A yagi without a boom would fall apart, but a quad without a boom can be an easy-to-build, rugged antenna. HB9PL's Spider Quad is a good example of the latter.

The Spider Quad

A Two-Element Beam Without A Boom

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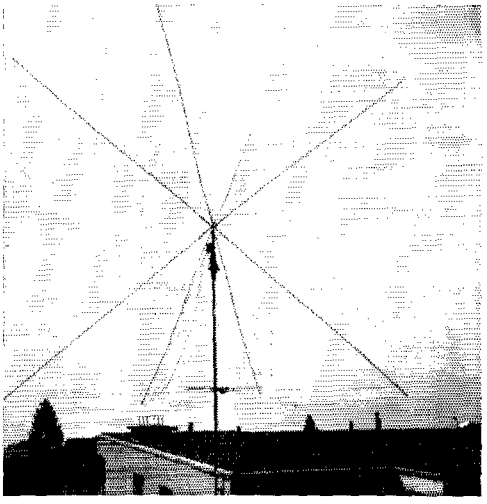

HB9PL's three-band Spider Quad before the reflector stubs at the base of the antenna were adjusted. Rope guys between the front and rear of the antenna help to strengthen the structure.

With the recent move of HB9PL from Basel to Zurich and the possibility of building an "antenna test range" at the new location, it was decided to start with a two-element, three-band cubical quad that offered simplicity in construction and maintenance and the capability to stand up in rough weather. Due to the high torque necessary to rotate a conventional quad (one that has a boom) and the parallel need for a large rotator, the boomless quad or "Spider Quad" was selected.

Admittedly the Spider Quad is an unusual sight; however, the structure that is seen by an outsider's eyes is definitely somewhat smaller than a conventional quad. Besides, we started with the principle of doing the job right and getting away from such compromises as using the same radiator-to-reflector distance for three bands. Since the Spider Quad closely resembles two pyramids with their peaks joining on a horizontal line, the requirement of having a different spacing of the elements for each band is no obstacle.

Because we believe in having the current in the antenna rather than in a large adjusting stub, the reflectors were purposely made somewhat larger (5 percent) than the radiators. As a result, the stubs are about one-third the length usually used.

Although it is rather easy to adjust a gamma match, the weather-exposed compensating capacitors often develop problems after a while. To avoid this, we decided to use coax between the transmitter and a 1:1 broad-band balun, and 70-ohm Twin-Lead between the balun and the driven elements. As shown in Fig. 1, two large, 2-pole mercury relays are used to do the switching between the balun and the three driven elements. The relays were modified to suit our needs and are remotely controlled from the shack; they are housed in a well-ventilated rainproof metal case that sits just below and to one side of the center of the antenna.

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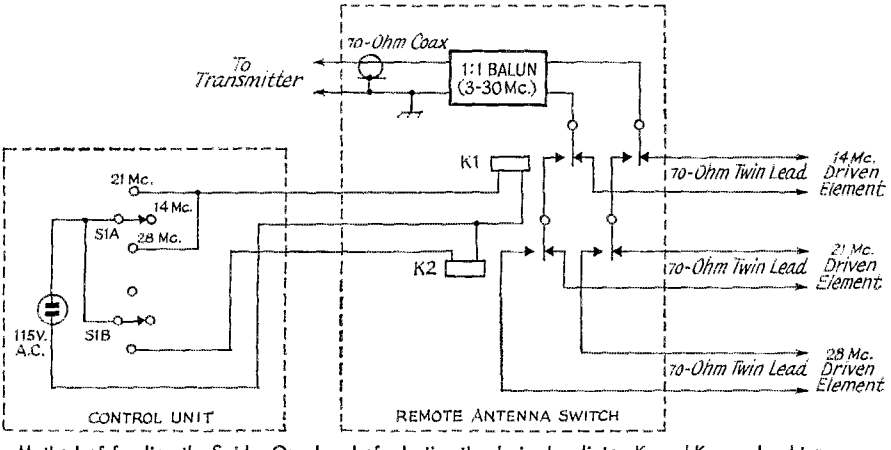


Fig. 1—Method of feeding the Spider Quad and of selecting the desired radiator. K_1 and K_2 are d.p.d.t. mercury relays with 115-v. a.c. coils. S_1 can be either a 2-pole, 3-position rotary or a d.p.d.t. toggle switch with a center-off position.

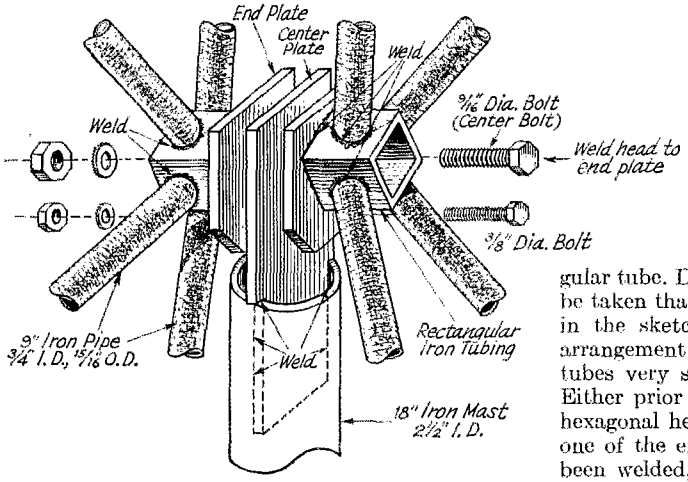


Fig. 2—Sketch showing the heart of the Spider Quad. Once the various pipes, plates and tubes have been welded, they are cleaned and hot-dipped galvanized.

The heart of the quad is shown in Fig. 2. It consists basically of a center plate, which is welded to an iron mast, and two X sections that are bolted to the plate with two nuts and bolts. The use of only two bolts has a particularly great advantage during the installation and maintenance of the antenna. If the center bolt is loosened and the other bolt removed, the whole array can be turned around the horizontal line of forward radiation.

Construction

Details of the central portion of the quad are given in Figs. 2 and 3. The plates, tubes and pipes that form this part of the antenna are made entirely of iron. Construction is started by welding the center plate to an 18-inch length of pipe. Then a 2-inch length of rectangular tubing is welded to each end plate. Next, after eight 9-inch pipes are prepared as shown in the spider leg details, four pipes are welded to each rectangular tube. During this last operation, care must be taken that the pipes are positioned as shown in the sketches. It is advisable to make an arrangement to hold the pipes and rectangular tubes very steady during the welding process. Either prior to the last step or just after, the hexagonal head of the center bolt is welded to one of the end plates. Once all the parts have been welded, they are cleaned and hot-dipped galvanized.[1]

The assembly procedure is started with the insertion of a 13-foot, 9-inch fiber glass rod in each welded pipe. A hole is drilled through the pipe and fiber glass rod at a point about 3 inches from the pipe end that isn't welded. Cadmium-plated hardware is used to hold the rods firmly in place (Fig. 4).

The next step is the wiring of the reflectors on one X section, and the wiring of the driven elements on the other. Note that, as shown in Fig. 5, each driven element and reflector terminates at a small porcelain insulator. A stub is connected to each reflector insulator, and a length of 70-ohm Twin-Lead is attached to each driven-element insulator. The stubs are uncritical in size; they can be made of No. 14 bare copper wires spaced 3 inches apart. To start with, the

[1] The addresses of outfits that do hot-dip galvanizing can be found in the yellow pages of the telephone directory. — *Editor.*

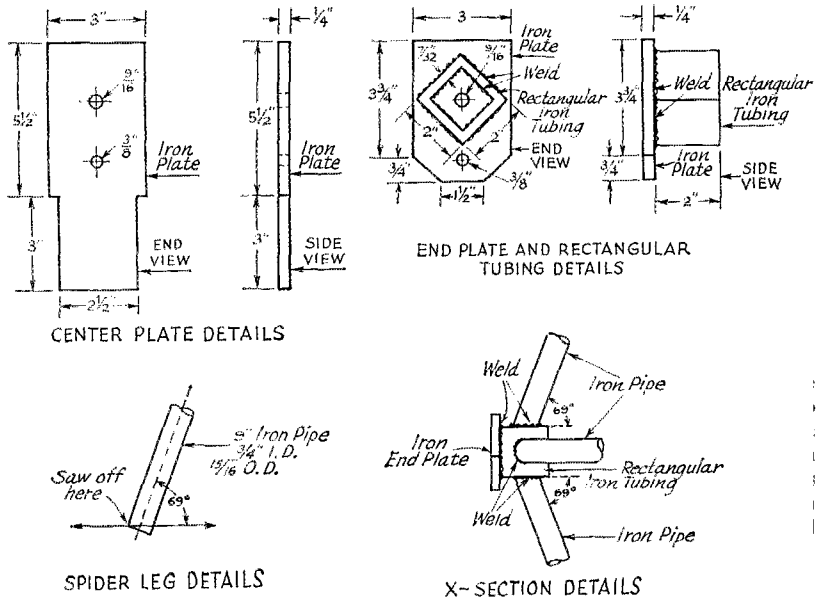


Fig. 3—Details of the various iron pieces that make up the center portion of the quad. As long as the resulting antenna is sturdy, plates and tubing of different sizes than shown can be used.

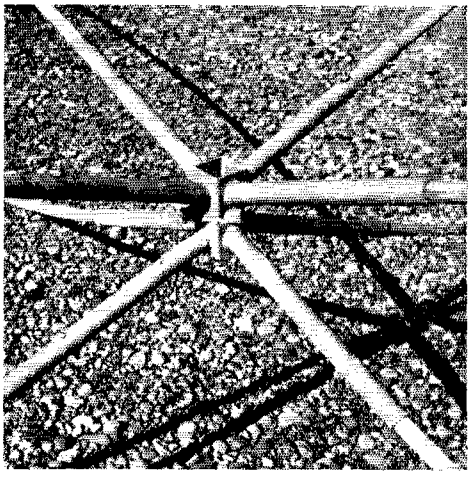


Fig. 4—A closeup of the heart of the antenna with the center plate and mast removed. A single nut and bolt secures each fiber glass rod to one of the eight pipes shown.

14-Mc. stub can be 48 inches, the 21-Mc. stub 36 inches, and the 28-Mc. stub 24 inches. Once the stubs have been adjusted, the excess length can be trimmed off.

Before the wiring is begun, each X section is placed on top of a support that lets the fiber glass rods extend freely and in a straight line toward the ground. Then three short rings of plastic tubing are pushed over each fiber glass rod. The approximate position of each ring (in respect to the center of the X section) and the element lengths are given in Fig. 5. No. 14 or 16 copper wire is used to string the antenna. As shown in Fig. 6, the antenna wire is looped around the rings on each fiber glass rod. After the elements are wired and properly placed, the ends of each loop are soldered together, and the plastic rings are glued to the rods with epoxy cement. This method of securing the elements to the fiber glass rods results in fastening points that have negligible wind resistance and very little area where ice and snow can be deposited.

Once the wiring has been completed, the center bolt is used to provisionally secure the two X sections to the center plate (the other bolt is left out). Since the Spider Quad is a very flexible array, the front and rear X sections of the antenna must be laced together to assure the necessary strength. For this purpose, the quad is raised above ground, and plastic-coated clothes line is connected between the four fastening points of the 20 and 15-meter radiators and those of the corresponding reflectors. As mentioned before, for this work the whole antenna can be rotated around the horizontal line of forward radiation.

Before the final installation of the quad, it is important that both bolts used to fasten the X sections to the center plate be securely tightened.

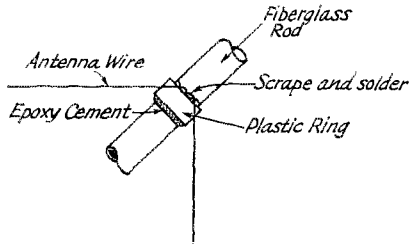
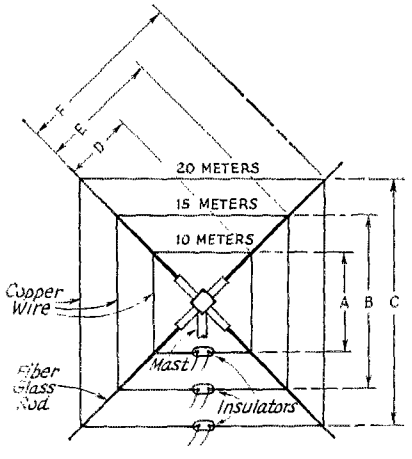


Fig. 6—Method of fastening the antenna wire to the fiber glass rods.



	A	B	C	D	E	F
RAD.	8' 7"	11' 8"	17' 7"	6' 3"	9' 6"	13' 5"
REF.	9' 0"	12' 3"	18' 5"	6' 3"	9' 6"	13' 5"

Fig. 5—Element dimensions and insulator placement for the Spider Quad. The figures in columns D, E and F are only approximate.

Adjustment

The only elements in the Spider Quad that require adjustment are the reflectors. Tuning can be accomplished by feeding power to the antenna and adjusting each reflector stub for minimum field strength as measured on a simple field-strength meter located in back of the antenna. However, this procedure requires three men, if the job is to be done within a reasonable length of time. One man slides a shorting bar up and down the reflector stub, one controls the rig, and one measures the field strength. This was the first method we used; however, after one of the men was burned by r.f. on a reflector, we quickly sought a safer and easier way.

In the procedure arrived at, no transmitter is needed. We made a simple transistor crystal-controlled oscillator that would supply a signal in each band, and hung the unit by two 10-foot copper wires in a tree that was approximately 150 feet from the quad. The supporting wires served as an antenna for the oscillator. Alignment was accomplished by pointing the back of the quad at the distant oscillator and adjusting each reflector stub for a minimum S-meter reading on the station receiver. QST