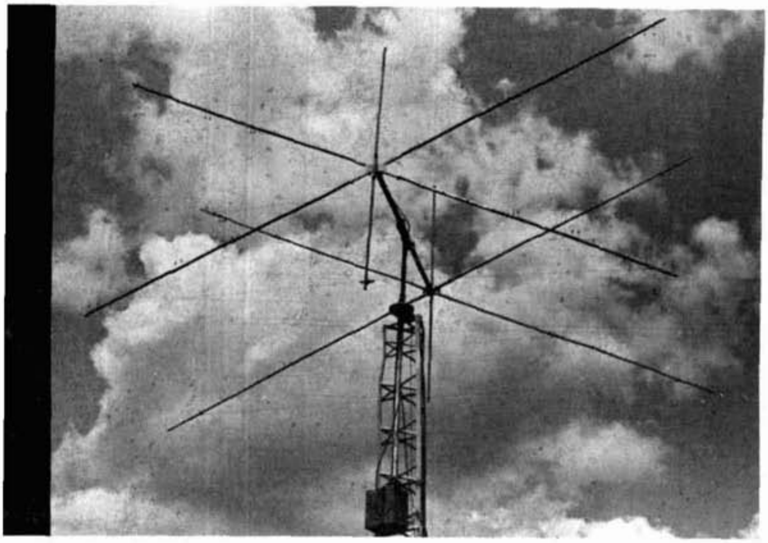

low profile three-band quad

The low profile quad offers several mechanical advantages over the usual three-band design

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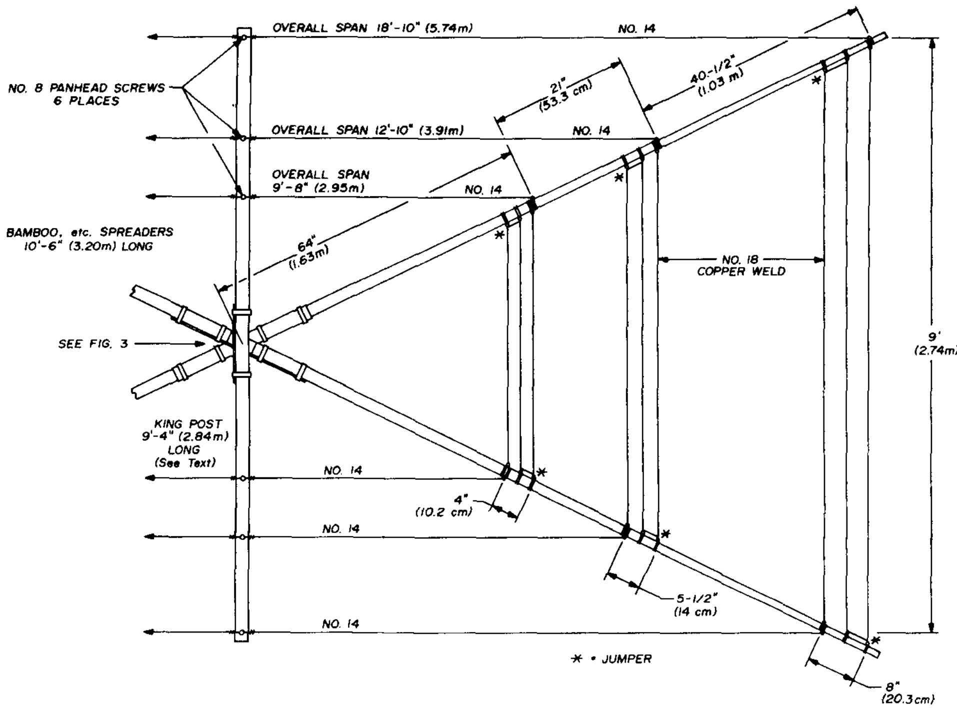
Multiband coverage with a compact beam antenna is a necessity with most amateur operators and complements the modern station contained in a single cubic foot of space. After having achieved excellent quad performance with the LPQ 20-meter monobander,[1] an excursion to the 10 and 15 meter arena with this same type of antenna seemed mandatory. At the same time, some structural and electrical improvements were to be implemented.

The casualty rate among quads is rather high, and although my bamboo spreaders survived last winter's ice storm, it probably would have finished off a tri-bander with its additional surface area. Static load tests revealed the quad's inherent weakness when built with small diameter spreaders. The easiest solution seemed to be the addition of a vertical king post to each spider; the horizontal wires of each loop could then be attached to them to provide some useful load bearing. To accomplish this, a 1-foot (30.5cm) length of 1x1 inch (25x25mm) angle iron was bolted to the outer side of each spider and a wood king post 1-1/8 inch (28mm) OD by 9 feet, 4 inches (2.84m) long was installed. Number-8 (4mm) panhead sheet metal screws at appropriate points along the king post provided anchor points for the wire.

An aluminum or metal king post would provide even greater rigidity.



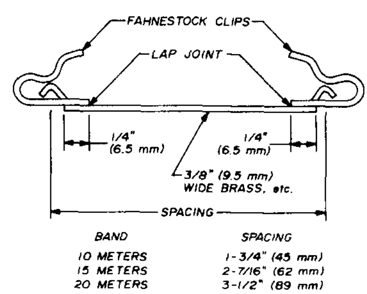


fig. 1. Details of the driven element and shorting bars. The movable shorting bars are made by sweat-soldering a pair of Fahnestock clips to a piece of 3/8" (9.5mm) wide brass or copper strip to the dimensions given for each band.

However, its presence might disturb the antenna electrically. To test its effect, the antenna was first built with the wooden king post described. After the tri-bander was completed and tuned to my satisfaction, a number-18 (1mm) wire was run the full length of the reflector king post and connected to all horizontal wires at their center (high current) points and to the spider and boom. This grounding did not upset the swr or field strength readings, so the driven element was also grounded in this same manner and with equally good results.

As an added benefit, static charge collection is reduced; now during a passing thunderstorm I am not disturbed by any snap-cracking within the confines of the tuner box! From these observations you can assume that a metal tubing king post could be used for better grounding and rigidity without affecting performance.

construction

To LPQ newcomers the spider shown in **fig. 3** is easier to make than the original type. If necessary, the parts can be assembled with 8-32 (M4) hardware and taken to a welding shop for finishing. Close attention to dimensions will take care of the necessary 54 degree spreader angle. To attain good radiator-reflector alignment once the individual spiders are assembled, the following procedure is recommended: First, insert one spider (without spreaders) in the boom and drill through both boom and spider with a 1/8 inch (3mm) drill. Then follow with a number-7 (5.1mm) drill, and finish by tapping both pieces together with a ¼-20 (M7) tap. Fasten them with a machine screw, and continue to drill-tap the other holes.

When one spider is completed, insert the opposite spider into the boom and lay the entire assembly on a flat surface. Check the top of the spider arms with a level, and repeat the drill-tap operation. Before dismantling, index and identify the spider-boom positions with a center punch or small chisel marks.

The spreader clamps, **fig. 3**, are made from 20 gauge (1mm thick) stainless or galvanized iron stock, and they should be formed so as to leave a gap of approximately 1/8 inch (3mm) when fully tightened. The bamboo spreaders should be weatherized by spiral wrapping them with PVC electrical tape. I also wrapped one set of spreaders with 3/4 inch (19mm) wide paper masking tape, wiped them off with naptha, and coated them with latex paint. To date the paper covering has not deteriorated, is cheaper, and can color match the sky or your house.

elements

Fig. 1 shows in detail the driven element and its shorting bars. In building this "monster," you're confronted with the unpleasant task of locating and providing a large number of anchor points along the spreaders. Begin by matching up the bamboo poles and selecting the stronger pair for the upper set. Then you can either fasten a spreader to the proper spider arm and measure off the given radii, or measure from the butt end and allow for the difference. Wrap three layers of PVC tape at all anchor points.

The wire-loop anchors are formed as shown in **fig. 2**. The approximately 1/8 inch (3mm) ID two-turn loop is made by wrapping the number-16 (1.3mm diameter) galvanized iron wire around a suitable nail held in a bench vise. First make up one sample and try it for size at the 10-meter section. To secure the anchor to the spreader, make two turns around the anchor point and then twist the remaining ends into a pigtail. After that step, insert a nail through the loop ID and apply an additional half turn more twist. The critical anchors are those holding the number-14 (1.6mm) horizontal wires. To prevent slippage, number-6 (3.5mm) panhead screws are driven alongside of the wrapped wire; a number-39 drill (0.1 inch or 2.5mm) is used to start them in the bamboo.

Wire stringing is started with the outer number-18 (1.0mm) copperweld vertical sections. Fashion a 9 foot, 2 inch (2.79m) gauge stick from 1x2 inch (25x50mm) wood, and insert it between the inner side of the end anchors before installing the wires and insulators. Leave several inches of pigtail on these wires for connection to the others; do not rely on the anchors for continuity! Transfer the gauge stick to the other side and repeat the procedure.

Next, attach the number-14 (1.6mm) twenty-meter lower wire to the mounted insulator, followed by the upper wire. Pull them up taut, but before securing, sight along the diagonal spreaders and make any corrections necessary. Follow with the number-14 (1.6mm) wires for 10 and 15 meters and the remaining number-18 (1mm) vertical runs, all of which are separate wires to permit proper tension adjustment. The shorting bar and jumper positions can be interchanged for best accessibility. The reflector element shown in

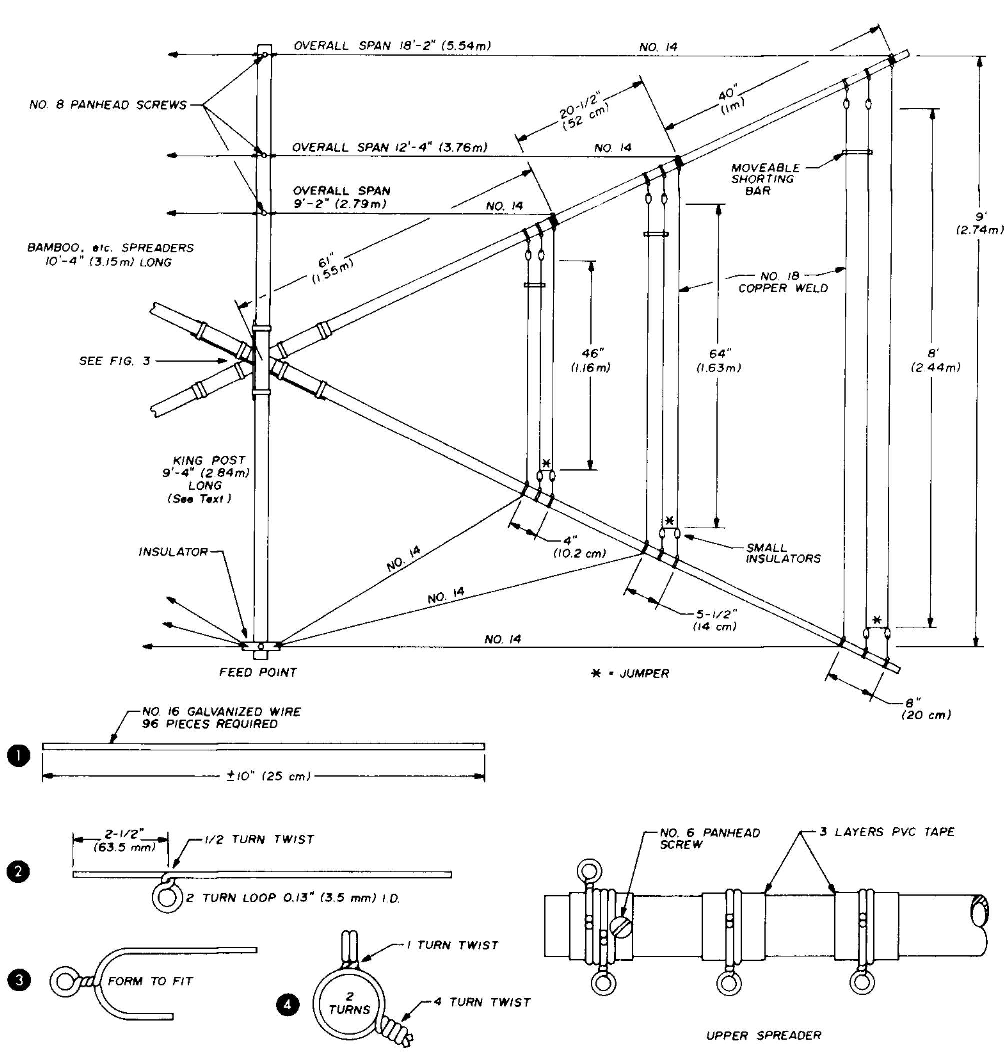


fig. 2. Construction of the reflector and wire loop anchors used in the three-band quad.

fig. 2 is assembled in the same way but without the insulators and shorting bars. To retard corrosion at the anchor loop connectors, dab on a bit of axle grease.

feeding and adjustment

The present direct feed with a single RG-8/U 50-ohm coaxial line is a quick and easy way to get going, but it is probably not the ultimate matching method. A triple gamma match is now feasible since there is now a convenient mast to support the required components. Some improvement was also noted when the original feedline length was extended from 80 feet (24.4m) to 91 feet (27.7m), a length which corresponds closely to multiple of a half wavelength on all three bands. Two other good choices for feedline length are 45 feet (13.7m) and 137 feet (41.8m). Adding the 10- and 15-meter elements to the original 20-meter LPQ lowered its resonant frequency by a substantial amount, and it required retuning. Tuning is accomplished by adjustment of the shorting bars.

As shown in **fig. 1**, moving the shorting bars upward increases the loop length and lowers the resonant frequency while moving them downward will raise the resonant frequency. Initial changes can be made in 5 inch (13cm) increments until the best swr is bracketed. The procedure I used was to raise the antenna, apply low power, and take swr readings across all three bands. At first do not concentrate on trying to obtain the optimum match for any one band. Since three antennas are connected to a common feedline, it may be necessary to make changes to all antennas and repeat the swr checks several times. An antenna impedance bridge will also show frequency changes and may be useful in the tune-up process. The reflector should not require any attention since it is broadly tuned.

Front-to-back ratio and comparative field strength were checked with a simple detector consisting of a short dipole and a 1N34 diode connected via twisted pair to a 1 mA indicator in the shack. When you are satisfied with the tuning, a fixed jumper should be soldered just below every shorting bar for insurance.

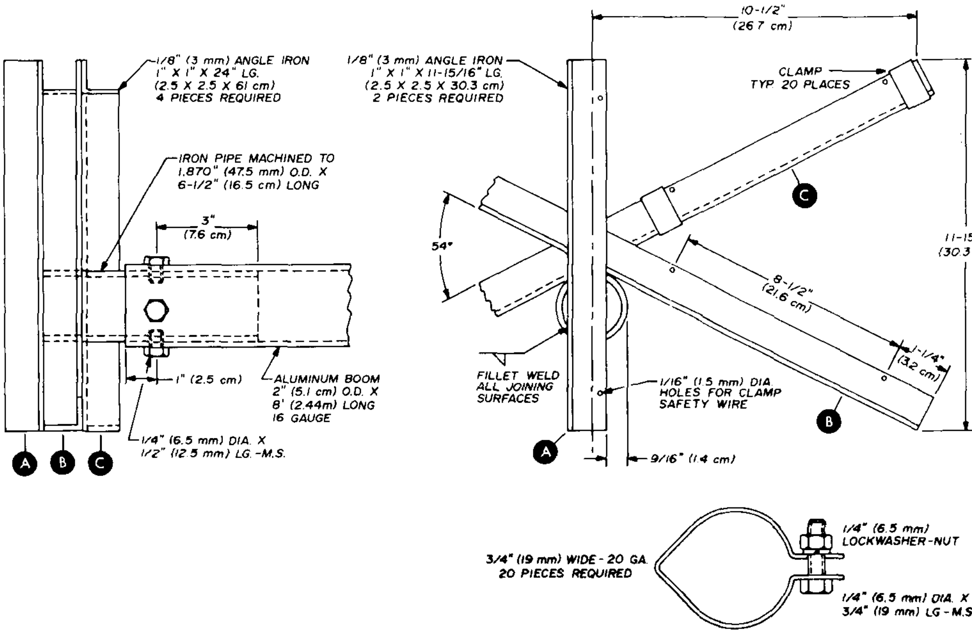


fig. 3. Spider and spreader clamp construction for the low-profile quad.

After finishing this antenna, another modification to improve the mechanical rigidity of the quad occurred to me: Why not have the 10- and 15-meter loops on the radiator and reflector fastened to the king post at the same point as the 20-meter loops? The elements would then assume a hexagonal shape and the assembly should be even more rigid.

reference

1. J.P. Tyskewicz, W1HXU, "The Low-Profile Quad Antenna," *CQ*, February, 1974, page 24.

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