K4JZB reports on his "V" beam experiments and shows us how to roll our own.

Development and Construction of "V" Beam Antennas

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The antennas to be described here are often mistaken to be log-periodic antennas. They are not. They are "V" antennas, ½-wavelength "V's" both parasitic and driven. I have been using them for over 10 years. I also have a three-element tribander, plus four-element monobanders for 14 and 21 MHz.

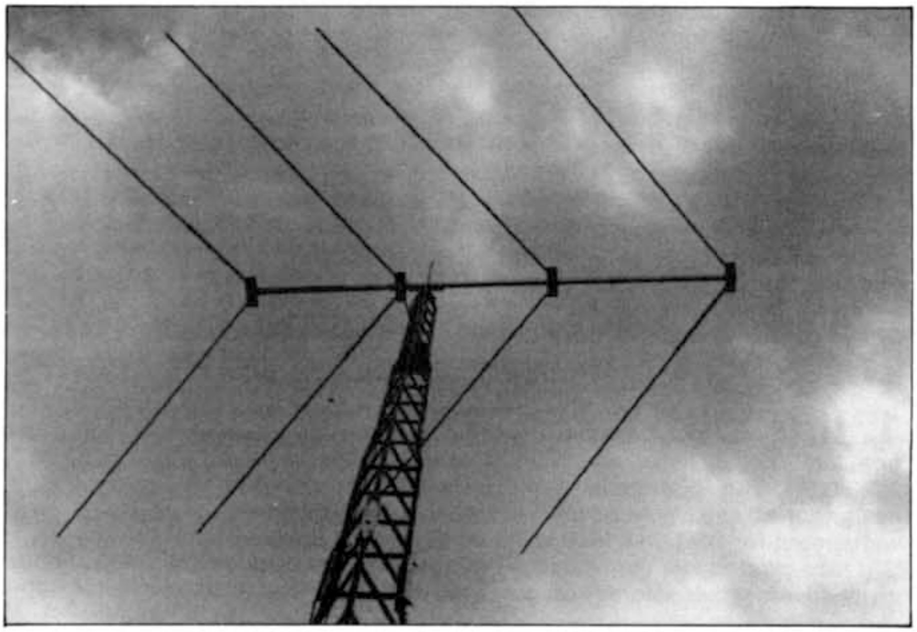
I started off first by bending the antenna elements forward 40° to determine if the reported 3 to 5 dB additional gain actually could be realized. The first antenna was a two-element antenna with both elements of equal length (fig. 1). This proved two things: (1) that front-to-back ratio could be obtained, and (2) that good forward gain could be achieved. They both were justified in this design.

Next I lengthened one element by 5% (fig. 2). This proved to be very beneficial and will out-perform three-element Yagi beams. These antennas were used on 21 MHz s.s.b. and were evaluated on short haul (1,000 miles), medium haul (3,000 miles), and long haul (10,000 miles plus). They were tested at heights from 5 to 50 feet and with output powers from 60 to 600 watts p.e.p.

I then built a three-element broadband antenna for 28 MHz (fig. 3). It was installed 24 feet up and aimed due west. With only 60 watts p.e.p. output, I was able to work VK's when they were only hearing west coast stations.

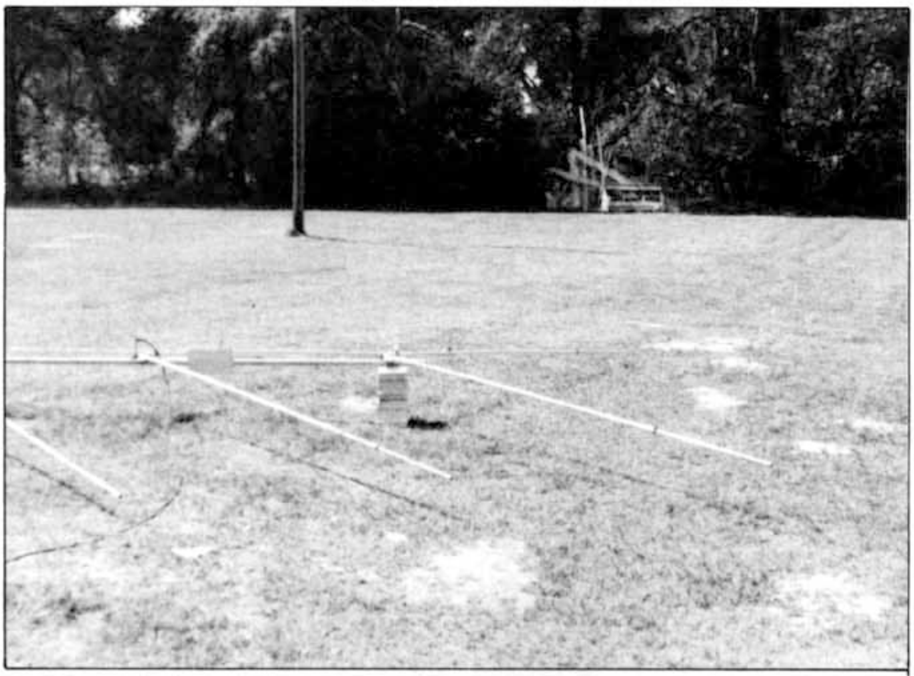
On January 27, 1982 I got caught with my antennas down when Martha, 3CØAC, came on. With the aid of my wife, the antenna shown in fig. 2 was hauled up on the roof and installed on the tower 24 feet up. I pointed it toward Africa and got 3CØAC on the first call through a terrific pile-up. This all took place in a half-hour period.

The next antenna to be described in this series is a four-element one. It has three driven elements plus a reflector on 21 MHz. It has been up since February at a height of 50 feet and has done a terrific job. I have had many inquiries about it from stations I've worked all over the



The 4-element version with 4 foot spacing between DE1, DE2, and DE3, 12 dB gain.

The 10 meter antenna ready to be put up on the tower.



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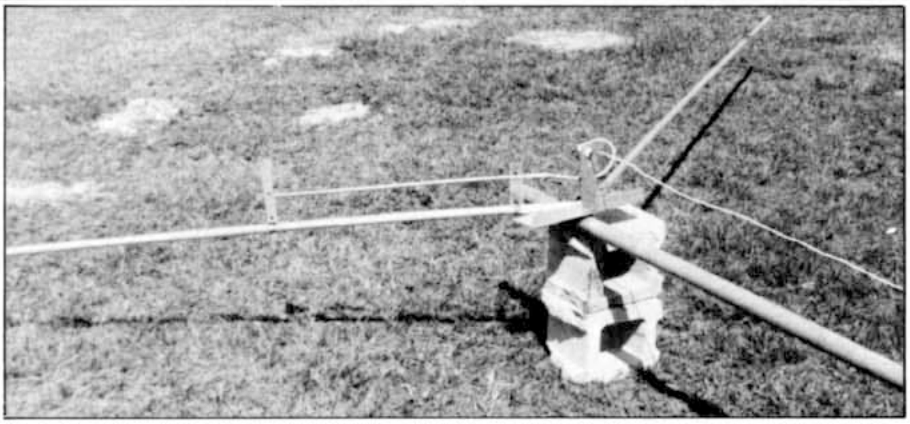


Note that the inner part of RG-8U is slid into the ⅜ inch Gamma rod to adjust s.w.r.

BAND	REFL	DE_3	DE_2	DE_1	DIR
20	424″	404″	400″	346″	376″
15	284″	270″	267″	264″	252″
10	210″	200″	196″	192″	182″

Table I– Element lengths.

ELEMENT SPACING	REFL TO DE_3	DE_3 TO DE_2	DE_2 TO DE_1	DE_1 TO DIR
20	8′	2′	2′	8′
15	5½′	2′	2′	5½′
10	4′	2′	2′	4′

Table II– Element spacing.

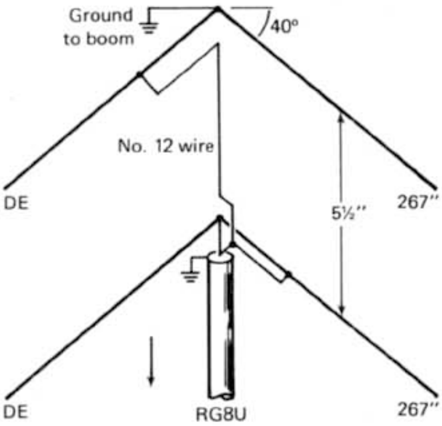


Fig. 1– This was constructed to test the theory of "V" beam operation. It proved forward gain and front-to-back ratio.

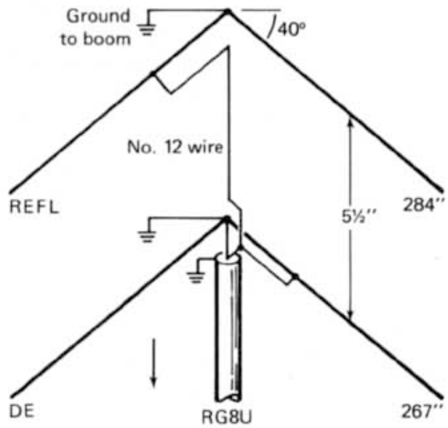


Fig. 2– This is a very good beam with 6.64 dBi gain. The front-to-back ratio is about 25 dB on 21 MHz.

world. I get reports of S-9 plus 10-20, to even pegging the "S" meter, to being the only "W" coming through.

When the elements are formed into a "V" there are two problems to be solved: the element mounting plates and the joining of the two halves of the tubing. The photographs show the method used to mount the elements to the boom. The automotive muffler clamps used to mount the plates to the boom are painted to retard rust, so it is necessary to use an aluminum strap to ground the plates to the boom.

I have never been able to bend tubing with ordinary tools found in a home workshop, so I just put the tubing in a vise and flatten the center. This also makes it very easy to drill and fasten at the center to the bracket. The elements can be made from almost any size aluminum tubing available at a local hardware store. They all seem to stock from ½ to 1¼ inch sizes in lengths of 6 and 8 feet and are of the thickness necessary for telescoping.

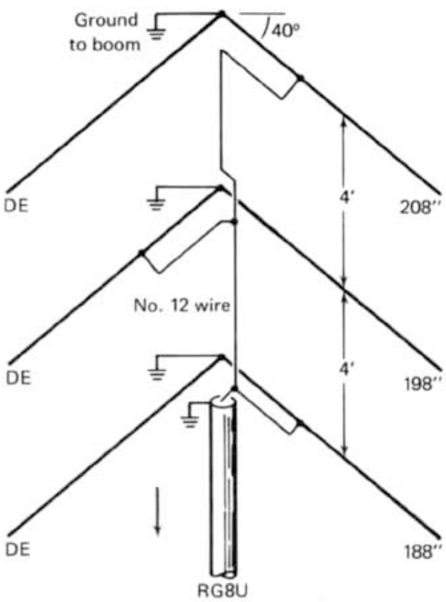


Fig. 3– The design shown in this diagram was used on 10 meters with 7.92 dB over the entire phone band.

BAND	GAMMA LENGTH	SPACING TO ELEMENT	CAPACITY
20	40–48″	6″	140pF
15	30–36″	4″	70pF
10	20–24″	4″	45pF

Table III– Dimensions of Gamma matches.

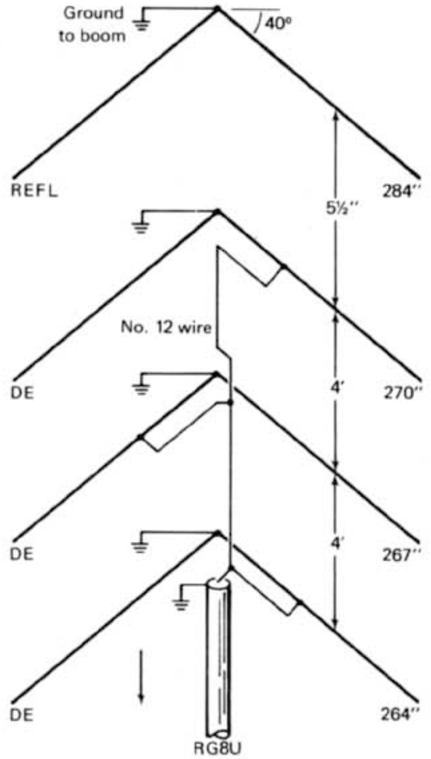


Fig. 4– This configuration is in use at present at K4JZB. It has a gain of 12 dB.

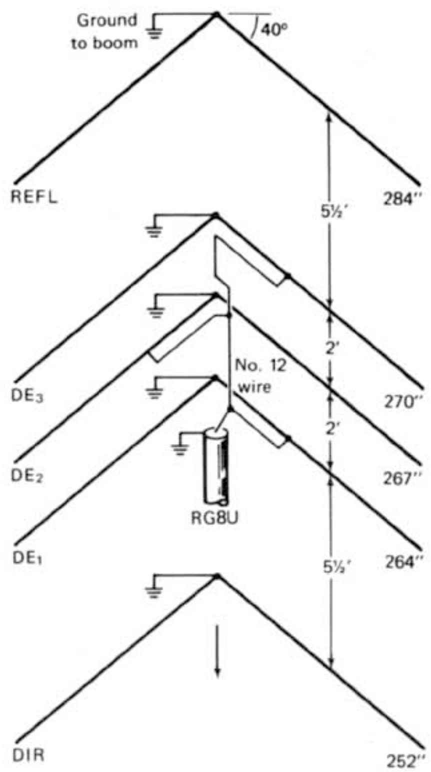
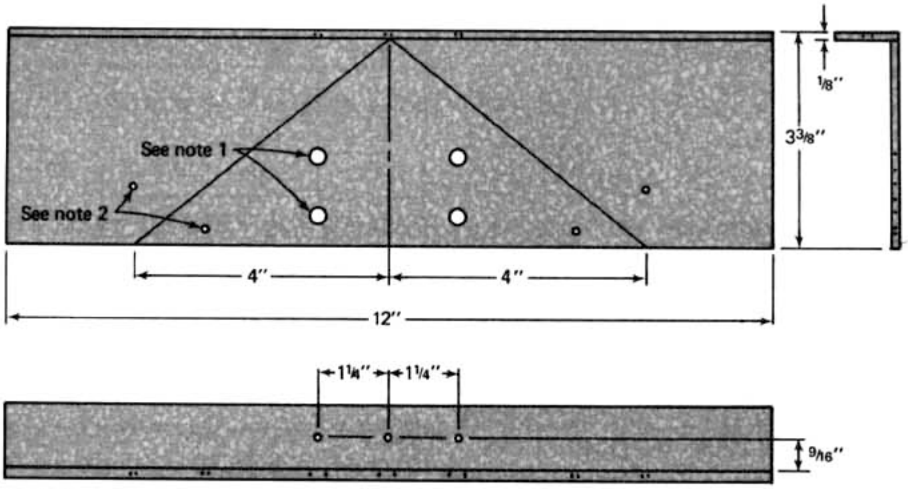


Fig. 5– Revised spacing results in 16 dB gain and sharper horizontal beam width.



NOTES:
1. These holes depend on boom size and size of clamps.
2. These holes, diameter and spacing depend on element size and clamps.

Fig. 6– Element-to-boom plate for 10 and 15 meters. Use two angle plates back to back as per the photos. For 20 meters use the stronger method as per the photos.

I have used 1 to ⅞ to ¾ inch tubing for 10 and 15 meter beams, as well as ⅞ to ¾ to ⅝ inch, and also ¾ to ⅝ to ½ inch, all with equal success. For 20 meter beams one or two sizes larger are recommended. To fasten one size into another, I use stainless steel automotive hose clamps and slit the tubing end 1 inch long with two cuts at 90° to each other.

The booms used here are aluminum tubing 1½ and 1⅝ inches in diameter. I picked up the tubing as surplus after World War II, and they have been used and reused since that time. For the shorter booms TV masting can be used very effectively.

One nice thing about these antennas is that they take a shorter boom. The antennas shown in figs. 3 and 4 were also used with spacing between driven elements (DE) of 2 feet as shown in fig. 5. These would have a boom length in fig. 3 of 4 feet and in fig. 4 of 9½ feet. This would make a very compact beam for 10 and 15 meters.

I could not ascertain any great difference between the 2 foot or 4 foot spacing. The main thing to watch for is to have each adjoining element out of phase to the other. This is necessary to have the gain additive. I recommend the 4 foot reflector spacing for 10 meters, 5½ foot spacing for 15 meters, and 8 foot spacing for 20 meters.

The element mounting plates (use two together) are used and inverted as per the photographs. The feedline between elements is No. 12 copper wire. This is preferred over coax cable. The only precaution is to be sure that the center of each element is well grounded to the boom.

The antenna in fig. 6 has an added di-

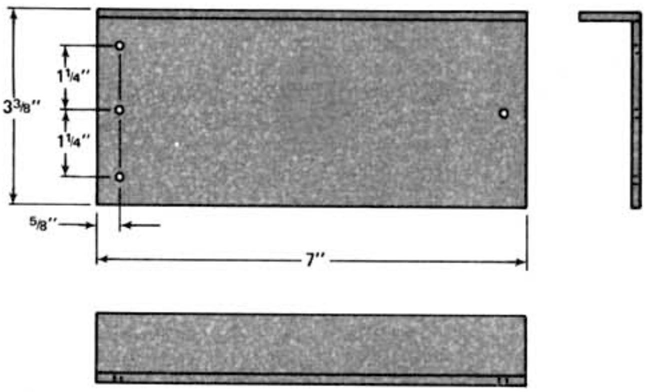


Fig. 7– Use the same angle plate for feedline support. It mounts at a right angle to the element plate.

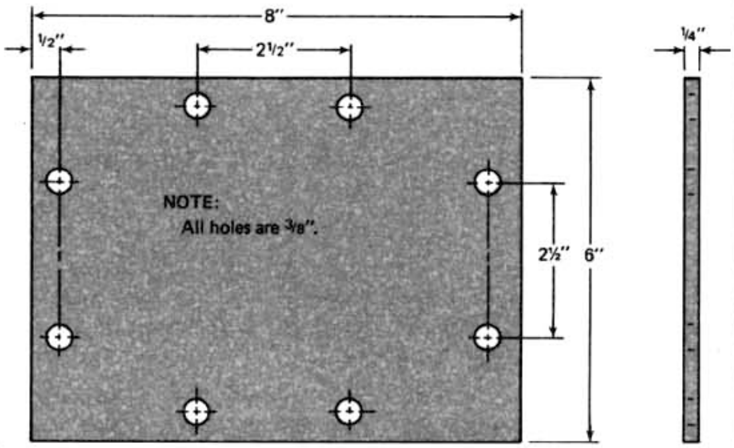
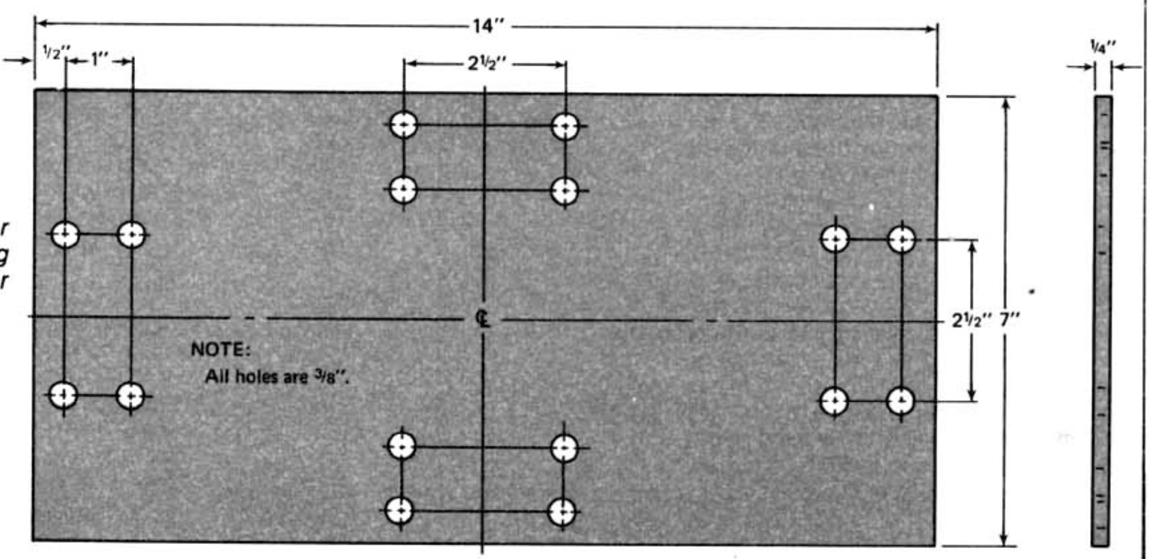
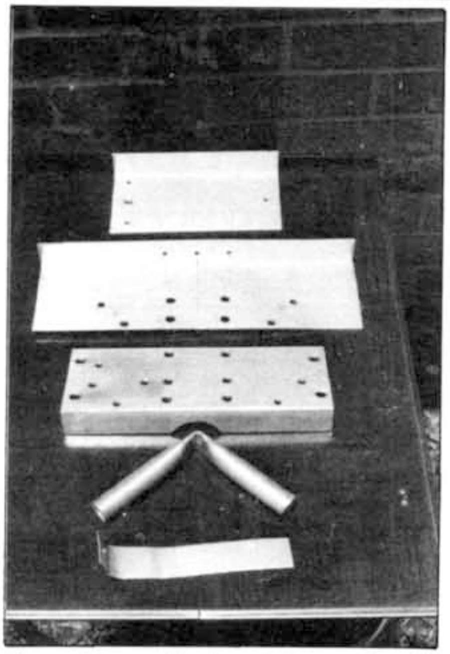


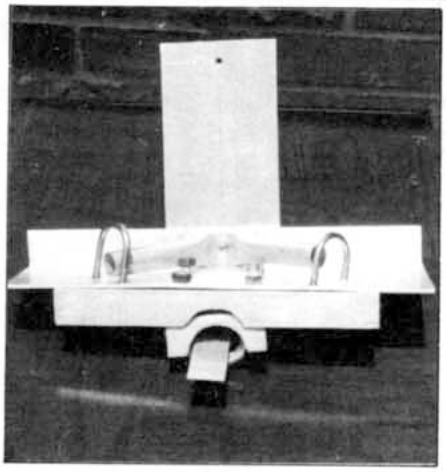
Fig. 8– The 10 and 15 meter boom-to-mast mounting plate for 2 inch boom diameter and 2 inch mast diameter.

Fig. 9– The 20 meter boom-to-mast mounting plate for 2 inch diameter boom and mast.

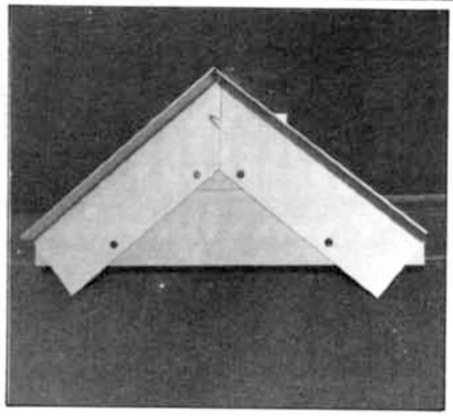




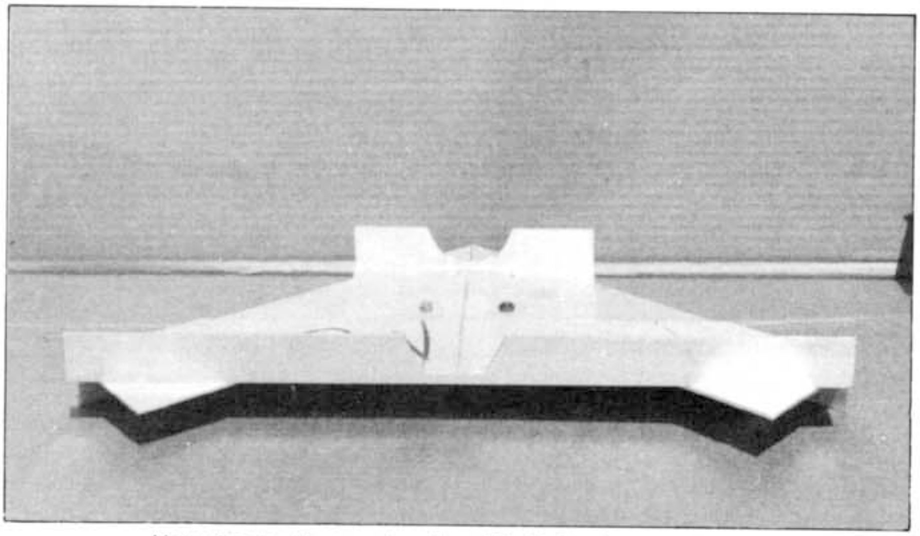
Element mounting brackets used on 10 and 15 meter beams.



Here the bracket is assembled and ready to go on a boom.



Brackets used on 20 meters are much heavier due to larger and longer elements. They are each 12 inches long.



Note the double construction. This is the bottom view.

rector which sharpens the beam width and greatly increases the gain. With the antenna pointed at VK land, the ZL stations cannot be heard. The direction must be changed 8° south of west to bring them in, and the VK's are lost at that time.

The mail I received from my first article in the January 1983 issue of *CQ* indicates that more information is needed about the construction and adjustment of Gamma matches. I trust the following information will be helpful.

I have used many different Gamma matches over the years. The one used now is made from ⅜ inch aluminum tubing, spaced 4 inches from element, shorted at far end to the driven element. Into the center is slid RG-8U coax which has the outer covering and shield braid removed. This makes a fine capacitor which seems to hold up very well in all climates.

To adjust the Gamma, I vary the shorting bar first to get the lowest s.w.r., and then vary the coax capacitor to lower the s.w.r. even further. When it has reached 1.5 to 1 or lower, I stop, as more time spent here does not seem to pay. When multiple driven elements are used, Gamma matches must be adjusted as a group—i.e., each one must be the same.

Each antenna has a critical angle of radiation, and at that angle the gain is maximum. At other angles the antenna will not exhibit its full gain.

I have found from use that multiple driven elements have a lower angle of radiation than parasitic beams. This is evident in the "W8JK" and "ZL Special" beams. The driven beams show their higher gain over longer paths. Also, the driven beams work more effectively at low heights. I have never found a Yagi that would work very well at heights of less than 40 feet, while the driven "V" antennas have proved to work well at 12 and 14 feet above ground. This is a bonus for those who do not have a 50 to 70 foot tower, as a lower-priced structure will work.

From on-the-air use I have concluded that tilting the elements forward 40° results in a 1 db additional gain per element. Adding more driven elements adds 2.64 db per element. I have figured the gain of each antenna many times over a long period of time and at various distances, and I have included this information in the drawings. CQ