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The Aussie Parasol Beam

What has twelve corners, three bands, and uses 140 feet of wire? Hint: It's not a quad.

The Australian ham with Novice-license privileges is limited to certain frequencies and very low antenna power—somewhere in the vicinity of 20 Watts PEP. Nevertheless, many of these Novices (not necessarily beginners in electronics) produce outstanding signals all over the globe on the 10- and 15-meter bands. Some of these stations, such as VK7KDR (formerly VK7NDR), VK7NRD, VK3VGW, and others that I have worked over 100 times, have spent many hours hand-honing their antenna systems close to perfection.

During the years 1978 through 1982, when I was on the air every day, there were many VK Novice stations that *consistently* laid down S9+ signals at W6TYH. My curiosity being aroused, I contacted most of these hams and found that they were using the VK2ABQ "parasol" beam antenna described by Fred VK2ABQ in the October, 1973, issue of *Electronics Australia.*

I wish to express my gratitude to the many VK hams who mailed me photocopies of the original article and others that showed more recent modifications of this unusual antenna system.

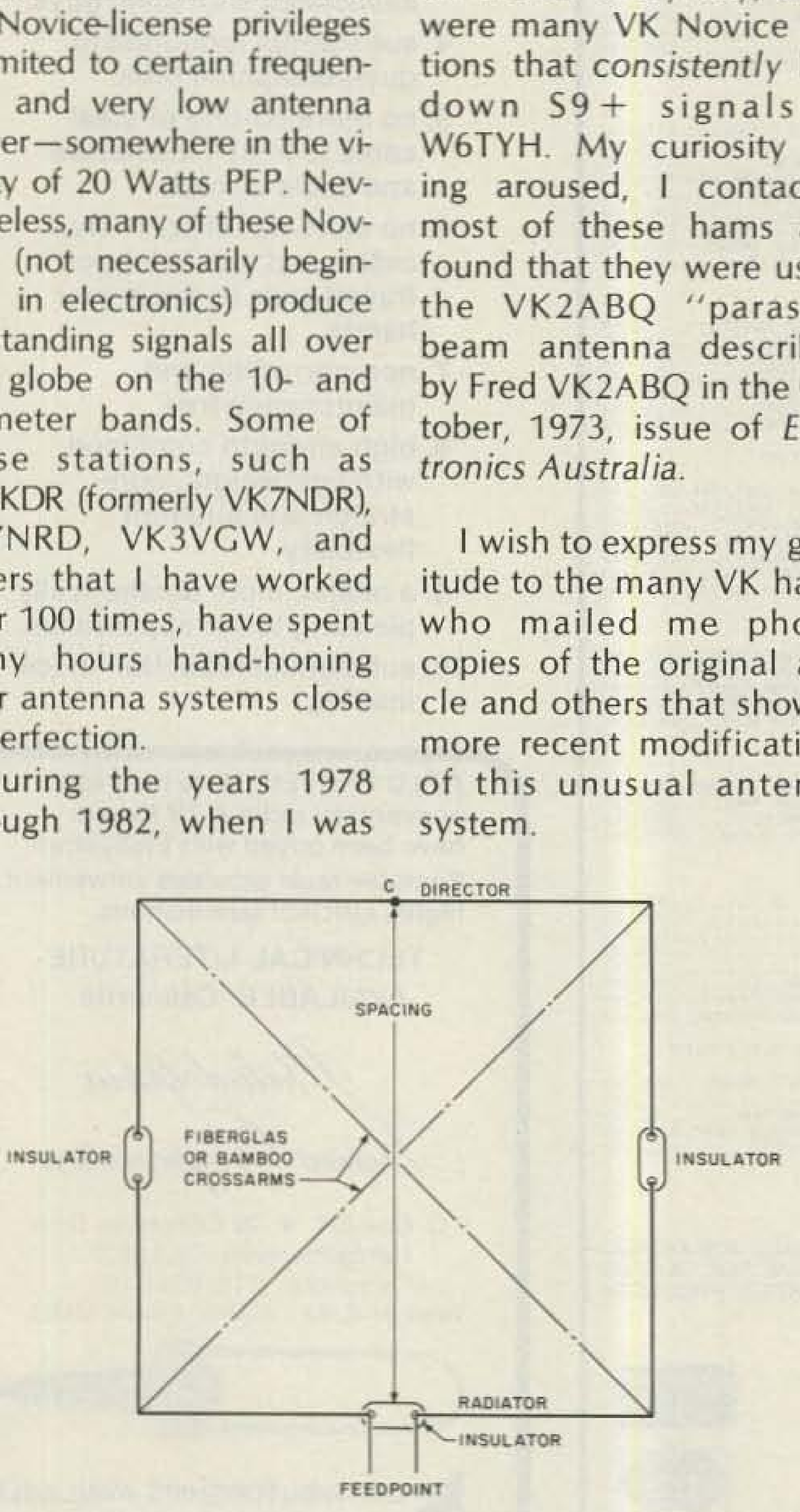

Fig. 1. Australian parasol beam antenna. Construction is similar to one frame of a cubical quad, but plane of loop is parallel to surface of the earth. Array is horizontally polarized.

One of the features of the parasol array that first caught my attention was its small, compact size. I immediately had visions of a 40-meter beam using a parasol-type loop. It is also suitable for the ham who wants a triband antenna system but is cramped for space. Because it is very light, when constructed with ordinary copper-wire conductors and bamboo or fiberglass spreaders, it can be rotated with a heavy-duty TV antenna rotator.

To satisfy my curiosity, I built and tested a dual-band parasol array with loops for the 10- and 15-meter bands only. Although the installation was not permanent, the following data should be of interest to all hams who desire a low-cost, simple, and low-weight antenna system for the three highest HF bands.

Antenna Design

As shown in Fig. 1, the parasol antenna consists basically of two wire conductor elements, each of which has its ends bent inward at right angles to the center section. Since most of the radiated field from an antenna element emanates from the center portion, the radiation efficiency is not noticeably poorer than that of a given element that used inductive traps or other shortening devices. As shown here, the parasol array is a modified 2-element yagi, using a driven element and a parasitic director.

The Australian versions of the array are fed directly at the center(s) of the driven element(s) with 72-Ohm coaxial cable. Although no specific swr figures were included in the photocopy material received from Fred VK2PHQ, I have been informed that the line swr is not greater than 2.5:1 when the three driven-element feedpoints are connected in parallel and fed from a single 72-Ohm line.

Frequency(MHz)	A	B	C	D	E	F
7.15	46' 7"	8' 2"	9' 9"	46' 7"	25'	16' 9"
14.3	23' 5"	4' 1"	4' 10"	23' 5"	12' 6"	8' 4"
21.3	15' 8"	2' 9"	3' 3"	15' 8"	8' 5"	5' 8"
28.6	11' 8"	2'	2' 5"	11' 8"	6' 3"	4' 2"

Table 1. Approximate dimensions of elements and spacing for 40-, 20-, 15-, and 10-meter parasol beam antennas.

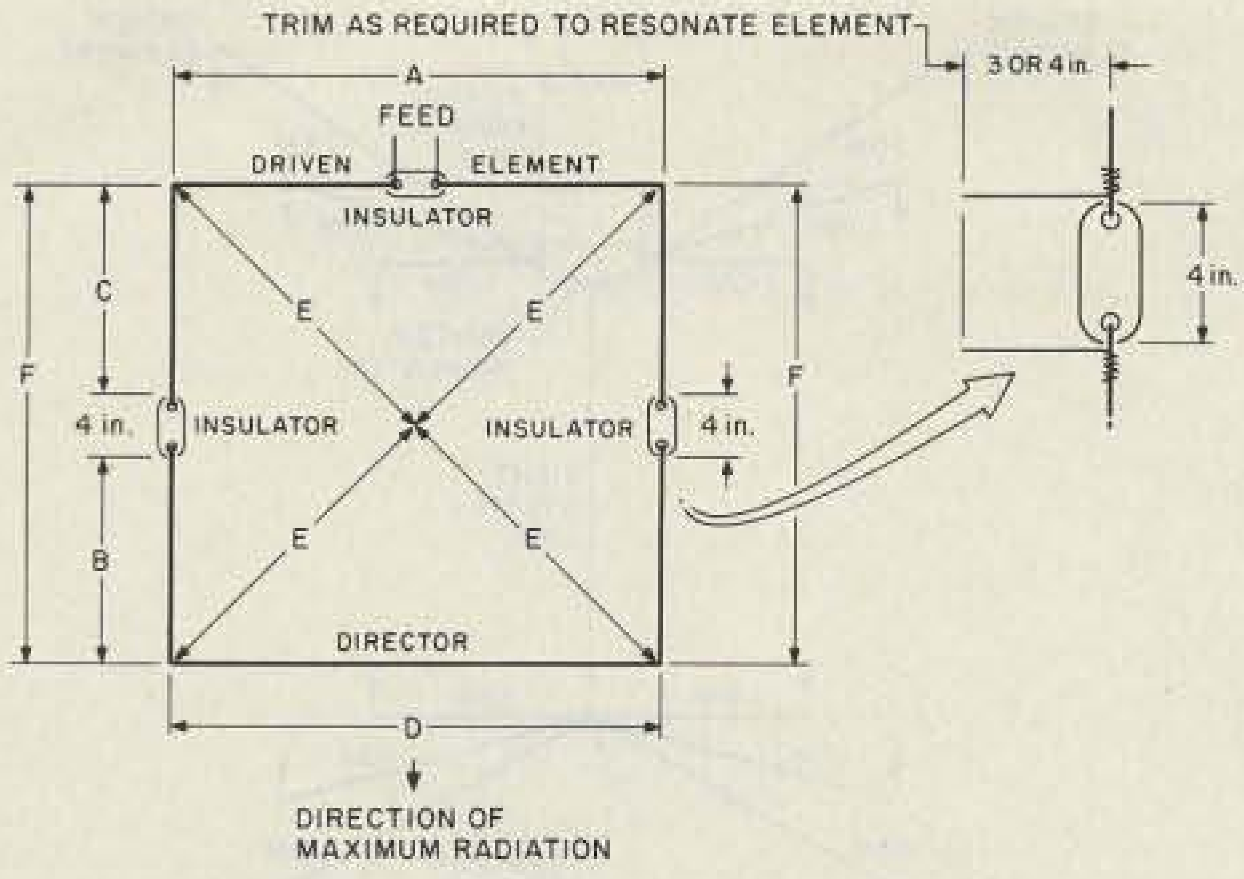

Fig. 2. General arrangement of parasol beam antenna.

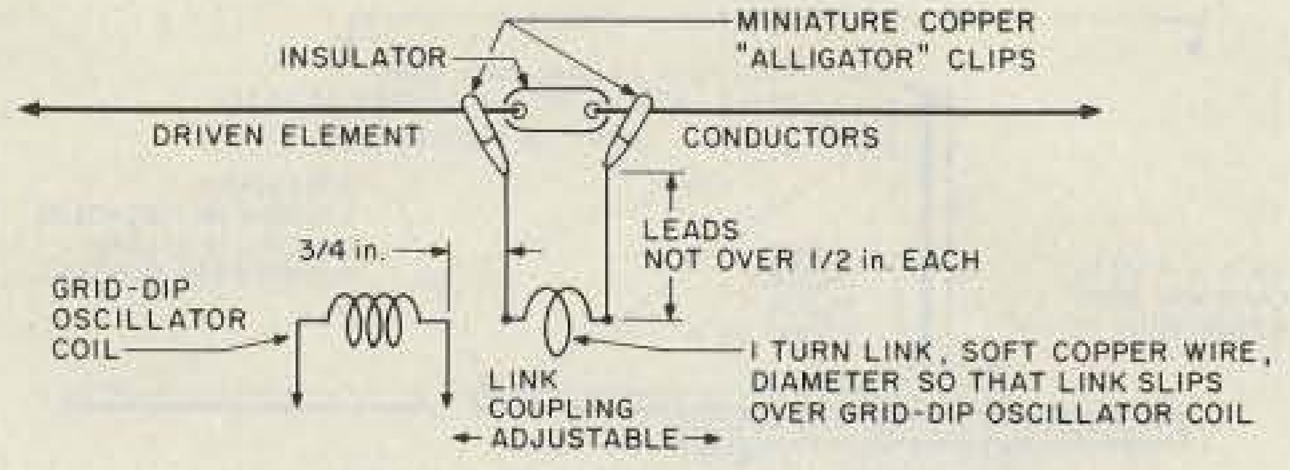

Fig. 3. How the grid-dip oscillator is coupled to the feedpoint of the driven element (see text).

In the W6TYH experimental version, the driven elements were fed by separate gamma-match arrangements, the coaxial line being switched from one to the other by a stepping relay. It should be possible to "match" the 72-Ohm (or 52-Ohm) coaxial line to the three feedpoints at a practical usable swr value by attaching a suitable coaxial line transformer to each feedpoint and connecting them in parallel at the end of the main transmission line.

The length of the folded, or bent, end sections will depend on the spacing between the driven and parasitic elements. In the W6TYH experimental version, the spacing (free space) between the centers of the driven and parasitic elements was made 0.11 wavelengths to keep the overall size as small as possible. Table 1 gives the dimensions of the parasol array for one-, two-, or three-band operation. The element lengths, particularly in the three-band arrangement, are approximate and should be "dipped" and trimmed to resonance as described later.

The approximate dimensions A, B, C, D, and E of Fig. 2 can be calculated by the following formulas. Assuming insulators I1 and I2 are 4 inches long, with F being the frequency in MHz and A to E dimensions are in feet, A = 335/F, B = 58.3/F, C = 69.7/F, D = 335/F, and E = 178.75/F.

It must be emphasized that the above dimensions are approximate but will be close to the actual operating values. The ends of the element conductors can be made about 3 or 4 inches longer than the calculated values, as shown at B in Fig. 2, and then trimmed to resonate the element at its proper frequency. In most cases, the director element will function satisfactorily when cut to the calculated value or about 5 percent shorter than the driven-element length.

Practical Construction

To start, you will need one spider or X mount, such as those used in the construction of the cubical quad antenna. You also will need four crossarm (spreader) sections, as shown. Each crossarm should be at least 14 feet long if a triband 20-15-10-meter array is to be constructed. The crossarm drilling data can be found as dimension E in Table 1. All of the wire elements should be strung on the frame before attempting any resonance adjustments.

With the array at least 8 or 10 feet above the ground, start with the 10-meter driven element and resonate it as described in the next section. Next, resonate the 15-meter driven element and recheck the resonant frequency of the 10-meter driven element. Third, resonate the 20-meter driven element and recheck the resonant frequencies of both the 15- and 10-meter elements. In the prototype array at W6TYH, the interaction between the three driven elements was negligible as far as the dip meter indication was concerned. However, when each driven element was being adjusted for lowest reflected power at its feedpoint, the swr reading changed when the matching adjustments of the other driven elements were moved.

It is likely that the greatest interaction will take place when all three feedpoints are connected in parallel and fed by a single coaxial transmission line. If the line swr is not higher than 2.5:1 on the element with the highest swr, usually 20 meters, the performance of the array will not have deteriorated to any great extent and an antenna tuner can be used at the transmitter end to present a 50-Ohm-resistance load to the transmitter output terminal.

Resonance Adjustments

As in any other parasitic array, the parasol antenna will give optimum performance only if the driven and parasitic elements are resonant at their proper frequencies. The length dimensions given for the parasitic director elements are about 5 percent shorter than those of the driven element. In the prototype array, the parasitic directors were calculated and cut according to the formula. The directors performed satisfactorily without further adjustment. The driven-element lengths required adjustment, however, as outlined below.

The preliminary driven-element adjustments are most easily made with a grid-dip oscillator and a calibrated receiver. First, make a 1- or 2-turn link coil from no. 14 soft-copper wire and with a diameter small enough to fit snugly over the grid-dip oscillator coil. As shown in Fig. 3, the link-coil ends are fitted with small copper alligator clips. Connect the alligator clips to the center ends of the driven-element conductors, as shown. Slip the

Parts List

140 feet, no. 12 copper wire, plastic covered household type	@ 10¢ per ft.	$14.00
4 bamboo spreaders	@ 50¢ ea.	2.00
1 marine plywood, 3/8" × 18" × 18"	@ $2.00	2.00
4 carriage bolts, 4-1/2" × 1/4"	@ 30¢ ea.	1.20
4 carriage bolts, 2-1/2" × 1/4"	@ 25¢ ea.	1.00
4 U-bolts, 1-1/4"	@ 75¢ ea.	3.00
Miscellaneous (alligator clips, etc.)		2.00
		$25.20

Note: 52- or 72-Ohm transmission line and insulators not included in above total.

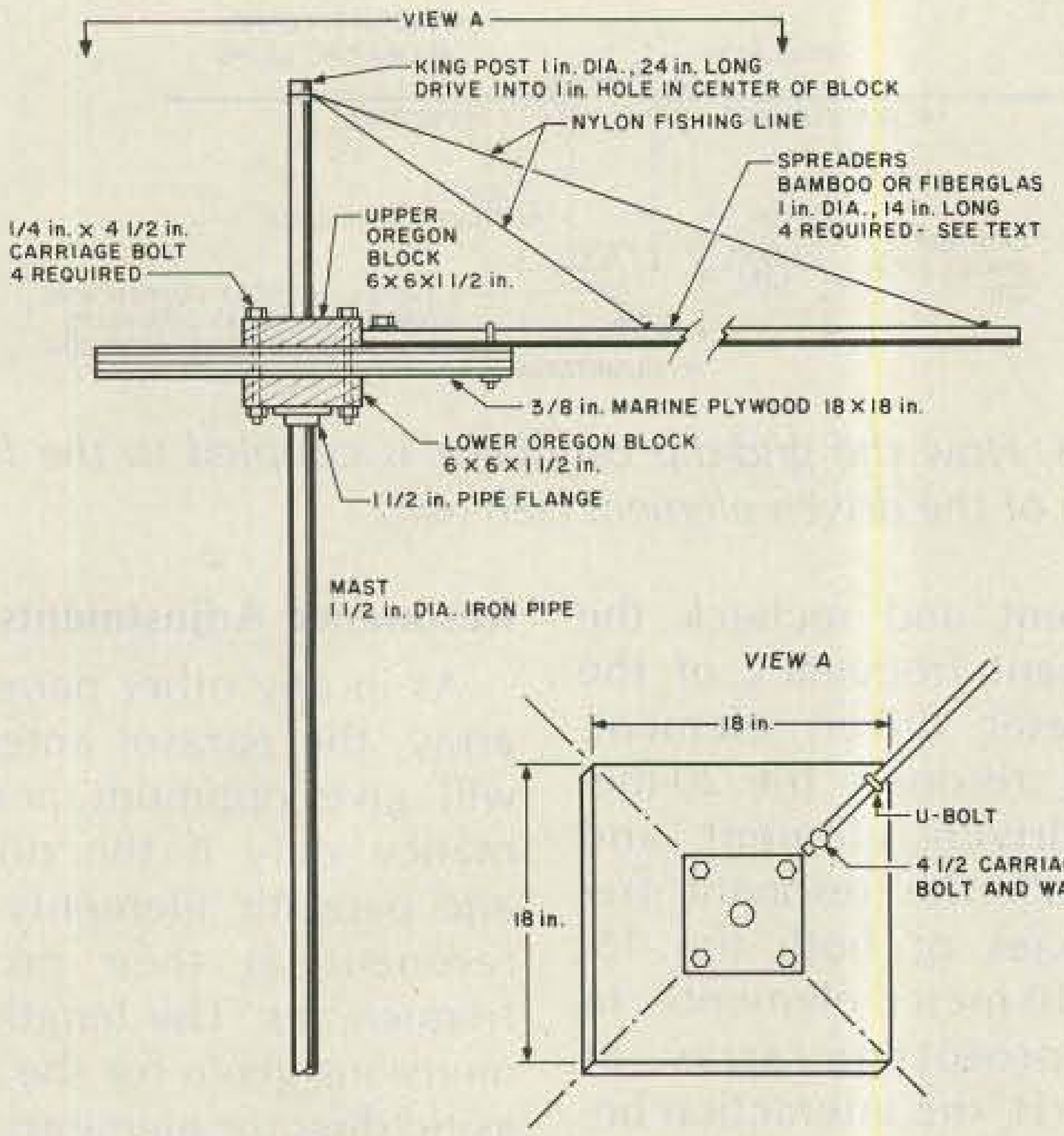

Fig. 4. Array assembly, parasol antenna.

link coil over the grid-dip coil form, and rotate the grid-dip oscillator dial until a deep null or "dip" is indicated.

With the calibrated receiver, check the grid-dip oscillator at the point where the null occurs. During this first check, the resonant frequency of the driven element is almost certain to be very close to, or outside, the lower frequency limits of the amateur band. Clip off half an inch or so of the excess wire at the support insulators and repeat the process. Be sure that you check the grip-dip oscillator frequency *with the calibrated receiver* each time that a dip is indicated. *Do not* depend on the calibrations of the grid-dip oscillator dial as the oscillator will be pulled off calibration by absorption of the rf energy by the driven element at its point of resonance. This pulling effect can be reduced by reducing the coupling between the grid-dip oscillator and the link coil to the point

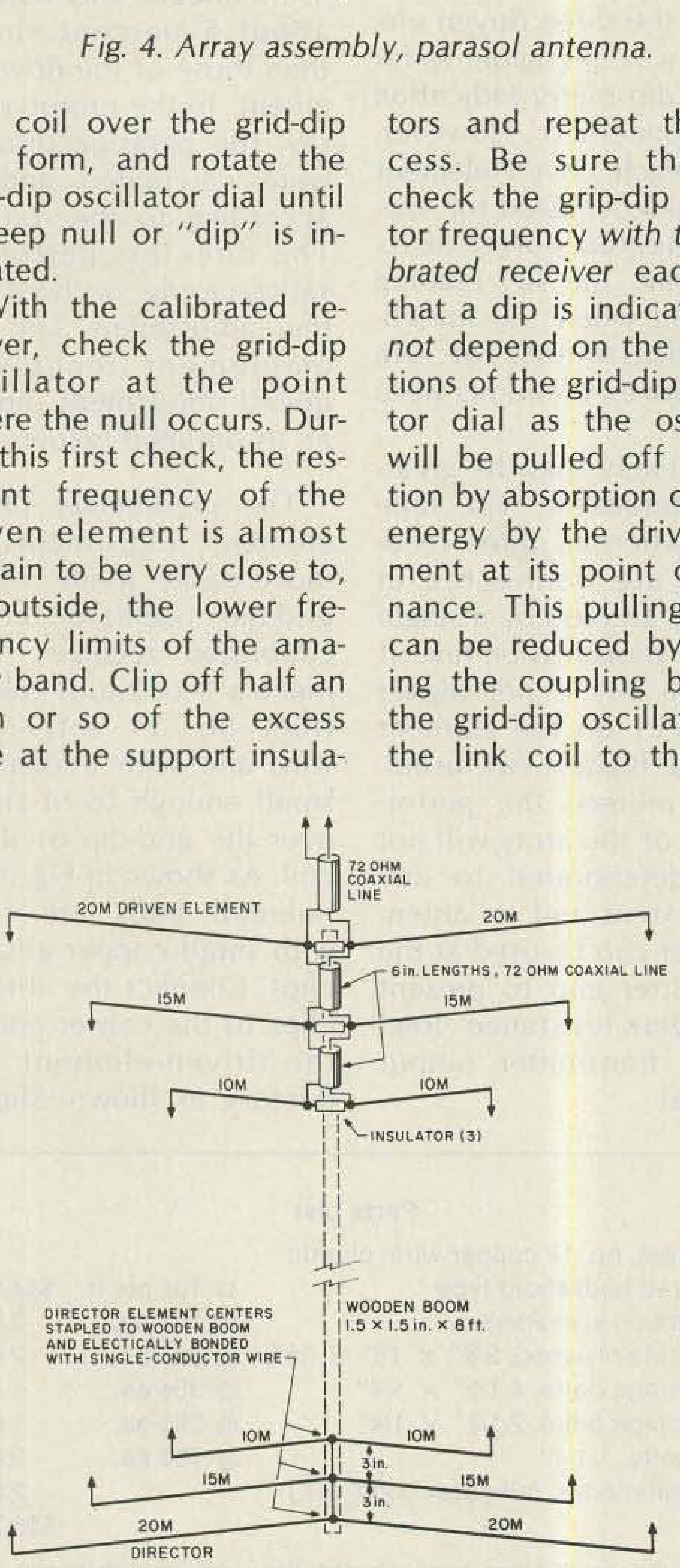

Fig. 6. Modified version of Australian parasol antenna (said to improve front-to-back ratio).

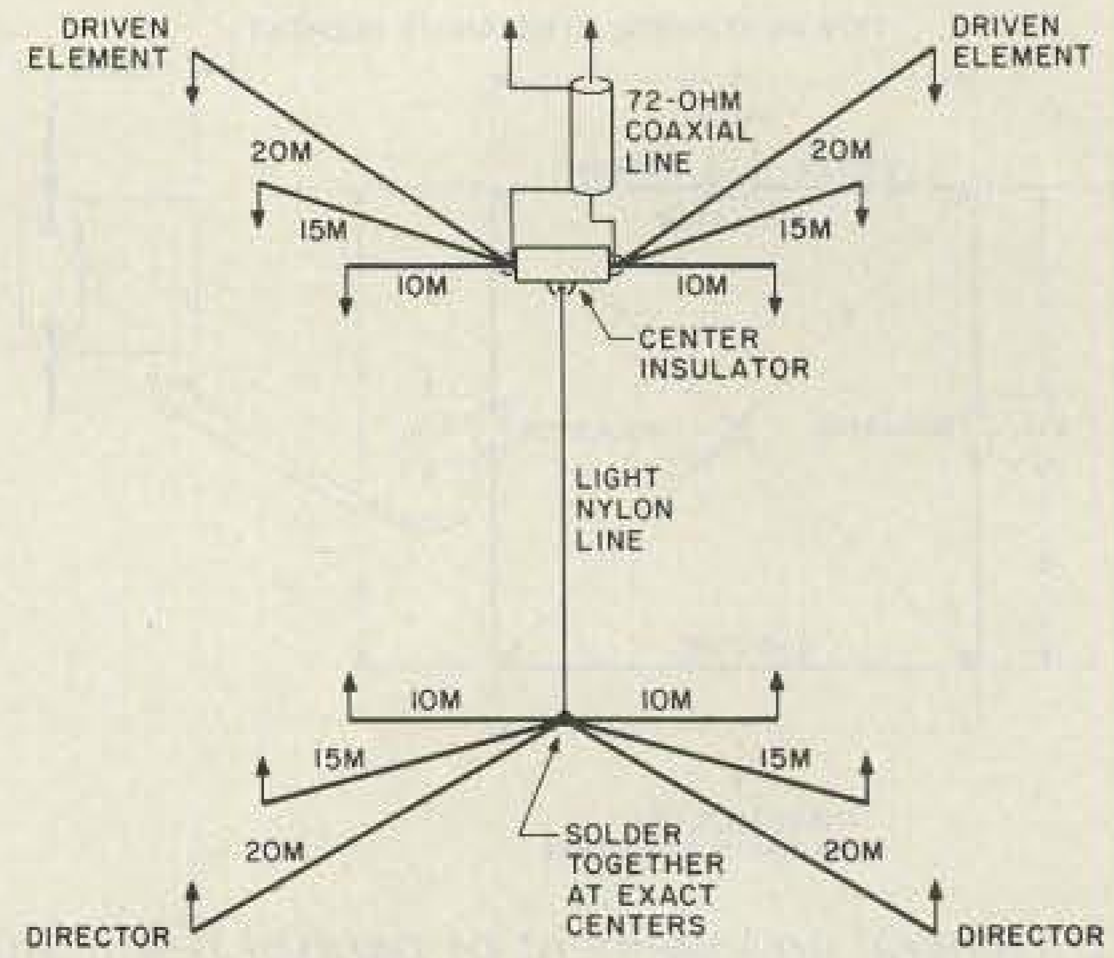

Fig. 5. Original Australian feed arrangement.

where only a very small null is indicated.

Continue to trim each end of the driven element and check the grid-dip oscillator frequency at the null until the element is resonant at a frequency about 50 kHz lower than the desired operating frequency. The driven-element resonant frequency can then be "worked in," or "fine tuned," to exact resonance at the operating frequency during the matching adjustments.

During the adjustment of the driven element for resonance, it is possible that the grid-dip oscillator may indicate two nulls—one deeper than the other. The major null will indicate the frequency at which the driven element is resonant. The minor null will be somewhat higher in frequency and will be the resonant frequency of the director. With very close coupling between the pickup loop and the grid-dip oscillator coil, the minor null should be pronounced. When the coupling between the link coil and the oscillator coil is reduced, the minor null may not be apparent. The minor null should occur at a frequency about 5 percent higher than that of the driven element.

Mounting the Array

In the original Aussie version of the array, the spreaders were mounted on an 18" × 18" × 3/8" piece of "bondwood" (plywood) as shown in Fig. 4. If the plywood mount is used, it should be good quality *marine plywood*. The center of the board was reinforced by a pair of 6" × 6" × 1-1/2" "Oregon" blocks. The upper plate has a 1-inch hole at the center for the 1-inch-diameter dowel kingpost. The kingpost is about 24 inches high and is sanded to fit tightly when driven into the center hole of the upper block. In the VK version, the spreaders were made from 1-inch hardwood dowels. Most American hams will prefer bamboo or fiberglass spreaders. Each spreader is supported at two points, as shown, by heavy-duty nylon fishing line; hence the name, "parasol array."

Feed System

The original Australian feed arrangement for the three driven elements is shown in Fig. 5. Here, the three driven elements use a common center insulator with the three feedpoints connected in parallel and fed with a single coaxial transmission line. A nylon tie cord is connected between the driven-element center insulator and the center point on the parasitic director (or reflector, as the case may be) and is drawn taut. The center points of the three directors (reflectors) are electrically bonded together.

Another VK arrangement is shown in Fig. 6. Here, a light wooden boom, 1-1/2" × 1-1/2" × 96", is used to support the driven-element center insulators. The three feedpoints are connected together with short lengths of 72-Ohm coaxial cable. The center points of the director (reflector) are attached to the wooden boom, as shown, and connected together electrically with a single copper conductor.

Antenna Performance

The W6TYH parasol array was constructed to satisfy my own curiosity, more or less. Although the antenna was a jerry-built affair mechanically and was suspended by a rope and pulley attached to an overhanging tree limb, it was electrically correct. On the 15- and 10-meter bands its performance was compared with that of a "standard" 2-element yagi similar to the one I described in "Rotary Beam for 10 or 15: the LB-2" (*73* for May, 1980), and in most cases there was little difference in the strength of the distant signal. The experimental model appeared to have about 5 dB forward gain and about 15 dB front-to-back ratio—about the same as that of the 2-element yagi used for comparison. The Australian hams rate this antenna at 5 dB forward gain, 18 dB front-to-back ratio, and 37 dB side rejection when used on the 15-meter band.

At any rate, the parasol antenna is probably the least expensive tribander. It should be possible to build it for not over twenty to thirty dollars. It can be rotated easily with a TV antenna rotator. ■

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