BS/7	7,070	
VE3CLT	1,216	
Mexico		
* XE2MX	17,202	
Alaska		
* KL7Y	27,846	
Bermuda		
* K6SVL/VP9	668,870	
Montserrat		
* VP2ML	1,615,906	

KG6/KH2, KH6, KX6, P29, S2, S79, VK, VQ9, VS5, VS6, VS9K, VS9M/8Q6, VU2, VU (Andaman, Nicobar & Laccadive Islands), XU, XV5, XW8, YB, YJ8, ZL, 3B6, 3B8, 3D2, 4S7, 4W1, 5Z4, 9K2, 9M2, 9M6, 9M8, 9N1 and 9V1.

AGCW-DL QRP Contest

Starts: 1500Z Saturday, July 19
Ends: 1500Z Sunday, July 20

This is a c.w. only contest, all bands 10 through 160 meters. The same station can be worked on each band for QSO point credit.

There are 5 classes as follows:
A. Single Op., 3.5 watts or less input.
B. Single Op., 10 watts or less input.
C. Multi-Op., 10 watts or less input.
D. QRO stations, over 10 watts input.
E. S.w.l. entries.

Multi-op stations may operate the full 24 hours; all others must take a 9-hour break.

Exchange: RST, QSO no. and power input. Add × if crystal controlled. (559001/5x) (579001/QRO)

Points: QSO within own country 1 point. With stations in own continent 2 points. With DX outside own continent 3 points. Double above points if station is crystal controlled. (Crystal controlled stations are limited to 3 crystals for each band.)

Multiplier: One for each country worked, and 1 for each DX contact.

Final Score: Total QSO points times the sum of the multiplier on that band. Then add the sum of the scores from each band.

For scoring purposes call areas in JA, PY, VE, VK, W and ZS count as multipliers.

Awards: Certificates to the first three places in each class and each country.

Submit your log no later than 6 weeks after end of contest to: Siegfried Hari, DK9FN, Spessartstrasse 80, D-6453 Seligenstadt, Fed. Rep. of Germany.

County Hunters C.W. Contest

Starts: 0000Z Saturday, July 26
Ends: 0200Z Monday, July 28

The County Hunters invite and encourage mobile and portable operation from the less-active counties during this contest.

The same station may be worked on each band for QSO points. Portables and mobiles changing counties may also have repeat contacts. Stations on county lines exchange only one number but each county is counted as a multiplier.

Exchange: QSO no., category (P-portable or M-mobile) RST, state, province or country, and county for U.S. stations.

Scoring: QSOs with a fixed station 1 point, 3 points if it's a portable or mobile. Multiply total QSO points by number of U.S. counties worked. Mobiles and portables calculate their score for contacts made within a state.

Frequencies: 3575, 7055, 14070, 21070, 28070. It is requested that P or M stations use frequencies below 7055 and 14070; others spread out above.

Awards: Certificates in three divisions.

F – Top fixed or fixed portable in each state, province or county with 1000 or more points.

P – Top score in each state by a portable operating from a county other than its normal location with 1000 or more points.

M – Top scoring mobile in each state operating from 3 or more counties, with a minimum of 10 QSOs from each county.

There are also trophies for the single operator Portable and Mobile in the U.S. Additional awards will be made where deemed appropriate.

Stations with 100 or more contacts must include a check sheet of counties worked. Enclose a large s.a.s.e. if results are desired.

Mailing deadline is Sept. 1st to: C.W. County Hunters Net, c/o Jeffrey P. Bechner, W9MSE, 673 Bruce Street, Fond du Lac, Wisc. 54935.

Here's a chance to use up some of your scrap wood constructively while making a useful addition to your workshop.

Build Your Own Tracing/Light Box

BY HARRY J. MILLER*

Did you ever have to make copies of drawings, schematics, etc. or want to combine various elements of each? There are literally hundreds of occasional uses you can put this tracing box through, including viewing slides.

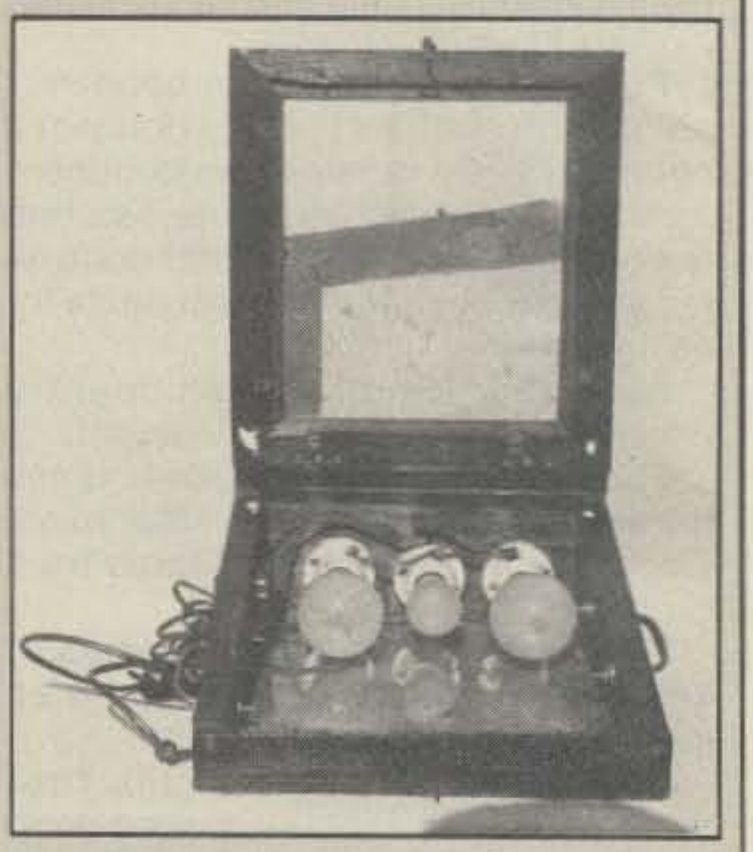
The tracing box is a simple affair built of scrap wood, three receptacles, and a three-point flush switch. The dimensions are not critical at all and should be determined by your own needs and available space. I used ½" lumber, 12" wide, 15" long, and 6"high, sloping down to a height of 3". The sloping, hinged top accommodates a piece of 9" × 12" glass held down by small clamps on each side. The glass can remain clear or you can opaque it with a piece of tracing paper.

The interior of the box can be covered with a piece of bright tin or aluminum, which acts as a reflecting surface for the lights. I used three different wattage bulbs to vary the amount of total light I wanted, and these are switched via the three-point flush switch cut into one side of the box.

Little finishing touches that can be added are a handle to make carrying the box easier, a hook and eye to keep the lid closed against dust, and a piece of felt glued to the bottom of the box to make it non-marring and skid-proof.

It's really very simple as you can tell from the photos and probably takes less time to build and use than to read about.

*991 42nd St., Sarasota, FL 33580



a monthly feature by
IRWIN MATH, WA2NDM

Math's Notes

A LOOK AT THE TECHNICAL SIDE OF THINGS

Ever since the FCC ruled that non-telephone company manufactured equipment could be installed on telephone company owned lines, there has been a whole range of such equipment offered for sale to the public. Answering machines, call diverters, private telephone sets and the like are available practically everywhere. As the electronic experimenter will get involved with the phone line at some point, we thought it a good idea to present some information that might be useful in this regard.

Please bear in mind that the telephone company network is a sophisticated system and should be treated as such. Do not randomly experiment with the line, as interruption of your service as well as the service of others could be easily accomplished.

All basic lilnes initiate in two wires. These two wires, usually red and black, terminate in a small square box which is mounted on a convenient spot on the wall near the actual telephone instrument. The voltage present between these two wires is one of three values depending on the status of the system.

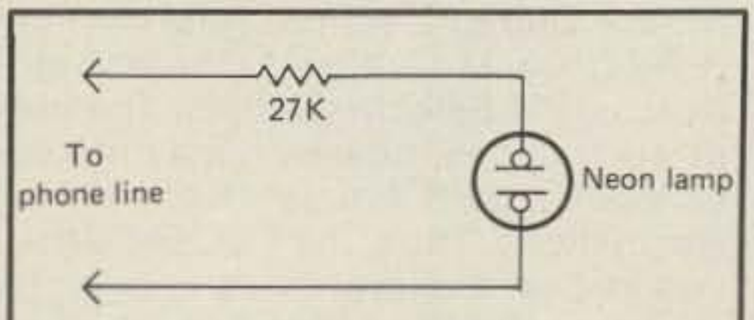


Fig. 1– A simple "ring" indicator.

With the phone "hung up," approximately 45-50 volts d.c. is present. With the phone off the hook in the talking position, 6-10 volts d.c. is present, and while ringing, about 90-120 volts a.c. at 20 Hz is applied. All of these must be accommodated properly.

The best way to hook up anything to a phone line is, of course, to use telephone company manufactured equipment. At present, such equipment is supplied by Western Electric, ITT, Automatic Electric and several others. All of this equipment is compatable and can be hooked up directly with no real problems. You can obtain such equipment in used condition from many of the normal electronic surplus outfits and in new or used condition from the hundreds of "telephone stores" or even Radio Shack type outlets. Be certain to obtain full hookup instructions or schematics when you do obtain equipment so that interfacing is made easier.

5 Melville Lane, Great Neck, N.Y. 11023

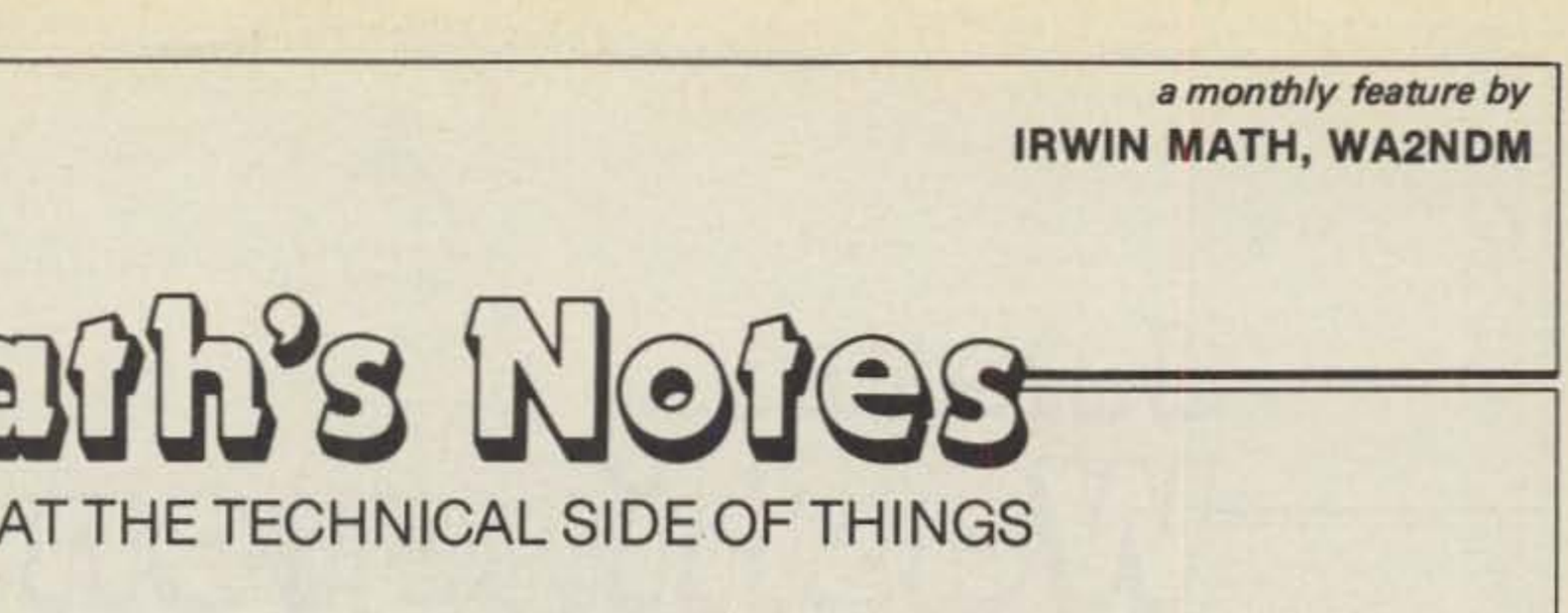


Fig. 2– A relay operated "ring" detector.

We will not go into very great detail at this time, as one could quite easily upset the system, and while this column always endorses all types of experimentation, caution really should be taken with regard to the telephone network. We have included a couple of circuits for those who simply must try something, however.

Fig. 1 is a very simple addition which can be made to any system employing one or more lines. It is a visual indicator that lights when the phone rings. As you can see, only a small neon lamp and series resistor are necessary. The lamp can be the type used for pilot lamps and, if so, will be in an easily mounted package which can be mounted directly on the phone. Connection is directly across the line, and only the a.c. ringing voltage lights the lamp.

For those applications needing an output with some current capability, fig. 2 should do the trick. This circuit uses an optical coupler made by GE, consisting of two LED's and a photo-transistor. The ringing voltage lights the LED, which in turn drives the photo-transistor. It, in turn, drives another transistor which operates a relay.

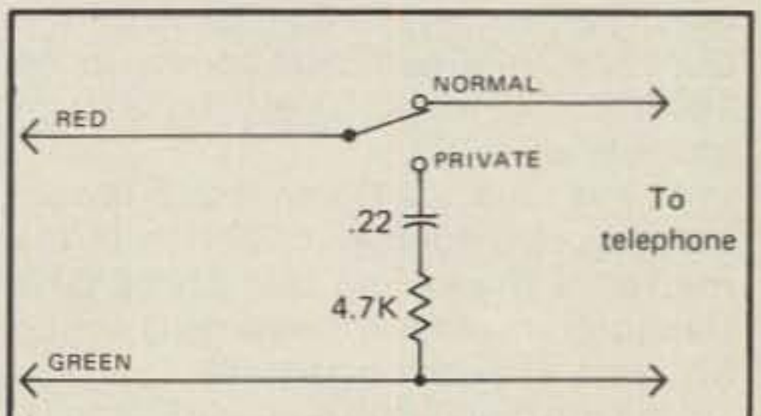


Fig. 3– A privacy switch.

Fig. 3 is a very simple "privacy" switch. As you can see, it is nothing more than a 4700 ohm 1 watt resistor and 0-22 microfarad capacitor which are switched across the line to simulate the hung-up condition. Obviously, the phone will not ring while this switch is on and callers will simply hear the phone ring. The most critical point with this simple circuit is to not forget to turn off the switch when you wish to resume receiving calls. You might wish to add a neon lamp circuit across this transistor/capacitor to at least serve as a visual reminder.

There are additional circuits of this sort that the experimenter can try, and if you are interested, please let us know. If there is enough interest, we will certainly provide more of these.

73, Irwin, WA2NDM

a regular feature by
THEODORE J. COHEN, N4XX

dateline... Washington, D.C.

THE INS AND OUTS OF THE WASHINGTON SCENE

Pressure Mounts For FCC Action On Speed-Radar Jammers

According to Jeffrey Young, Chief of the Investigations Branch (Enforcement Division, Field Operations Bureau), the Commission is receiving an increasing number of complaints from police and local government officials around the country on the use of 10 GHz transmitters to jam speed radar units. Because many of the 10 GHz transmitters are advertised as "amateur transmitters," amateur radio is receiving an undeserved "black eye." Further, any action taken by the Commission to eliminate abuses in the 10 GHz band is likely to affect amateurs.

At this time, the Commission is considering two courses of action in the matter: a marketing ban on 10 GHz transmitters, and enforcement action on users of such equipment.

Under a marketing ban, the Commission would set specifications for 10 GHz transmitters so as to prevent manufacturers from marketing devices intended for radar jamming. The problem here, however, is that many forms of modulation (e.g., pulse modulation) which are used by amateurs are similar in form to the pulsed signals used for jamming purposes.

As for enforcement action, Young admits that such action would be costly. However, because of promised support from police and local governments, it is likely that the U.S. Attorney's office and the Commission will shortly mount a field operation which is intended to catch and prosecute individuals who jam speed radar units.

Shockley Receives IEEE Medal of Honor

The 1980 Medal of Honor, the highest award of the IEEE, has been presented to Dr. William Shockley "for the invention of the junction transistor, the analog and junction field-effect transistors, and the theory underlying their operation."

As noted in *The Institute* (April 1980, news supplement to IEEE *Spectrum*), the engineering society probably remembers Shockley best as the inventor of the junction transistor. For this and other work, Shockley and two former collegues at Bell Telephone Laboratories, John Bardeen and Walter H. Brattain, jointly received the 1956 Nobel Prize in physics.

Said IEEE's Past President Jerome Suran of the award: "If there's one person who's had the most impact on electronics in this century, it is Dr. Shockley."

Repeater Operators Complain Of Abuses

The FCC is receiving an increasing number of complaints from the owners and operators of 2-meter repeaters about the conduct of individuals who use their "machines." Specifically, the repeater sponsors complain that they are being held responsible for the content of the communications which go out through the repeaters. In the deteriorating moral and ethical environment which marks today's society, these communications often contain profanities while other transmissions are intended only to jam legitimate communications.

In response to complaints received, the Commission notes that under the current regulations, both the repeater owner and the station originating a message are responsible for the content of any communications transmitted through a repeater. While the latter is more difficult to identify, the Commission has no intention at this time to relax its regulations in this area.

Amateurs Voice Enthusiastic Response to FCC On ASCII

Officials at the FCC are pleased with the positive response they are receiving to the new ASCII regulations. Many amateurs have written to the Commission in support of the regulations, noting that they will facilitate transmissions between personal computers and other digital devices.

The regulations on the use of ASCII are contained in Part 97.69 of the Amateur Rules ("Digital Transmissions") and took effect 17 March 1980. Among other requirements, sending speeds may not exceed 300 bauds for operations between 3.5 and 21.25 MHz; 1200 bauds for operations between 28 and 225 MHz; and 19.6 kilobauds for operations above 420 MHz.

While amateurs appear pleased with the FCC's action on ASCII, many are anxious to progress further to the use of other codes such as Binary Coded Decimal (BCD), Extended Binary Coded Decimal Interchange (EBCDIC), Moore and Correspondence (IBM Selectric) codes. The use of such codes, however, may not be consistent with Article 41 of the ITU Regulations. Thus, the FCC feels that "additional exploration is needed to verify the literal and implied intent of Article 41 in relation to international radioteleprinter communications."

Debate Over Radiation Hazards Continues

In its response to the Notice of Inquiry (NOI) in General Docket 79-144, the ARRL Ad Hoc Committee on the Biological Effects of Nonionizing (r.f.) Radiation recommended that the present Occupational Safety and Health Administration (OSHA) standard of 10 mW/cm² be retained. As noted in March 1980 *QST*, "the Committee concluded that nothing in the literature it surveyed showed a hazard to humans from exposure to 10 mW/cm² of r.f. energy." The Committee also demonstrated that radiation levels in the

8603 Conover Place, Alexandria VA 22308

vicinity of amateur installations are well below 10 mW/cm².

Far more stringent radiation standards, however, have been proposed to OSHA by the National Institute of Occupational Safety and Health (NIOSH). These standards, for exposure over a six minute period, are given as a function of frequency:

- Below 2 MHz 25 mW/cm²
- 10 to 400 MHz 1 mW/cm²
- Above 1.5 GHz 5 mW/cm²

A sloping curve of power density limit is used between 2 and 10 MHz, with a similar curve used between 400 MHz and 1.5 GHz. The result is a "U" shaped curve which is the inverse of the biological r.f. absorption curve.

"So You Think You Have Problems" Department

A company that manufactures cash-registers recently marketed and fielded a register which was housed in a plastic case. In some cases, the registers were placed in stores which used microwave security systems. Because the registers were not adequately shielded for radio-frequency interference (r.f.i.), however, the cash drawers mysteriously opened by themselves. Needless to say, the registers were immediately recalled by the manufacturer, and a conductive coating was sprayed on the inside of the cases.

The staff of CQ Magazine joins your Washington editor in congratulating Carlos Roberts (FCC) and his wife, Linda, on the birth of their third son, Jonathan Michael, 18 March 1980. Portions of the material in this month's column were contributed by Vic Clark, W4KFC.

a monthly feature by
GEORGE JACOBS, W3ASK

Propagation

THE SCIENCE OF PREDICTING RADIO CONDITIONS

Sunspot cycle 21 is now the *second* strongest cycle in recorded history!

The Swiss Federal Solar Observatory at Zurich reported a monthly mean sunspot number of 159 for February, 1980. This results in a smoothed sunspot number of 157, centered on August, 1979. The progress of a sunspot cycle is measured by the value of smoothed sunspot number. Of the 21 cycles recorded since the mid-18th century, only one other ever exceeded a level of 157. This was the record breaking Cycle 19, which reached its peak of 201 during November, 1957.

The present cycle, Cycle 21, probably reached a peak near 160 during October or November, 1979. It will take at least another six months of data to know this for certain. Table 1 contains the smoothed sunspot numbers recorded for Cycle 21, and an estimate of those expected through the end of 1980.

The exceptionally high peak of Cycle 21 has accounted for the generally excellent propagation conditions on the h.f. bands this past year or two. High solar conditions are expected to continue through the remainder of 1980, although the cycle is very likely decreasing at present. A smoothed sunspot number of approximately 144 is forecast for July, 1980.

July Propagation

Fifteen meters should be the best band for worldwide DX during the daytime hours, with *20* meters not far behind. Excellent DX propagation conditions are forecast for *15* meters throughout most of the daylight hours, and through the evening hours to as late as Midnight. Conditions should peak, with openings expected to most areas of the world, during the late afternoon and early evening hours.

11307 Clara St., Silver Spring, MD 20902

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for July 1980

	Expected Signal Quality			
Propagation Index	(4)	(3)	(2)	(1)
Above Normal: 7, 20	A	A	B	C
High Normal: 1-3, 6, 11, 15, 19, 21, 23,	A	B	C	C-D
Low Normal: 4-5, 8, 10, 14, 16-18, 22, 24-26, 29-30	A-B	B-C	C-D	D-E
Below Normal: 9, 12-13, 27-28, 31	B-C	C-D	D-E	E
Disturbed: None	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 any day of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be good (B) on July 1-3; fair (B-C) on the 4-5; good (B) on the 6th, etc.

For updated information, subscribe to bi-weekly MAIL-A-PROP, P.O. Box 1714, Silver Spring, MD 20902.

Twenty meters should open for DX shortly after sunrise, and remain open to most areas of the world for a period of about two hours. High solar absorption will reduce DX possibilities considerably from about 9 a.m. through the early afternoon hours. Expect signals to begin to increase again by 4 p.m., with optimum conditions expected after sundown. Exceptionally strong signal openings to most areas of the world should be possible during the hours of darkness.

Due to the continuing high level of sunspot activity, some exceptionally good *10* meter DX openings are forecast to many areas of the world during the hours of daylight. Conditions are expected to peak during the afternoon, with openings favoring southern and tropical regions.

During the hours of darkness, along with optimum conditions on *20* meters, look for some good DX openings to many areas of the world on *40* meters. However, seasonally high static levels may often make this band noisy. High static levels may also make DX propagation difficult on *80* meters, but

Smoothed Sunspot Numbers Recorded During Cycle 21

	1976	1977	1978	1979	1980
January	-	17	61	123	(156)
February	-	18	65	130	(154)
March	-	29	70	136	(152)
April	-	22	77	141	(150)
May	-	24	83	147*	(148)
June	12.2	26	89	154*	(146)
July	13	29	97	156*	(144)
August	14	33	104	157*	(142)
September	14	39	108	(159)	(140)
October	14	46	111	(160)	(138)
November	14	52	113	(160)	(136)
December	15	57	117	(158)	(134)

* Provisional values subject to slight correction as additional data becomes available.

( ) Predicted Values.

some fairly good openings should be possible during July. Don't expect much DX on *160* meters due to the high static level and increased solar absorption experienced during July. Some openings may be possible to the Caribbean area and the northern countries of South America, and perhaps towards the South Pacific, about an hour or two before sunrise.

Check last month's column for comprehensive band-by-band DX propagation predictions for July. This month's column contains *Short-Skip* Charts for July and August, 1980, and charts centered on Hawaii and Alaska.

V.H.F. Ionospheric Openings

Short-skip openings on both *6* and *2* meters resulting from sporadic-E propagation should reach a peak during July. Openings on *6* meters should fall within the 600-1300 mile range, but some may be as long as 2300 miles, and others may be shorter than 600 miles. During many *6* meter sporadic-E short-skip openings, signals may reach exceptionally strong levels. Be sure to check the *2* meter band during intense *6* meter openings.

CQ Short-Skip Propagation Chart
July & August, 1980
Local Daylight Savings Time At
Path Mid-Point
(24-Hour Time System)

Band (Meters)	Distance Between Stations (Miles)			
	50-250	250-750	750-1300	1300-2300
10	Nil	08-10 (0-1)* 10-14 (0-3)* 14-18 (0-1)* 18-22 (0-2)* 22-08 (0-1)*	08-10 (1)* 10-14 (3)* 14-18 (1-2)* 18-22 (2-3)* 22-08 (1)*	08-10 (1-0)* 10-14 (3-1)* 14-18 (2-1)* 18-20 (3-2) 20-22 (3-1)* 22-08 (1-0)*
15	Nil	08-10 (0-2)* 10-14 (0-3)* 14-18 (0-2)* 18-20 (0-3)* 20-22 (0-2)* 22-08 (0-1)*	08-10 (2)* 10-14 (3)* 14-18 (2)* 18-20 (3)* 20-22 (2)* 22-00 (1-2)* 00-08 (1)*	08-10 (2) 10-14 (3) 14-18 (2-3) 18-20 (3-4) 20-22 (2-3) 22-00 (2) 00-08 (1-0)
20	10-01 (0-1)*	07-10 (0-2)* 10-18 (1-4)* 18-22 (1-3)* 22-00 (1-2)* 00-07 (0-1)*	07-10 (2-4) 10-18 (4) 18-22 (3-4)* 22-00 (2-4)* 00-02 (1-3)* 02-07 (1-2)*	08-10 (4) 10-16 (4-3) 16-00 (4) 00-02 (3) 02-07 (2) 07-08 (4-3)
40	08-10 (2-4)* 10-15 (3-4) 15-20 (4) 20-22 (2-4) 22-00 (1-3) 00-08 (1-2)*	08-10 (4) 10-12 (4-3) 12-17 (4-2) 17-18 (4-3) 18-22 (4) 22-02 (3-4) 02-05 (2-4) 05-08 (2-3)	09-10 (4-1) 10-12 (3-1) 12-17 (2-1) 17-18 (3-1) 18-21 (4-3) 21-05 (4) 05-06 (3-4) 06-08 (3) 08-09 (4-2)	09-18 (1-0) 18-19 (3-0) 19-20 (3-1) 20-21 (3-2) 21-22 (4-3) 22-06 (4) 06-07 (3-2) 07-08 (3-1) 08-09 (2-0)
80	06-12 (4) 12-16 (4-3) 16-00 (4) 00-06 (3-4)	07-08 (4-2) 08-10 (4-1) 10-12 (4-0) 12-16 (3-0) 16-18 (4-1) 18-20 (4-2) 20-22 (4-3) 22-07 (4)	07-08 (2-1) 08-10 (1-0) 10-16 (0) 16-18 (1-0) 18-19 (2-0) 19-20 (2-1) 20-21 (3-1) 21-22 (3-2) 22-05 (4) 05-06 (4-3) 06-07 (4-2)	07-19 (0) 19-20 (1-0) 20-21 (1-0) 21-22 (2-1) 22-04 (4-3) 04-05 (4-2) 05-06 (3-1) 06-07 (2-1)
160	18-19 (0-1) 19-20 (1) 20-22 (3-2) 22-00 (4-3) 00-06 (4) 06-08 (3-2) 08-09 (1) 09-10 (1-0) 10-18 (0)	19-20 (1-0) 20-21 (2-0) 21-22 (2-1) 22-00 (3-2) 00-04 (4-2) 04-06 (4-3) 06-08 (2-1) 08-09 (0-1) 09-19 (0)	21-22 (1) 22-01 (2-1) 01-04 (2) 04-06 (3-2) 06-07 (1) 07-08 (1-0) 08-21 (0)	21-23 (1-0) 23-01 (1) 01-06 (2-1) 06-07 (1-0) 07-21 (0)

*Predominantly Sporadic-E Openings

HOW TO USE THE SHORT-SKIP CHARTS

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distances column of a particular Meter band (10 through 160 Meters) as shown in the left hand column of the Chart. For the Alaska and Hawaii Charts the predicted times of openings are found under the appropriate Meter band column (10 through 40 Meters) for a particular geographical region of the continental USA as shown in the left hand column of the Charts. An * indicates the best time to listen for 80 meter openings.

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

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

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

3. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M. etc. On the Short-Skip Chart appropriate *daylight time* is used at the *path midpoint*. For example, on a circuit between Maine and Florida, the time shown would be EDT; on a circuit between N.Y. and Texas, the time at the midpoint would be CDT, etc. Times shown in the Hawaii Chart are HST. To convert to daylight time in other USA time zones, *add* 3 hours in the PDT zone; 4 hours in the MDT zone; 5 hours in the CDT zone, and 6 hours in the EDT zone. *Add* 10 hours to covert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 15 or 3 P.M. in Los Angeles; 18 or 6 P.M. in Washington, D.C.; and 22 GMT. Time shown in the Alaska Chart is given in GMT. To convert to *daylight* time in other areas of the USA *subtract* 7 hours in the PDT zone; 6 hours in the MDT zone, 5 hours in the CDT zone and 4 hours in the EDT zone. For example, at 20 GMT it is 16 or 4 P.M. in N.Y.C.

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

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

As a rule of thumb, when the skip on *6* meters is shorter than approximately *600* miles, there's a good chance that *2* meters will open over a similar path. *Two* meter openings are likely to range in distance between 1000 and 1300 miles.

The combination of widespread sporadic-E propagation in the northern hemisphere, and seasonally high F-2 layer values in the southern hemisphere, where it is winter, may produce an occasional DX opening on *6* meters between the United States and such locations as southern Africa, the South Pacific, Australasia and South America. The best time to check for such openings would be the afternoon hours.

The *Delta Aquarids* meteor shower, scheduled to take place between July 26th and 29th, should make possible some meteor-reflection type openings on the v.h.f. bands. Approximately 20 meteors an hour should enter the earth's atmosphere as the shower nears its peak at approximately 7 a.m. EDT on July 28th.

July is the poorest month for trans-equatorial (TE) openings on *6* meters, but some may still be possible from the southern tier states. The best time to check for such openings to deep Latin America should be between 8 and 11 p.m., local daylight time.

Some v.h.f. ionospheric propagation may also be possible during periods of radio storminess. Check the "Last

HAWAII
July & August, 1980
Openings Given In Hawaiian Standard Time #

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

ALASKA
July & August, 1980
Openings Given in GMT #

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

**Indicates best time for 80 Meter openings. Openings on 160 Meters are likely to occur during those times when 80 Meter openings are shown with a propagation index of (3).

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

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

Minute Forecast" at the beginning of this column for the days in July that are expected to be BELOW NORMAL or DISTURBED.

Shortwave Propagation Handbook

A limited number of personalized copies of *The Shortwave Propagation Handbook*, signed by both authors, are still available. Written by George Jacobs, W3ASK and T.J. Cohen, N4XX, this book explains the many facets of shortwave propagation in simple language. The book is also 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 the first of its kind for the radio amateur, shortwave listener, commercial user and all others who make use of the shortwave 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 of the USA, please remit $8.50 in US funds for surface delivery, $10 for airmail delivery.

73, George, W3ASK

CQ SHOWCASE

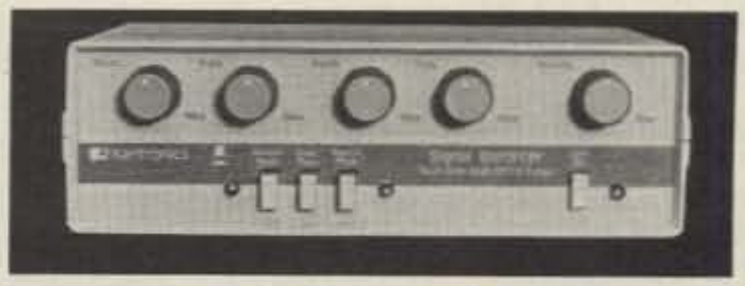
I NEED IT. I WANT IT. I GOTTA HAVE IT.

Datong R.F. Speech Processor

The Model ASP, manufactured by Datong Electronics Ltd., is a fully automatic r.f. speech processor. It gives increased "punch" comparable to a times-ten increase in peak sideband power (s.s.b. or a.m.) or peak deviation (f.m.). No manual input-level control is required. For maximum punch, the unit has instant selection of 0, 6, 12, 18, 24, or 30 dB of true r.f. clipping. The tone button simplifies transmitter adjustment, and the unit has lo/hi microphone impedance matching. It connects between microphone and transmitter with no internal connections required. Internal or external supply is only 15 mA at 6 to 16V. The current price of the ASP is $249.95, UPS shipping and insurance included, with a 90-day guarantee. The Model ASP is available from AR Technical Products Corp., P.O. Box 62, Birmingham, MI 48012, or for more information, circle number 105 on the reader service card.

Magnus Linear Amplifier

The Model A1000 all solid-state kilowatt linear amplifier from Magnus Electronics Corp. covers 160 to 15 meters without tuning adjustments. It has a built-in 115/230V AC power supply and uses a new series of high-power transistors operating at a supply voltage of 14VDC. Bandswitches and tuning have been eliminated when operating in the remote mode. It is designed for s.s.b. voice operation, and is also available for f.s.k. operation. The unit is FCC type accepted, and is available for $1,345 from Magnus Electronics Corp., 5715 Lincoln Ave., Chicago IL 60659, or for more information, circle number 103 on the reader service card.



Kantronics Signal Enforcer™

A frequency-agile, dual audio filter that will reduce or eliminate signal interference to any of five common modes has been introduced by Kantronics. The Signal Enforcer™ uses two independently tunable filters to team up on signal interference to c.w., s.s.b., a.m., radioteletype, and ASCII computer transmissions.

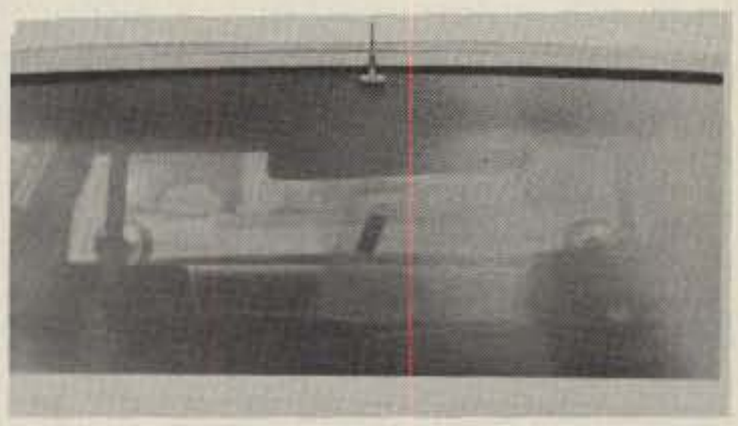
The Signal Enforcer's two filters have both notch and peak capabilities. The filters can be operated in series on separate frequencies to notch and peak, or they can be teamed to make a super peak or super notch filter. The filters can also be used in parallel to peak two frequencies at once. The Signal Enforcer can be hooked in-line with the audio output of a receiver so that no connections inside the receiver are necessary. It will drive up to 2 watts through an 8-ohm speaker. The audio output is adjusted through a volume control.

Each Signal Enforcer filter has its own "tuning-eye" indicator, peak/notch switch, bandwidth control and frequency control. The quality of the filters allows the bandwidth to remain constant, once it has been set by the operator. The filters are continuously variable in bandwidth from less than 30 Hz to over 1000 Hz. Their audio-frequency range runs from less than 150 Hz to over 3000 Hz.

The Signal Enforcer is in a tan, cream and brown enclosure about 2½" × 8" × 6". It comes with operator's manual and all necessary connectors used on the unit. The list price of the Signal Enforcer is $189.95. For more information contact Kantronics, Inc., 1202 E. 23rd Street, Lawrence, KS 66044, or circle number 114 on the reader service card.

Avanti's On-Glass 3 dB Antenna

Especially designed for use by amateur radio operators, Avanti R&D had introduced a high performance full half-wave u.h.f. mobile antenna that's twice as powerful as a conventional ¼ wave. The AH 450.3G 3/4 meter antenna has a frequency range of 440-450 MHz (tunable to 406-512 MHz) and features a newly patented design that gives gain equal to or better than a 5/8 wavelength deck mount antenna, plus a proven better omnidirectional pattern.



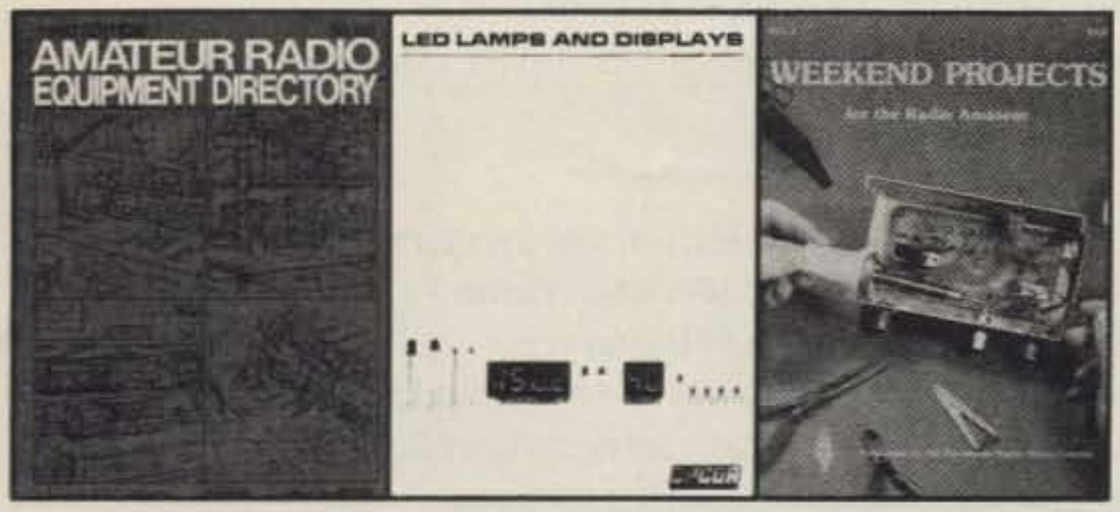
The unique on-glass design eliminates the need for external electrical connections, preventing coax cable deterioration caused by corrosion and water seepage. No ground plane is required so it can be used as a base station antenna as well. Whip is chrome plated phosphor bronze to reduce skin effect losses and can easily be removed. Contour mount and 180 degree tilt-angle adjustable whip holder are both triple chrome plated. For further information, contact Avanti Research and Development, Inc., 340 Stewart Ave., Addison, IL 60101, or circle number 104 on the reader service card.

The Printed Word: new reading material

Amateur Radio Awards (2nd Ed.). The completely revised and updated edition of *Amateur Radio Awards,* put out by the Radio Society of Great Britain, contains details of how to obtain most of the well-known h.f. awards, plus several v.h.f. and listener certificates. Country, prefix, and zone lists (and maps) are given where appropriate, and many photographs of certificates illustrate the text. 80 pp., paperback, 2nd edition 1980. UK list price is 2.95 pounds. For a copy of the book, contact the Radio Society of Great britain, 35 Doughty St., London WC1N 2AE (we suggest you also include return postage if you want airmail delivery), or for more information circle number 120 on the reader service card.

List of Time Signal Stations (8th Ed.). The annually published *List of Time Signal Stations* is compiled in close cooperation with a lot of time signal stations and is called the most up-to-date publication dealing with this subject. The 39-page booklet includes detailed information of the time signal stations, photographs, and art work, and has been thoroughly revised since the 7th edition. It can be ordered by sending $2.25 U.S. dollars or 5 IRC's (for airmail delivery add an additional IRC) to Gerd Klawitter, D-4430 Steinfurt, Ochtruper Strasse 138, Federal Republic of Germany, or for more information circle number 118 on the reader service card.

Reference Book on Interconnection. The 308-page book *Electrical/Electronic Interconnection Systems: A Guide to Connector Design and Techniques,* by Roland B. Lawrence, presents a timely treatment of the latest interconnection technology, including fiber optics. The fully illustrated book provides a framework for designing a total termination system, by presenting both background information and a historical overview of interconnection technology. It concentrates on innovations leading to a systems approach to interconnection design. Copies of the book may be obtained for $6.95 from The Deutsch Company, Newsmaking International, Inc., 3333 Bowers Ave., Santa Clara, CA 95051, or for more information circle number 123 on the reader service card.



Weekend Projects for the Radio Amateur. New for 1980, *Weekend Projects for the Radio Amateur* is written for the weekend hobbiest interested in constructing low-cost amateur radio equipment while investing a minimum of time. Volume 1 in a series is a 60-page softbound book which supplies the builder with schematics and helpful suggestions for the construction of a preamplifier, noise blanker, transmatch, 160-meter converter, small transmitter, amplifier, external v.f.0., plus test equipment and accessories. All projects can be completely assembled within hours or a day. This book is available from the ARRL, 225 Main St., Newington, CT 0611, or for further information circle number 121 on the reader service card.

Amateur Radio Equipment Directory. Kengore Corp. has announced the publication of the new 1980 edition of the Amateur Radio Equipment Directory. This master reference guide to amateur gear contains listings for over 1500 products and 100 manufacturers and distributors. Included are hundreds of pictures, product specifications, and list prices. Included with each edition is a newsletter with the latest products and price changes. The directory is available for $5.50 (includes U.S. postage only) from Kengore Corp., 9 James Ave., Kendall Park, NJ 08824, or for more information circle number 117 on the reader service card.

Short Form Catalog of Optoelectronic LED Products. OPCOA has published its 1980 short form catalog which features the firm's line of standard LED lamps, display modules, and cost-effective, custom "Chip-on-Board" display assemblies. Detailed specs and mechanical dimensions have been included for each product. Also included is OPCOA's new line of Bi-Color LED lamps. For a copy of the catalog, contact OPCOA, 330 Talmadge Road, Edison, NJ 08817, or circle number 122 on the reader service card.

Tech 300 Bulletin. Beckman Instruments has made available a 2-page, 4-color bulletin on their Tech 300 and Tech 310 3½ digit portable multimeters for service technicians and hobbyists. The free bulletin describes all the features of the new instruments, including 2000-hour typical battery life, a special semiconductor test function, and overload protection on all ranges. For a copy of the Tech 300 and Tech 310 Digital Multimeters brochure, contact Advanced Electro-Products Division, Beckman Instruments, Inc., 2500 Harbor Blvd., Fullerton, CA 92634, or circle number 112 on the reader service card.

A VERY IMPORTANT ANNOUNCEMENT FROM MOR-GAIN

WORLD'S LARGEST SPECIALISTS IN THE DESIGNING, DEVELOPING
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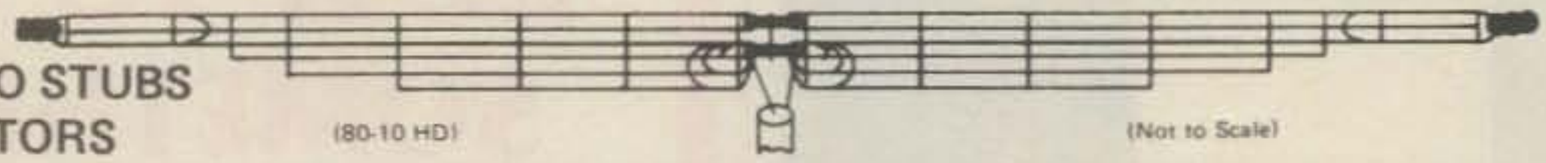

multi-band multi-frequency HF communications antennas
one half the length of conventional antennas
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fully assembled and pre-tuned ready for installation

★ ★ ★ NEW ★ ★ ★

Available Only from MOR-GAIN Two Models Specifically Designed for the Novice/Technician Operator. All of the Features and Performance of the Regular MOR-GAIN HD Dipoles but Optimized for the Operating Requirements of the Novice/Technician Licensee. See Below for Specifications and Prices.

• There is no better antenna at any price . . . W9QIO • I had a Mor-Gain antenna and liked it extremely well . . . K4JMR • The antenna has worked out well with very good reports . . . W2TVK • I can only give glowing reports about it . . . WA2IRN • I have used these fine antennas before and see no reason to change now . . . W6BF • It has given me excellent service and results . . . W6CZS • I believe I have "sold" your antenna to almost every ham I have talked to . . . W4AHN • Its performance here far surpasses any other antenna that I have had . . . WA5GGS • For several years I have used the Mor-Gain and have been very satisfied . . . K2TSD • Am letting everybody know that it has been doing a good job for me . . . VE2VW • The antenna is performing just beautifully . . . W8WDZ/6 • My 75-40 has performed beautifully and I'm very happy with it . . . WB8DMB • Another chap said he had also used it and that it was the greatest . . . W4NSP • I do not hesitate to recommend the antennas to others . . . K0SPR • I heard a ham extolling the virtues of your antenna . . . WB0PTM • I worked a station last night and the Mor-Gain was doing quite a job for him . . . WA3TCV

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. • Permits 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.

• ST and HD models are furnished with crimp/solder lugs for transmission line connection. • HD/A models are furnished with female coax connector which mates with standard PL-259 male cable connector. • Designed for low height installation: 20-40 feet. • 50 ohm feed point impedance on all bands. • 75-(**) models are factory tuned for resonance at 3950 kHz; 75- (xx) HD (S/P) models - 3800 kHz., 80-(xx) models - 3650 kHz.

EXCLUSIVE 66 FOOT, 75-10 METER DIPOLES

• May be installed as inverted vee with negligable effect on performance. • Fabricated from high-strength 40% copperweld wire - over 500 pound breaking strength. • Stainless steel hardware. • Completely assembled and pre-tuned. No cutting or measuring necessary. • 1-year limited warranty. • Patented linear phase loading principle eliminates need for traps, loading coils or stubs. • Engineering design and manufacturing is backed by our more than 15 years experience. • Professional grade design - Amateur models are identical to those we produce for commercial/industrial systems • No antenna tuner required for operation within stated specifications. • Re-tuneable by the user to accomodate site proximity effects.

MODEL	BAND (Meters)	LENGTH (feet)	PRICE
40-20-HD	40/20	36	$58.25
40-20 HD/A	40/20	36	$63.50
75-10 HD	75/40/20/15/10	66	$94.25
75-10 HD/A	75/40/20/15/10	66	$99.50
75-10 HD(SP)	75/40/20/15/10	66	$94.25
75-10 HD(SP)A	75/40/20/15/10	66	$99.50
75-20 HD	75/40/20	66	$80.25
75-20 HD/A	75/40/20	66	$85.50
75-20 HD(SP)	75/40/20	66	$80.25
75-20 HD(SP)A	75/40/20	66	$85.50
75-40 HD	75/40	66	$68.00
75-40 HD/A	75/40	66	$73.25
75-40 HD(SP)	75/40	66	$68.00
75-40 HD(SP)A	75/40	66	$73.25
80-10 HD	80/40/20/15/10	69	$98.50
80-10 HD/A	80/40/20/15/10	69	$103.75
80-10 HD(NT)	80/40/20/15/10	69	$98.50
80-10 HD(NT)A	80/40/20/15/10	69	$103.75
80-40 HD	80/40/15	69	$72.00
80-40 HD/A	80/40/15	69	$77.25
80-40 HD(NT)	80/40/15	69	$72.00
80-40 HD(NT)A	80/40/15	69	$77.25

Please include $2.75 for shipping and insurance.

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 $20.00 per band - an unbeatable low cost.

LIMITED REAL ESTATE. Where real estate for antenna installation is limited, the HD dipole is the ideal solution. Operation on 80/75/40 meters is now possible since the HD dipole is only half the length of a conventional half-wave dipole. For all around operation, the HD dipole will outperform any trap loaded horizontal or vertical dipole.

Mor-Gain
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(913) 682-3142
Monday - Friday: 9AM - 5PM CST

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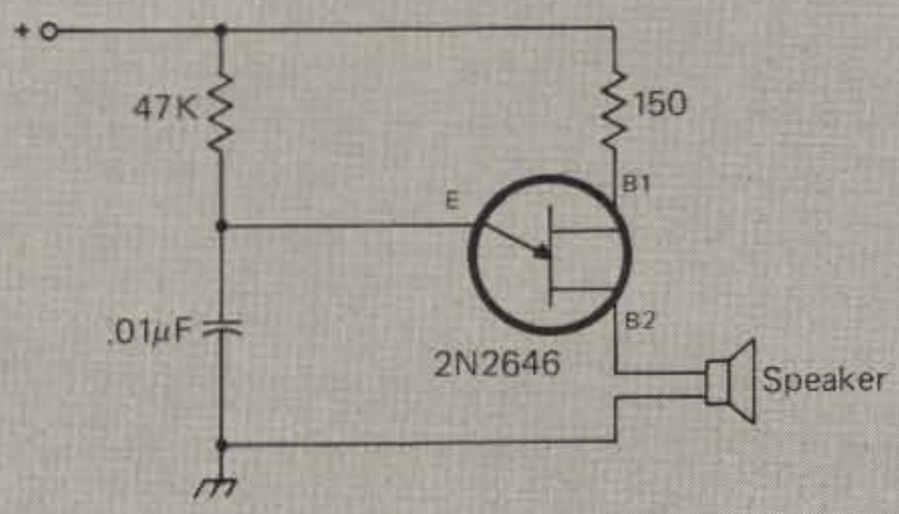
CRANIUM QUERIES

FIND THE ERROR

BY MARTIN BRADLEY WEINSTEIN, WB8LBV
c/o CQ

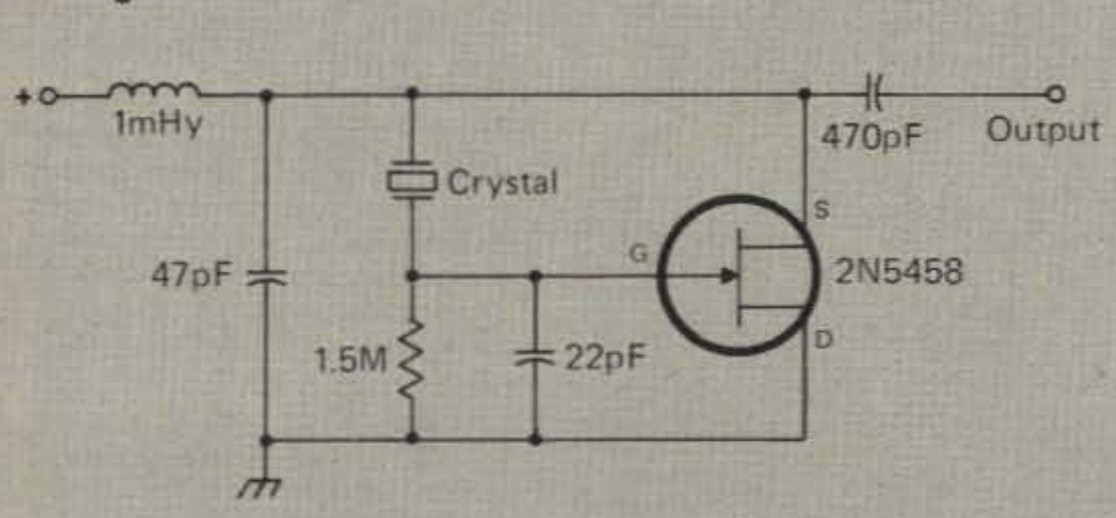
Here's What Was Wrong

So you thought a flip-flop was a bistable multivibrator, did you? Here, it's two goof-ups. First, the b1 and b2 leads got flipped; then, the 150 and 47K resistors got flopped. Here the tone's back in tune.



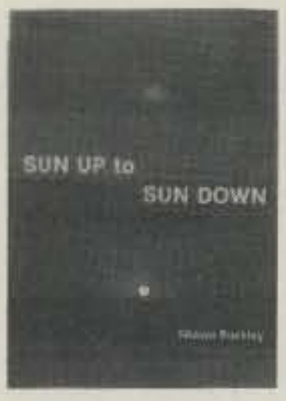
What's Wrong?

It's a JFET Pierce Crystal Oscillator, right out of the handbooks. But what's aggrivatin' is that it isn't oscillatin', so what gives?



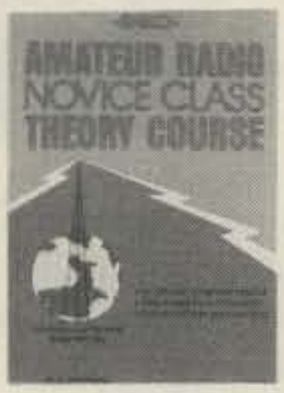
CQ BOOK SHOP

Solar Energy Handbook: Theory and Application
by The Power Systems Group, Amatek
Here's the handbook that bridges the gap between the highly technical exposition and the oversimplified hard-sell treatments for do-it-yourselfers. It covers the basic principles on how solar energy works, the future uses of this energy source, and system configurations for heating and cooling. Included is a step-by-step procedure for determining collector area and necessary storage capacity. This book is the only book that quantifies the effects of shadows from clouds and trees. 192 pages, hardbound, $18.50. Order #A120.



The Radio Amateur's Handbook (1980 Ed.)
No hamshack is complete without the latest edition of *the* handbook! It's the No. 1 bestseller in resource/reference books for the radio amateur and electronics professional. Covers basics of operating practice and equipment design. Plus new, larger section on advanced receiver design, new satellite operations techniques and antennas, a new section on measuring receiver performance, new keying circuits, revised tube and semiconductor tables, design tables for Chebyshev filters, a revised digital logic IC section, an expanded parts supplier list, practical information on discone antennas, and an updated frequency allocations chart. Paperback, $10.00. Order #A018. Hardbound, $15.75. Order #A018A.

Ameco Novice Code and Theory Package
A complete training package containing the 128-page Novice theory course and a 60-minute code cassette, which teaches how to send and receive code up to 8 words per minute, and a 32-page book. Also included are FCC-type code and theory examinations to help even a rank beginner get a ticket fast! $6.95. Order #A024.



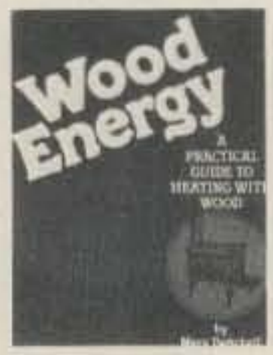
RSGB Radio Communication Hdbk (5th Ed.)
First published in 1938, and a favorite ever since, this large and comprehensive guide to the theory and practice of amateur radio takes the reader from the first principles right through to such specialized fields as radio teleprinters, slow-scan television, and amateur satellite communication. Two volumes. Expensive, but worth it! Volume 1: 480 pages, hardcover/dust jacket, $23.95. Order #R030-1. Volume 2: 336 pages, hardcover/dust jacket, $21.95. Order #R030-2.

Basic Microprocessing Fundamentals in Hardware and Software
by E. V. Ramirez & M. Weiss
A technical-level introduction to microprocessors and microcomputers, this book covers the basic elements of a microprocessor, pro-processor interface, microprogramming fundamentals, and microprocessor applications. Based on a so-called "generic" microprocessor, the book provides a sound background of general microprocessor fundamentals. Since a basic knowledge of digital technology is useful, a review is contained in the first chapter. 384 pages, hardbound, $11.95. Order #R052.

All Through the House: A Guide to Home Weatherization
by T. Blandy and D. Lamoureaux
An architect and a contractor reveal their unique "diagnosis," a series of simple tests to determine the weatherization needs of any home. Using the diagnosis, any homeowner can perform an energy audit during leisure time and free of charge. The authors show how an effective home-management program can save money and enhance comfort. 176 pages, hardbound, $7.95. Order #B124.

The Solar Decision Book
by R. H. Montgomery, with J. Budnick
Through many detailed, yet easy-to-follow diagrams, illustrations, and charts, this book shows you how to narrow down solar energy options by understanding energy needs and costs. You'll also learn how to deal effectively with system contractors, how to understand the much-needed advice on solar system design and operation, component selection and sizing, job pricing and system installation, the effect the system will have on cash flow and taxes, and much more. 328 pages, paperback, $12.95. Order #M122.

Sun Up to Sun Down: Understanding Solar Energy
by Shawn Buckley, Ph.D.
How solar energy works is the subject of this highly practical, non-technical book written by an M.I.T. professor whose patented solar diode is now in production. Buckley first establishes a conceptual framework by explaining conduction, convection, radiation, thermal resistance, and thermal storage; then he turns to the practical application of solar energy, focusing primarily on heating systems—from solar collectors to heat storage. Dozens of illustrations, plus an easy-to-read text, make this book a must for those who want to understand solar energy and its use. 160 pages, hardbound, $6.95. Order #B123.



RSGB Test Equipment for the Radio Amateur (2nd Ed.)
by H.L. Gibson, G2BUP
Explains the principles of measurement techniques, and gives constructional details of many items of up-to-date equipment of interest not only to the radio amateur but also to the electronics enthusiast. 151 pages, hardcover/dust jacket, $10.95. Order #G050.

The Energy Crunch Cookbook
by J.Bingham and D. Riccio
Fast and easy recipes to help save energy and money. Cooking techniques utilize kitchen appliances such as the mixer, slow cooker, pressure cooker, microwave oven, and more. Features a chart giving the estimated kilowatt hours used for small and major appliances. 224 pages, paperback, $7.95. Order #B121.

Solar Energy Sourcebook
by Marty, Moonan, Kruysmen, Robinson
Here is a solar energy directory for both laymen and professionals. Provides a short introduction to solar energy and an overview of solar systems. *includes a products-by-category section and a list of persons and companies involved in solar.* Lists by state all legislation passed and proposed in the U.S. as well as proposed federal bills. Includes a state and city index of solar products and services available. 797 pages, paperback, $15.00. Order #M119.

Home Energy for the Eighties
by R.D. Wolfe and P. Clegg
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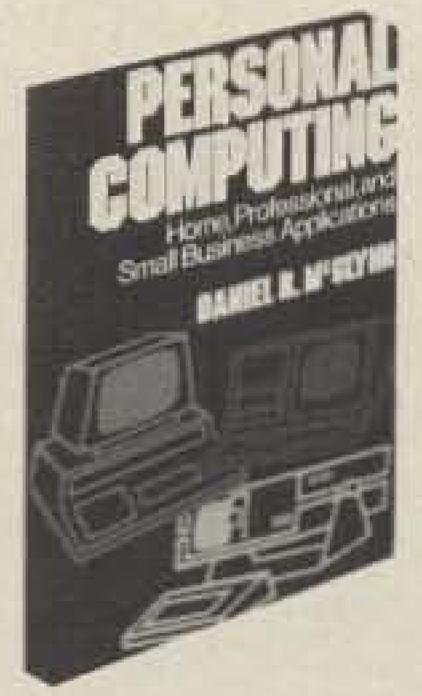
This nontechnical guide emphasizes systems, applications, and programming languages to make it easy for you to use and understand the personal computer. It surveys the entire field of personal and small business computing and covers: the features, capabilities, and limitations of today's hardware and software; guidelines for selecting and buying a system; the various programming languages; and disk operating systems and applications programming. 296 pages, paperback, $9.95. Order #M060.



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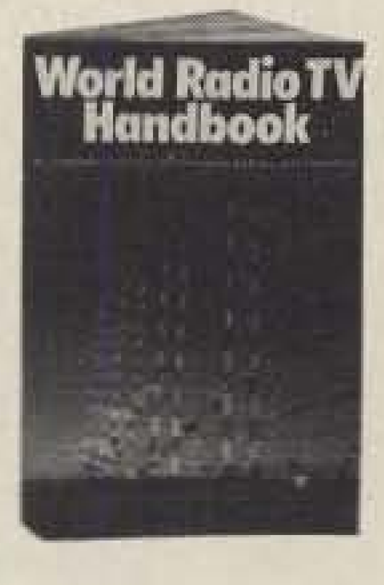

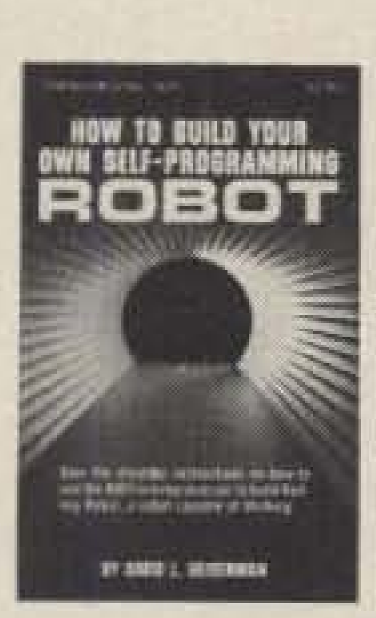

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You say you don't have room for an 80 meter beam? Is that what's bothering you? Well fret no more, as WB0AOF shows you how to build a workable 80 meter antenna on a city lot.

The 80 Meter Pyramid Antenna

BY WILLIAM R. MEST*, WB0AOF

Trying to solve antenna problems on small city lots for operating on the 80 meter band is one of the more difficult tasks I have been confronted with for a long time. However, at long last, I believe I have finally arrived at the answer to this problem. After searching through various piles of antenna articles (collected for several years) and reading subsequent articles on erecting this antenna or that antenna, I settled on the antenna described in this article.

The original appearance of this article, *CQ* magazine, February 1961, seemed to have been written at a time when 80 meters was not a very popular band, other than for ragchewing purposes. With the advent of 5BWAZ, 5BDXCC, and 5BWAS, the need for such an antenna appears to be much greater than ever before. Erecting this antenna for 160 meters may also be applied if you have a better than average size city lot.

I have tried numerous types of antenna systems on 80 meters both here in the USA and overseas. The pyramid antenna described here is, by far, the best system I have found for me. It performs much better than a single inverted-Vee or two-element inverted-Vee antenna. Although a skeptical individual may grumble as to its performance compared to other antenna systems for 80 meters, I only attest to the fact this antenna has given me many enjoyable 80 meter local (stateside) and DX contacts. At the time this was written I have worked all states and 77 countries on this band utilizing this simple antenna system. I have tried this antenna system at heights of 50 feet and 40 feet. S.w.r. figures are shown for each antenna height. The reason for the difference in heights used is due to the fact that the antenna was first put up at 50 feet using a Rohn 50 foot push-up mast. At 40 feet the antenna was raised using a small 40 foot crank-up tower. Dimensions in this article are shown originally at the 50 foot height mark, and deviations in the configurations are not drastic changes.

The antenna system described herein is supported by a mast at 50 feet in height. The mast is located in the center of my backyard as seen in fig. 1. The antenna system is pretty much straight-forward. It actually looks like two delta loops, about the size of 40 meter loops, sloping in opposite directions. The entire wire length of the antenna is a full wavelength in a configuration that is doubled back (or flipped over) on itself, then sloping in opposite directions as seen in fig. 2. The actual length of wire will depend on what frequency you care to have as a center portion of your bandwidth. My antenna was originally cut for 3800 kHz. Not having pre-stretched the wire, it has since lengthened and the resonant frequency appears to be very close to 3700 kHz. This error can best be corrected with a little trimming of the antenna. I never trimmed my antenna since there has been no degradation of performance. However, for the purist really concerned with s.w.r. figures, the cut-and-try method will bring fast results. If you cut about 1½ feet of wire off each loop (or add) you will raise (or lower) the resonant frequency approximately 50 kHz. Use the formula 1005/F (MHz) as a basic start for antenna length.

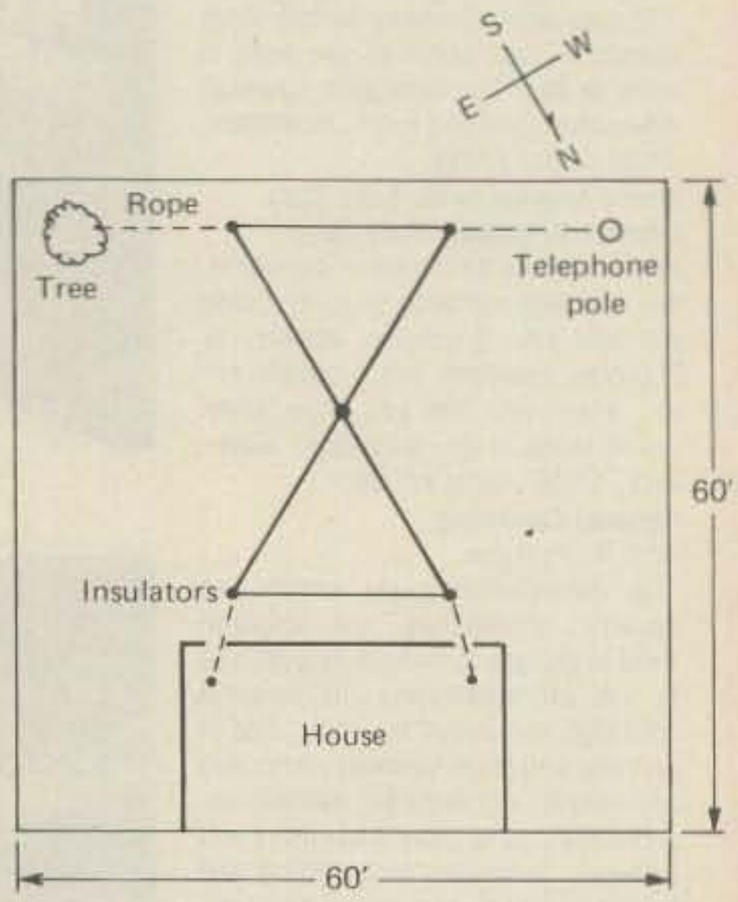

Fig. 1 - 80 meter pyramid antenna in relation to my house and property.

As can be seen in fig. 3, the wire crosses itself at the midpoint of the antenna. Where the wire crosses is the feed point for the coaxial cable. In the original article the author chose 75 ohm coax but I stayed away from this direct feed system and used a quarter-wave matching transformer section of RG59U, 75 ohm coax cable. If you choose to match it this way remember to figure the velocity factor of the coax. In my case, with a design frequency of 3800 kHz, I connected 42 feet 6 inches of coax to the feed point of the antenna. Then I placed a random length of RG8AU down to my shack. This pyramid antenna exhibits a characteristic impedance of approximately 90 ohms. Therefore, the

*8747 Glenwood Drive, St. Louis, MO 63126

quarter-wave matching transformer section is highly recommended for a low s.w.r. across a greater portion of the 80 meter band. Keep in mind that s.w.r. figures will vary, depending on surrounding objects, telephone wires, adjacent house wires, etc. Fig. 4 gives my s.w.r. figures for the antenna at 40 feet and 50 feet respectively.

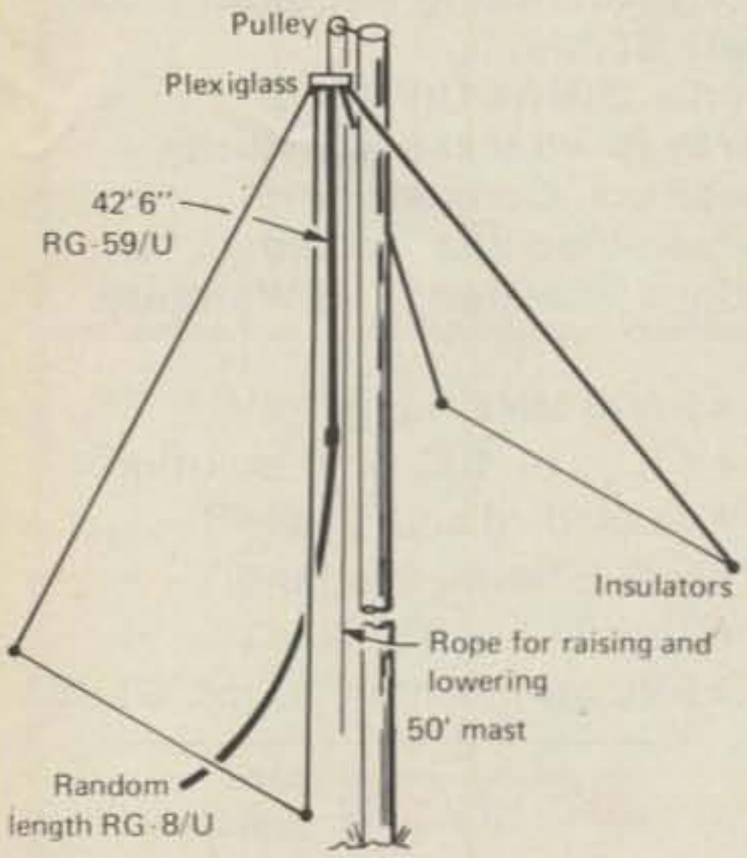

Fig. 2 - An oblique view of the pyramid antenna.

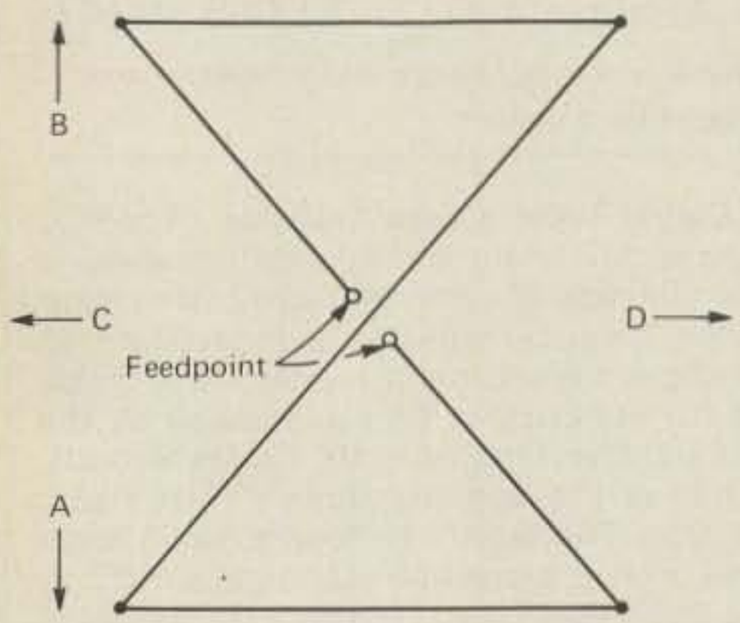

Fig. 3 - Top view of the pyramid antenna. The letter designations indicate directions which are discussed in the text.

The original article gave spacing between the horizontal elements of this antenna as 42 feet, and the length of each horizontal portion as 42 feet. These figures were made at a design height of 40 feet, yet are not fixed as the only possible dimensions. In my case, with the mast at 50 feet high, the spacing between the horizontal portion is 48 feet, each horizontal portion being 33 feet long, so the antenna appears as a large ice cream cone. At 40 feet high my antenna closely resembles those dimensions of the original article. Additional height will probably enhance the antenna's performance as more wire is in a vertical position

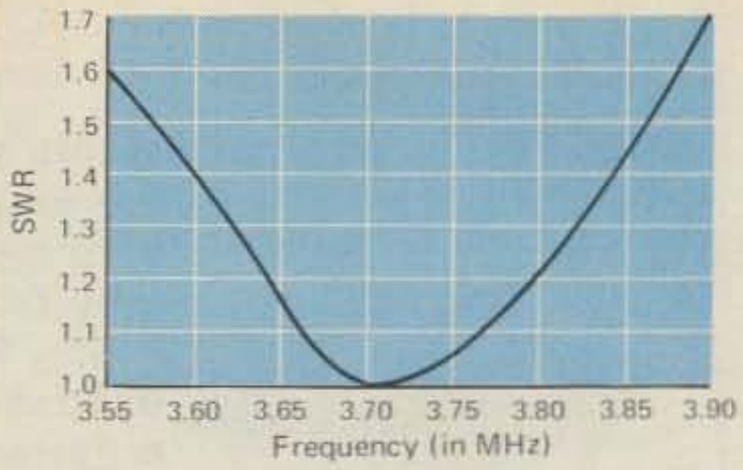

Fig. 4 - S.w.r. measurements of antennas 50 and 40 feet high.

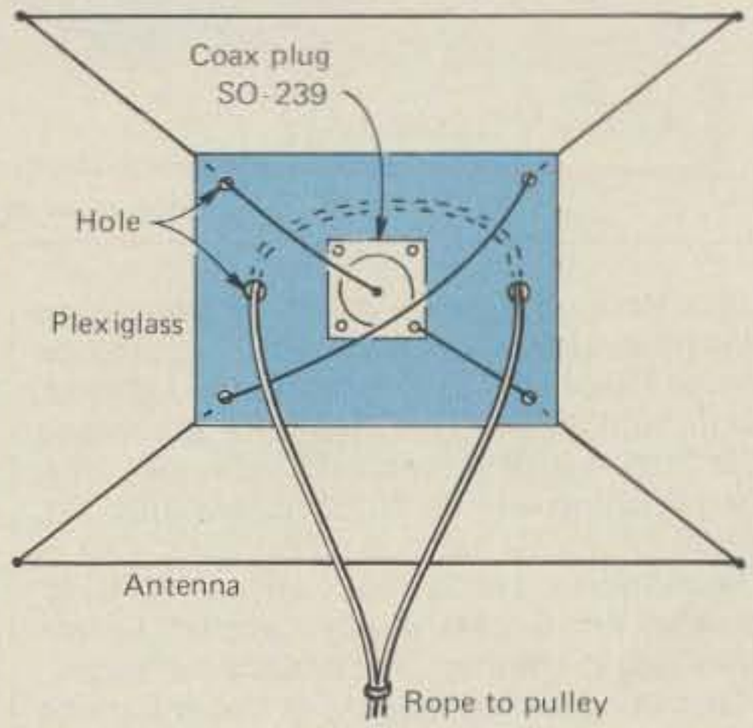

Fig. 5 - The coaxial cable feed system as seen from the top.

(or sloping position), which seems to be the most radiating portion of the antenna. The height of the horizontal sections above ground should be a minimum of 10 feet. Serious ground losses will affect antenna performance if this minimum height is not met. Negligible radiation is emitted from the horizontal portions of the antenna. As noted from the original article, "Radiation is mainly off the slanting wires. As can be concluded from the current distribution, the horizontal sections carry comparatively small currents that are equal in magnitude and opposite in direction so that the fields tend to cancel. Radiation from the horizontal sections is therefore negligible. At high angles with respect to ground, the antenna is substantially omni-radiant; at lower angles radiation is strongest in the direction A-B, weakest in the direction C-D." (See fig. 3.) In other words, the antenna is great for short distance (stateside) contacts and very good for DX contacts.

The manner in which you attach the antenna to the feed line is strictly a matter of preference. My antenna system is made so I can pull it up or down from the mast section utilizing a small pulley at the top of the mast. I used a small piece of plexiglass to aid in the sure connection of the feedline as shown in fig. 5.

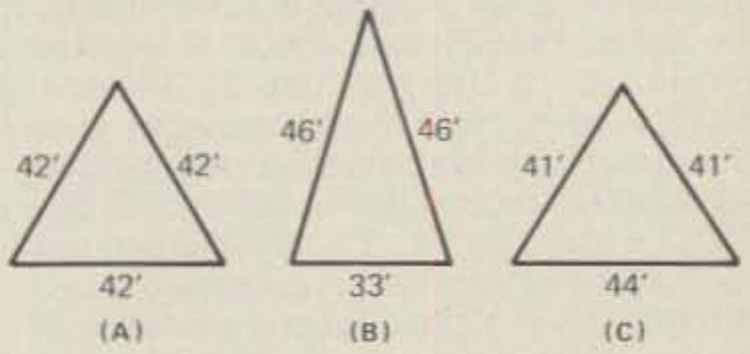

Fig. 6- Various loop dimensions. (A) The original design for 40 foot height. (B) The ice cream cone design used at 50 feet. (C) My antenna used at a height of 40 feet.

Fig. 6 shows you the size of the loops from the original article and my own installation at heights of 40 feet and 50 feet. Keep in mind that a unilateral triangle (delta loop) *is not* absolutely necessary to make this antenna work. Remember, as stated previously, the lengths of the antenna are not precise, but rather are guideline figures for working the proper length for your particular location. More than likely you will have to prune the antenna for lowest s.w.r. readings at your selected frequency of operation. Don't be too critical about getting the s.w.r. absolutely flat, although using the quarter-wave matching transformer section will greatly enhance doing so. Anything 1.5 to 1 or lower will be just fine.

This antenna has been in use at my station well over a year. The antenna will not compete with the delta loops or various other antenna systems at 100 feet or more, but it certainly will get you plenty of DX contacts as well as stateside contacts, if you have the intestinal fortitude to put it in the air. I can usually be found on approximately 3805 kHz each evening (plus or minus DX). Try this antenna, and join in the fun of great 80 meter DXing. You'll like it.

ANNOUNCEMENTS

(from page 6)

Logansport, IN 46947.

• **Zero-Beaters Washington Hamfest** – The Zero-Beaters ARC will sponser the Washington Hamfest at the Washington, Missouri Fairgrounds on Sunday, July 20. Prizes, good buys, and great excitement for hams, and bingo and candy scramble for other family members. Delicious food. Talk-in on .52 simplex. For more information, tickets, prizes, camping, write ZBARC, Box 24, Dutzow, MO 63342.

• **Oklahoma State Convention** – The Oklahoma State ARRL Convention and "Ham Holiday" will be held July 25 through 27 at Lincoln Plaza, 4445 Lincoln Blvd., Oklahoma City, OK. Sponsored by Central Oklahoma Radio Amateurs (CORA), its program will include an ARRL forum and technical talks presented by qualified speakers. In addition, a full program is scheduled for the ladies. Preregistration is $5 if received before July 19; after that date, $6. A special award is being given to encourage preregistration. There will also be many other awards. Mail registration to CORA, P.O. Box 15013, Oklahoma City, OK 73155. Adequate rooms are available for commercial exhibitors. Over 10,000 square feet of floor space, all under cover, convenient to loading and unloading, and with unlimited table space, is available at no cost to flea-market swappers. (No commercial exhibits in the flea-market.)

"City of Champions" Sports Certificate – The North Hills Amateur Radio Club of Pittsburgh, Pennsylvania is sponsoring a "City of Champions" sports certificate in honor of the Pittsburgh Pirates World Series victory and the Pittsburgh Steeler Super Bowl victory. The certificate is available to all radio amateurs, the only requirement is to contact members of the North Hills Club. Contacts may be made on any band, any mode. Multiple contacts with the same member on different bands count as one contact only. Number of contacts required: Western PA ARRL section, 5 contacts; continental U.S. (except WPA) 3 contacts; DX (including Hawaii and Alaska) 1 contact. Exchange: Call, ARRL section, and signal report. To apply send log entries (time, date, band, etc.) and an 8½ X 12 s.a.s.e. with 22¢ postage to: NHARC – City of Champions, c/o WA3WOX, 4197 Timberlane Drive, Allison Park, PA 15101. All contacts must be made before Dec. 31, 1980. NHARC members will be working the following frequencies beginning Sunday, May 4 until June 30 (after that they may be on other frequencies):

Band			UTC
10 M	28.600	Sunday	1900–2100
15 M	21.365	"	"
20 M	14.300	"	"
40 M	7.250	"	"
75 M	3.920	"	0000–0200
40 M (Novice)	7.110	"	2000–2100

• **South Dakota Hamfest** – The 1980 Annual South Dakota Hamfest and picnic will be held at the Surbeck Center, South Dakota School of Mines Campus, Rapid City, S.D. This event, sponsored by the Black Hills Amateur Radio Club, will begin with registration Friday, July 25th at 4 p.m. and continue through Sunday, July 27th. Doorprizes will be awarded along with a pre-registration prize. There will be forums, tours, exhibits, xmtr hunt, flea market, contests, prizes and YL activities. Flea market tables are free. Registration will be $6.50 before July 1st; $7.00 after July 1st and at the door. Call in frequencies 146.34-94, contact W0BLK. Sunday noon meal will be catered; tickets available at the door. Assistance will be provided in obtaining lodging or trailer parking facilities. To pre-register or obtain further information contact Black Hills Amateur Radio Club, P.O. Box 1014, Rapid City, S.D. 57709.

• **BRATS Maryland Hamfest** – The annual Maryland Hamfest, sponsored by the Baltimore Radio Amateur Television Society (BRATS), will be held on Sunday, July 27, at the Howard County Fairgrounds, just off I-70 and Route 32 at Route 144, in West Friendship, Maryland. Activities, which will be held rain or shine, begin at 8 a.m. Talk-in on 63/03, 16/76, and 52 simplex. For information or table reservations, write BRATS, Box 5915, Baltimore, MD 21208

• **Nashville Hamfest** – The all in-door Nashville Hamfest will be held on Sunday, July 27 beginning at 8:00 a.m. CDT at the National Guard Armory, Sidco Drive, Nashville, Tennessee. Admission $1.00. Tables $3.00. Refreshments available. Talk-in on .90/.30. For more information contact Radio Amateur Transmitting Society (RATS), P.O. Box 2892, Nashville, TN 37219.

• **Carlos Roberts Tape Available** – The FCC has an important and interesting message for all users of personal radio communications. An audio tape has been prepared, offering a discussion of numerous personal radio benefits to be considered by the public. The narrator is Mr. Carlos Roberts, Chief of the Commission's Private Radio Bureau. The tape is for loan to radio clubs and organizations free of charge, and it may be freely duplicated. The general content of Mr. Robert's 5 minute talk concerns the possible creation of a new personal radio service in the 900 MHz, and new channels for exclusive single-sideband operators, in addition to clarifying the status of the present 27 MHz CB band. Anyone desiring to borrow a tape should contact: Education Branch, Private Radio Bureau, Federal Communications Commission, Washington, D.C. 20554.

• **Pennsylvania** - The 43rd Annual South Hills Brass Pounders and Modulators Hamfest will be held on Sunday, August 3, on the South Campus of Allegheny Community College, located just off Rt 885 in West Mifflin Boro, south of Pittsburgh. Large in-door, air-conditioned facilities, as well as plenty of out-door flea market area. Dealers, flea market, forums, demonstrations, good food and prizes. Doors open 11 a.m. Talk-in on 146/13/73 and 52 simplex. For more infor contact Doug Wilson, WA3ZNP, 185 Orchard Ave., Emsworth, PA 15202.

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SELL: HEATH HP-13B Mobile power supply, very nice, $35. W0ULU, Fred, 8534 Ingersoll Ave. So., Cottage Grove, MN 55016.

SELL: Hammarlund HQ-105TR. Complete with speaker, crystals and schematic. Excellent, $130, you ship. C. Klawitter, 4627 N. Bartlett, Milwaukee, WI 53211.

SALE: Model VHF 126 Converter, RME-Electro Voice, 220 MC, 144 MC, 50 MC, with manual $100.00. WA9AXA, 201 E. 59th Street, Westmont, IL 60559.

HALLICRAFTERS HA-10 tuning unit for SX-117, mint $50. Wanted: any National Receiver, working or not. T.N. Colbert, WA8MLV, 1800 Rhodes Rd., #612, Kent, OH 44240.

FOR SALE: Tempo RBF-1A vswr/watt meter 2000/w F.S. ½ hour used, $25. Omega digital Squeeze Keyer w/6.3 vac supply built-in, $50. LM-18 Freq. meter no p/s w/chart by SIN, $10. Sale or trade surplus xmtr gen. coverage 1.5-20 MHz 850w input cw/rtty weight 650 lb, pick-up only! Wanted: Collins 312B-4 console good condition and fairly priced. WB7AVO/6, 415-964-6184, 178 Centre St. #3, Mtn. View, CA 94041.

WANTED: Swan 510X xtal oscillator and C.E.20A. Hobert R. Combs, W0NRX, Grant City, MO 64456.

WANTED: Pre-1938 I.R.E. Proceedings. Donald Chester, Route 1 Box 281, Woodlawn, Tennessee 37191.

ROHN TOWER: Buy wholesale from worldwide distributior, - 20G $28.44 each 25G, $37.62 each, 45G, $83.60 each. 48 ft. foldover tower, $660.00 freight paid. 48 ft. BX free standing $224.02. Hill Radio, 2503 GE Road, Box 1405, Bloomington, IL 61701, 309-663-2141.

WANTED: E and F coil sets plus corresponding dial tuning strips for NATIONAL HRO-60. Don Chepurna, 41 Clinton St., Waterbury, CT 06710.

SALE-TRADE: Wyoming-Utah ranch land. 10 acres $50 down, $50 month. (Offer void in California.) FREE maps, photos, information. Trade for ham gear, home computer, test equipment, etc. Owner- Mike Gauthier, WB7QGR, 9550-Q-Gallatin, Downey, California 90240.

SELL: Kenwood T-599D, R-599D, S-599, 1 yr. old, $560 & shipping. N0AJZ, 314-838-7285.

TRADE: Meade 8" Telescope, many accessories, for all mode 2M Transceiver. Jon, WB0TIE, 303-576-5119.

WANTED: Tempo 8120 speaker. FOR SALE: SB-634 console, new, $110. DX-300 receiver, $300; Yaesu FR227RA, $280; Heath UF2031 with tone pad, $180. N0WB, 7429 Frederick St., Omaha, NE 68124, (402) 397-2461.

WOULD LIKE TO CORRESPOND with YL's anywhere. WA1GFJ, 160 Elm St., Apt I-4, North Haven, CT 06473.

HEATH HR1680 Receiver $175.00. DENTRON JR Monitor $45.00. N2BIB, 201-828-1295.

FOR SALE: CX7-A $850. R4C, T4XC, AC4, MS4 $850. 312B-5 $495. IC230 $239. New TR 7400A, ACPS $449. KWM2, ACPS $675. ITT 3010-C $550. 75A4 #4491 (0.5, 1.5, 3.1) $495. 75S3B #30435 $750. TEK-535 $200. 32SI, ACPS $350. KWM2-A, ACPS $795. DRAKE ML-2 $100. James Craig, Box 615, Portsmouth, NH 03801.

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SELL: Hammarlund HX-50 SSB Transmitter, excellent, $195. You ship. Chuck, W9VZR, 4627 N. Bartlett, Milwaukee, WI 53211.

QSLS PRINTED: Samples 50¢, refundable with first order. HAWTHORN PRINTING, P. O. Box 591, Washington C.H., Ohio 43160.

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NOVICE ALL-AMERICAN CERTIFICATE: Work a Novice in all 10 call areas. Send list and $1. K6AS1, 25 Rudnick Ave., Novato, CA 94947.

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FOR SALE: Heath HP-23A A.C. Power Supply, $37. 2 KW Transmatch, $85. Two 3-500Z Tubes, full output, $60 each. H. Parks, 293 Warburton Ave., Yonkers, New York 10701, 914-963-0689.

SELL: Harris RF comm. rcvr. RF505 and RF507 preselector/amplifier. Documentation, almost like new. 1/3 of current price. Will ship. LA5HE, Box 73, Ljan, Oslo 11, Norway.

SELL: Frederick 1273 FSK, Model 170 Hz with loop pwr supply $250 or best offer. Will ship. LA5HE, Box 73, Ljan, Oslo 11, Norway.

WANTED: DD-76 digital readout to work with Swan Cygnet 300 B. In good condition and working order. George A. Collet, 5405 N.W. 42nd Ave., Fort Lauderdale, FL. Tel: 739-1947.

WANTED: Drake MN2000 Antenna Tuner. Drake L-4B Amplifier. Hallicrafters HT-41 Amplifier, free of modifications and fair priced. After 4 p.m., WB7AVO 415-964-6184.

WANTED: Magnetic Video Corp. Copycorder. Halliburton Briefcase. Larry Kleber, K9LKA, Belvidere, Illinois 61008.

SELL: Plate Xfmr 3600-0-3600 at 1 Amp with 110/220 Pri $45; Johnson Kw Matchbox with SWR Meter, very good condx $150. Paul Bittner, W0AIH, 1616 South St., Eau Claire, Wisc 54701.

CLUB CALL PINS 3 lines 1¼ × 3¼ $1.55 each call, first name and club. Colors blue black or red with white letters. (CATALOG) Arnold Linzner, 2041 Linden Street, Ridgewood, NY 11385.

SPLIT SCREEN RTTY Machine lang program for TRS80 (LII, 16K)/M80. $10 from B. Gorsky, 2449 Derbyshire, Cleveland, OH 44106.

WANTED: Hallicrafter S-1 through S-7, DD-1, 8 HPA, SX-10, SX-12, and other early Hallicrafter gear, parts, manuals, and accessories. Any condition. For my collection, please write, even if in doubt on Model No. Chuck Dachis, WD5EDG, 4500 Russell Dr., Austin, TX 78745.

QSLs with Class! Unbeatable quality, reasonable price. Samples: 50 cents, refundable. QSLs UNLIMITED, POB 27553, Atlanta, GA 30327

CANADIANS: "UNIVERSAL CROWBAR" module protects radio equipment against excessive power supply voltage. Easy installation. 20 Amp 12V, 5V models $12.95 plus $1 shipping, Ontario add 7%. CGU Radio Electronics, Box 231, Goderich, ONT.

FREE INFORMATION: On Linear Amplifiers, CB Radio Repair, and CB Radio Modification. Send to: A.P. Systems, POB 488, Dept. AR, Milford, PA 18337.

SCANNER CRYSTAL CERTIFICATES: $3.85, Limited Quantities. Please Include Stamped Envelop. J. Bready, 1515 Ropers Rd., Orange Park, FL 32073.

TRANSFORMERS: Input/Output for your linear amplifiers. ¼" to 1¼" Ferrites with from 1 to 5 turns of teflon 18ga. wire. LRI, 4035 Oceanside Bl. B-25, Oceanside, CA 92054, 714-726-8099.

NEW & USED HAM AND COMPUTER EQUIPMENT. Monthly Publication. Subscription $5.00. Write Nuts & Volts, P.O. Box 1111, Placentia, CA 92670.

SATELLITE TV RECEPTION 36-Page "How-To" Book. Complete reprint of Bob Cooper's 7-article series from *Radio-electronics* Magazine. $6.00 postpaid U.S. and Canada. All others add $3.00 postage. N.Y.S. residents add 48¢ sales tax. SATELLITE TV RECEPTION, Box E, *Radio-Electronics*, 45 East 17th Street, New York, NY 10003.

HEATH STATION CONSOLE, MODEL SB-630 W/Manual $100.00...Jack M. Gutzeit, W2LZX, c/o CQ Magazine, 76 N. Broadway, Hicksville, N.Y. 11801, 516-681-2922.

NEW! EXCITING! **AMATEUR OPERATORS PICTURE YEARBOOK.** SEND CALL LETTERS, ADDRESS, PICTURE, AND $20 to Lee Kent, P.O. Box 236, Malden, MO 63863 and receive your book. Sponsored by First United Pentecostal Church.

QSL INSURANCE: No more QRL DX operators, managers, or bureaus. New product called "Confirmation Mailer" is your best guarantee in Amateur Radio of receiving a fast direct reply. $5.50 brings 30 C/M's. Bob Zittnan, K9UJA, Box 94973, Schaumburg, IL 60194.

TUBES: Octals, 7-9 pin miniatures, obsolete types, etc. List 25¢. Warnock, 45 Rothwell, Ottawa, K1J 7G7, Canada.

KENWOOD TS520S with matching speaker $630. Used only a few hours. New HUSTLER 4BTV $70. John Erwin Smith, West 405 Main, Pullman, WA 99163. 509-334-3344.

QUADS AVAILABLE in 2 and multi element tri band kits from 150.00 all components severe duty construction fiberglass spreaders 13' long use a unique internally reinforced contruction as strong as pole vaulting poles with ¼ the wind area. db+ ENTERPRISES, P.O. Box 24, Pinevalley, NY 14872.

DXERS: Get new DX Tables custom computed for your exact QTH—All Dx Prefixes, Beam Headings, Reverse Headings, Distances, Time Differences, U.S. Cities, Country/Prefix Listings, QSL Checklists. Send callsign, $3.15 to Willcomp, Inc., P.O. Box 86, South Salem, NY 10590.

COLLINS 75S3 with 200 Hz Filter, Excellent Condition $425.00 firm. Jack M. Gutzeit, W2LZX, c/o CQ Magazine, 76 N. Broadway, Hicksville, NY 11801, 516-681-2922.

COLLINS KWM-2 $425.00—516F2 Power Supply $135.00—Mobile Power Supply and Rack for KWM-2 $100.00. Or Take ALL for $575.00 Firm. Jack M. Gutzeit, W2LZX, c/o CQ Magazine, 76 N. Broadway, Hicksville, N.Y. 11801, 516-681-2922.

CRYSTALS: S.A.S.E. for my list. K8LJQ, 355 Mower Rd., Pinckney, MI 48169.

RESISTORS ¼W, ½W5%C.F. 2.2-ohm through 4.7-meg stocked. 3¢ ea plus $1.00 shipping. No minimums. JR Industries, 5834-F Swancreek, Toledo, OH 43614.

SELL: Atlas RX-110S deluxe QRP 80-10M Transceiver $350. Matching 250W module and power supply $300. All Excellent with warranty, plus UPS, Richard Brock N8RB, 15806 Fernway Road, Shaker Heights, OH 44120, (216) 751-7340.

WANT: Paddles for a Signal Corp J 36 made by Vibroplex. R.W. Randall, K6ARE, 1263 Lakehurst Rd., Livermore, CA 94550.

WILSON, MARK IV, LIKE NEW, FULLY CRYSTALED, TOUCH PAD, PL (136.5/4Z), Ni-Cad, plus Spare Ni-Cad, Leather Case, Desk Top Charger, Car Charger, Speaker Mike, and Duckie Ant. First $275.00 Takes All. . . .Jack M. Gutzeit, W2LZX, c/o CQ Magazine, 76 N. Broadway, Hicksville, N.Y. 11801, 516-681-2922.

FOR SALE: Hammarlund 120 Receiver complete with speaker and manual in working condition, some spare tubes. TEL. 601-426-3567. Al Hines, W5LWQ, 820 South Magnolia St., Laurel, MS 39440.

SELL: 80M RCVR BC454 $35, you ship. W2EZ, 9 Whitney Farms Circle, Fairport, NY 14450.

WANTED: Paperback copy of James Bond's "Casino Royale" by Ian Fleming. WB4PIQ, Rt. 4, Box 348-A, Glen Allen, VA 23060.

SELL: Wilson two meter T1502 MX, hand-held transceiver, range 136 to 174 MHz. Two watts out with charger, nicad batteries, case, external mike, and auto patch kit, wired. Six channels, good condition. $250.00. Sal Francione, W1HFL, Phone: 203-878-4333, 14 Broadway, Milford, CT 06460.

SELL: General Radio 546C Audio Frequency Microvolter, converts audio oscillator into calibrated sig. gen. Manual. $60. Ph.D., 5220 Carlingford, Riverside, CA 92504.

FOR SALE: HEATH HW 101, CW Filter, PS 23 Power Supply, 1 year old, excellent condition, factory aligned. Asking $425.00 or trade towards Kenwood TS520 S. Al Bulin, KA5DLZ, 503 Crutcher, Springdale, Ark. 72764.

VERTICAL USERS: Hustler endorses it! Cushcraft, MorGain, Palomar bought it! 21 nationwide dealers now advertising it! Ham Radio Publishing Group calls it, "...most interesting...very well put together..." Followup letters praise it! Indispensable to all vertical owners! What is it? "The Comparison of Relative Performances of Commercial Trap Vertical Installations Under Less than Ideal Geographic Conditions." Send 15¢ stamp for details. DANRICK ENTERPRISES, Dept. Q21, 213 Dayton Ave., Clifton, NJ 07011.

BUILD A 30 Hz to 40 MHz Frequency counter, a second and 10th of a second counter, and a thermometer, all in one for less than $25.00. Block and schematic diagrams with circuit explanation. Send $2.25 to Frequency Counter, 319 So. 10 Ave., Wausau, WI. 54401.

SCANNERS, CRYSTALS: At low Wholesale Prices! Wholesale to Everybody! Prompt Service! Send stamped envelope! Alfords, Box 339-Q1, Middlesex, NC 27557.

SELL: Swan W-2000A Bridge $65, Mark 2 Linear 10-80 $695. Both used 1 hour. Mint. A1, W1JVQ, 84 Glendale Ave, Bridgeport, Ct 06606. 203-372-9440.

WANTED FOR PARTS: Swan Cygnet, Drake 2-B, Heath HW101, DX-60, SB 303, SB 401, and such. Price 1st letter, please. Marti, BX 6113, Hilton Head, SC 29928.

SELL OR TRADE: Mint Kenwood TS-600. WANTED: FM unit for IC-551D, Drake LP-5200 filter, MFJ-101 clock, Heath 1390 digital thermometer, BN-86 balun, Kenwood R-300 or R-1000. K0MK, F.Kauppi, 690 Vermilion Trail, Gilbert, MN 55741.

FOR SALE: Tempo One Trnscvr, AC/PWR SUP 444 Shure, MFJ CW Filter. $400. Al Moore, Box 216, Gosport, IN 47433.

NEED SCHEMATIC for Pearce Simpson Gladding 25. Will promptly copy and reimburse postage. WB4ZOJ, Rt. 1, Temple, GA 30179.

DRAKE 2-C, 2-CQ Rcvr, "WARC" ready, Mint: $169. Midland 13-500, 10W, FM, 2m, clean: $120. SSB processor: $39. Hank, WA2OVG, 212-490-2160, Days.

WANTED: Prop Pitch Rotator - W0MLY type -with or without control box. K9DX - 312-382-1731.

FREE! Heisenburg Uncertainty ACCEPTED by Trajectory, Unifield, C+ Relativity! W.T. Thomas, Jr., 408 Vermont, Daytona Beach, FL 32018.

SELL: 1-American & 1-Foreign 1980 callbook, $13.00 each. Nathan Rosen, 2440 Olinville, New York, NY 10467.

WANTED: QSL INFO FOR HW3ITU worked MAY 79. WB8OWM, Skip, 1309 24th St NW, Canton, OH 44709.

WANTED: KWM2/A any condition, state condition and price. H.F. Schnur, 115 Intercept Ave, North Charleston, SC 29405.

NATIONAL RADIO INSTITUTE advanced amateur course (originally $120). 4 extra class professionally made code tapes. All for $40 including shipping. R. Hughes, KC4CJ/NF, 2302 Briargrove Court, Richmond, VA 23233.

SELL: Pickering Keyboard Keyer Model KB-1 $150. Clem Duval, W8VO, 33727 Brownlea, Sterling Hgts, MI 48077, (313-268-2467).

NOVICES: FOR SALE-SB-400 and SX-111 $125 each. Both for $235 plus shipping. Shipped freight charges collect. Ed Morrison, Box 175, Blandinsville, IL 61420.

CCTV Camera Shiba HV-14 w/lens, video & RF $100, Millen GDO w/coils $65, Heath GDO w/coils $30. K6KZT, 2255 Alexander, Los Osos, CA 93402.

FOR SALE: QST's from 16, CQ's from 46, Miscellaneous call books and handbooks. Early vacuum tubes from 201's. 202's including early wireless tubes. SASE for lists. Erv Rasmussen, W6YPM, 164 Lowell, Redwood City, CA 94062.

Advertiser's Index

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We'd like to see your company listed here too. Contact Jack Gutzeit, W2LZX, our Advertising Manager at 516-681-2922 to work out an advertising program tailored to suit your needs.

FT-707 is shown with optional FV-707DM VFO & Scanning Microphone

THE FT-707 "WAYFARER"

The introduction of the "WAYFARER" by Yaesu is the beginning of a new era in compact solid state transceivers. The FT-707 "WAYFARER" offers you a full 100 watts output on 80-10 meters and operates SSB, CW, and AM modes. Don't let the small size fool you! Though it is not much larger than a book, this is a full-featured transceiver which is ideally suited for your home station or as a traveling companion for mobile or portable operation.

The receiver offers sensitivity of .25 uV/10 dB SN as well as a degree of selectivity previously unavailable in a package this small. The "WAYFARER" comes equipped with 16 poles of IF filtering, variable bandwidth and optional crystal filters for 600 Hz or 350 Hz. Just look at these additional features:

FT-707 with Standard Features

- Fast/slow AGC selection
- Advanced noise blanker
- Built-in calibrator
- WWV/JJY Band
- Bright Digital Readout
- Fixed crystal position
- 2 auxiliary bands for future expansion
- Unique multi-color bar metering—monitors signal strength, power output, and ALC voltage.

FT-707 with Optional FV-707DM & Scanning Microphone

- Choice of 2 rates of scan
- Remote scanning from microphone
- Scans in 10 cycle steps
- Synthesized VFO
- Selection of receiver/transmitter functions from either front panel or external VFO
- "DMS" (Digital Memory Shift)

Impressive as the "WAYFARER" is its versatility can be greatly increased by the addition of the FV-707DM (optional). The FV-707DM, though only one inch high, allows the storage of 13 discrete frequencies and with the use of "DMS" (Digital Memory Shift) each memory can be band-spread 500 KHz. These 500 KHz bands may be remotely scanned from the microphone at the very smooth rate of 10 Hz steps.

The FT-707 "WAYFARER" is a truly unique rig. See it today at your authorized Yaesu Dealer.

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The radio.

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Hello World!

If you want it all in HF... read on...

The IC-720 Standard Features

- All 9 HF Bands with 100KHz (min) each side.
- All solid state, broadband tuned & low pass filters.
- Digitally synthesized, tuning resolution to 10 Hz.
- Human engineered, compact, functional package.
- Passband tuning in CW, SSB, RTTY modes.
- Two VFO'S, simplex or duplex operation and RIT.
- RF speech processor, easily set to your needs.
- CW filter plus narrow CW, fast semi-break in.
- RTTY function & special filter, DC level TTL compatible.
- Noise blanker, fast & slow AGC, 20dB RF Attn.
- Matched microphone, metered ALC for great TX audio.
- PTT or VOX for voice, CW VOX with full first character.
- WWV Reception — 2.5, 5, 10, 15, 20 MHz.
- ★ General coverage receiver 0.1 to 30 MHz includes AM, CW, SSB, RTTY Filters for your BCL, SWL and other listening pleasure. Transmitting is not possible in the General Coverage mode.

Power Requirements: 13.5 VDC ± 15% @ 20A

(IC-PS-15 is available for normal duty cycle. PS-20 for 100% Duty or use your own supply).

Accessories

Power Supply.
Ext Speaker.
Earphones.
Others to be announced.

Brief Specifications

TX: A1. A3J (USB, LSB), A_3H, F_1
Output SSB 10~100W PEP
AM 10~40W
CW•RTTY 10~100W
continuously adjustable

RX Sensitivity
less then 0.25V
1st IF 39.7315 MHz
2nd IF 9.0115 MHz
Selectivity
SSB•CW•RTTY 2.3KHz @ −6dB, 4.2KHz @ −60dB
continuously adjustable $700H_2$ @ −6dB, 2.0KHz @ −60dB
CW-N 500Hz @ −6dB, 1.5KHz @ −60dB
AM 3.0KHz @ −6dB, 9.0KHz @ −60dB

MIC Impedance 1300Ω
Ext. Spk. or phones 8Ω

Wired for computer and remote control.

All stated specifications are approximate and are subject to change without notice. All ICOM radios significantly exceed FCC regulations limiting spurious emissions.

HF/VHF/UHF AMATEUR AND MARINE COMMUNICATION EQUIPMENT

ICOM

ICOM AMERICA, INCORPORATED
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CIRCLE 96 ON READER SERVICE CARD

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