• *Beginner and Novice*

A 15-Meter Beam "On A Budget"

BY CHUCK DAILY,* WN7PDT

THERE ARE many plans available for constructing beam antennas which use aluminum tubing for the elements. However, in many areas of the country aluminum tubing is difficult to find. Also, aluminum stock can be quite expensive. For the Novice who has just tied up his life savings in a transmitter and receiver, the cost of a commercial beam can be prohibitive. Necessity breeds strange inventions, and in my case it enabled me to put together a high-performance, three-element beam at a fraction of the cost of a commercial unit.

Beating the High Prices

The key to keeping the cost down is the use of electrician's thin-wall tubing and pressure connectors. Thin-wall tubing comes in 10-foot lengths, which of course are too short for use as elements. In order to join the tubing sections, to obtain the required lengths, pressure connectors are used. A pressure connector is a coupling unit that fits over the tubing ends and can be tightened to make a solid connection between the two lengths of pipe. Thin-wall tubing and pressure connectors can be purchased from Sears, either at their stores or through the mail-order catalog.[1]

Constructional Details

Information is given here for the assembly of either a two- or three-element beam. I originally built a two-element version using 1 1/4-inch thin-wall tubing for the boom (Fig. 2). Then I found that Sears stocks 21-foot lengths of tubing that are used as the top rail in their chain-link fence. I couldn't pass up the chance to try a three-element beam, which is now what's in use at WN7PDT.

The supports for the elements are made from 3/4-inch plywood which is treated with an outdoor preservative to protect it from the weather. Details for the supports are given in Fig. 2. The

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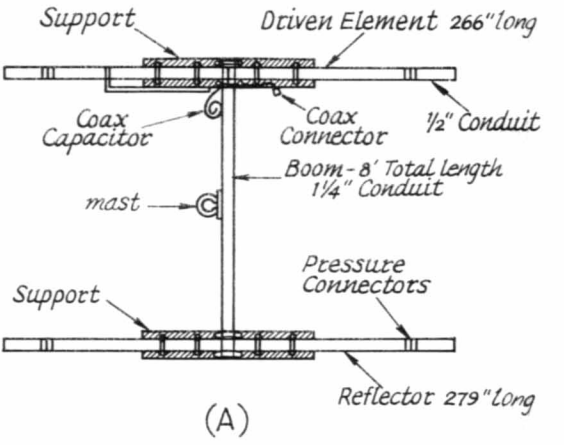
[1]Also, nearly all cities or towns have nearby electrical parts distributors. – *Editor*

Here's a Novice who designed his own three-element beam. This is a high-performance Yagi, and what's more important, it can be built for "peanuts".



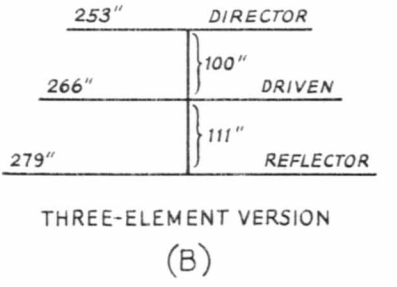
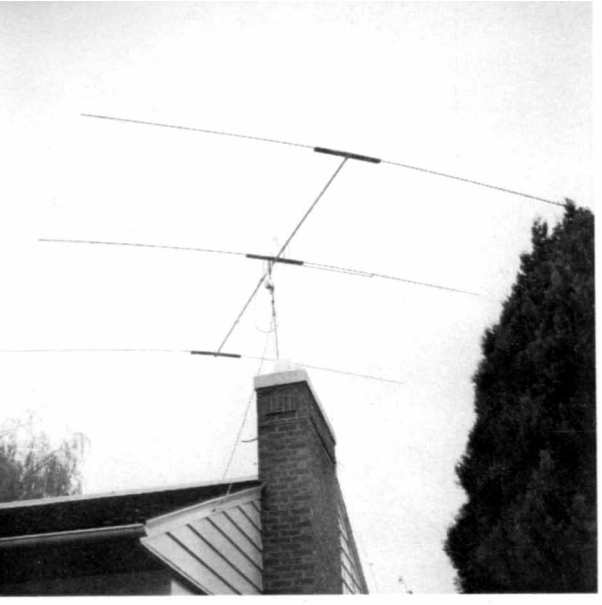


Fig. 1 — At A are the details for the original two-element beam. At B, the information for three elements.



The completed antenna has been mounted on the chimney, using TV hardware. While not clearly visible, guys are used to secure the rotor and mast.

center of the support should be chiseled out, 1 X 2 inches, and to a depth of 1/4 inch, so that the center pressure connector can be recessed. Without this step the U-bolts pull the elements down, causing too much stress at the center connection. Four small U-bolts and two large ones are used to connect the element to the support, and the support to the boom.[2]

The elements are made by connecting 10-foot sections of the thin-wall tubing together. It was found that support was needed in addition to the pressure connectors. I decided to turn down 5/8-inch wooden dowel rod with my electrical sander (disk type) and place the rod inside the conduit at each of the connections. This dowel rod fits inside the tubing at each of the joints and provides the additional support required. The same system of connectors and dowel rods is used to make up the supplemental length at both ends of the 20-foot section.

A gamma system is used for matching the antenna to 50-ohm coax. For the gamma rod I used a 5-foot length of the 1/2-inch thin-wall conduit and made clamps out of aluminum strips. I used a length of coax for the gamma capacitor. The capacitor is formed by the outer braid and inner conductor (Fig. 3 shows the details). The length of the coax section can be determined from Table 1. Make the capacitor at least six inches longer than the value listed because the coax must be pruned to obtain an exact match.

[2]If the antenna is to be used in an area where moisture is a problem, it would be a good idea to insulate the elements from the U-bolts. This could be accomplished by using pieces of plastic garden hose over the elements where the U-bolts hold the elements. Also, all elements can be grounded directly to the boom, at the center of the elements. This is known as "Plumber's Delight" construction. The performance of beams using grounded or ungrounded elements is identical. – *Editor*

The capacitor is constructed by removing three or four inches of the outer insulation to expose the braid. The shield should then be cut in the middle of the area from which the cover was removed. Make sure not to cut the dielectric between the shield and the inner conductor. The two lengths of exposed braid should then be unraveled and twisted together to form the two leads. The coax shield should be connected to the center coupling of the driven element by means of a self-tapping metal screw. The shield lead from the gamma capacitor should be connected to the end of the gamma rod. No connection is made to the center conductor at the capacitor end. A coax fitting, for connection to the feed line running to the station, should be installed at the other end of the piece of coax. It is a simple matter to install an SWR indicator at this point for observation during matching adjustments.

Adjusting the Gamma

When assembled, the antenna should be mounted at least 10 feet above the ground for making the matching adjustments. If the antenna can be reached in its permanent location, all the better for making the adjustments.

Feed enough power into the antenna to get a reading on the SWR indicator and then slide the

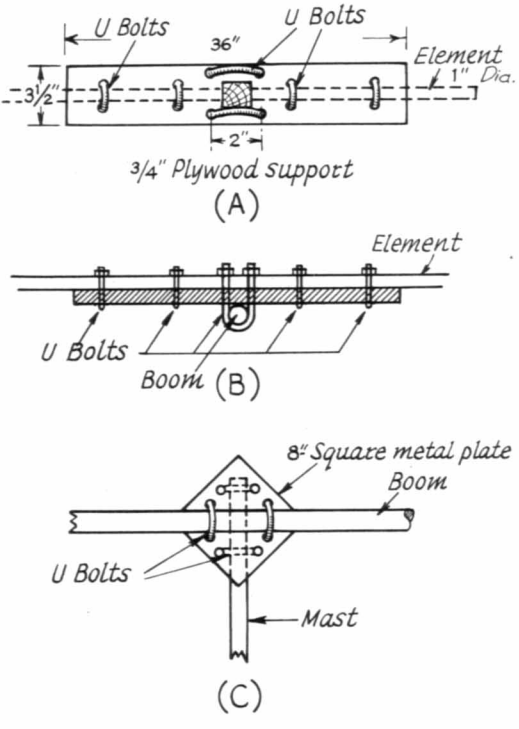


Fig. 2 – Constructional details for the element supports are shown at A and B. Illustration C shows the mount used for the boom-to-mast bracket.

TABLE I

Band (Meters)	*Capacitance required (pF)*
20	100
15	75
10	50
6	30
Given below are figures for capacitance-per-foot of various coaxial cables.	
RG-8/U	29.5 pF/ft.
RG-11/U	20.5 pF/ft.
RG-58/U	28.5 pF/ft.
RG-59/U	21.5 pF/ft.

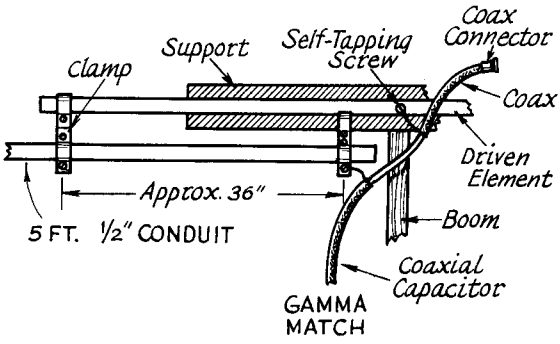


Fig. 3 — Details of the gamma-matching system. The portion of the gamma rod extending past the shorting clamp can be cut off after the matching point is found.

gamma shorting clamp back and forth, looking for the lowest SWR reading. Be sure the transmitter is tuned to the design frequency of the antenna for these tests. Prune the gamma capacitor about an inch at a time and adjust the shorting bar for the best match (minimum reflected power). It should be possible to get a perfect match if care is taken in the adjustments.

The dimensions given in Fig. 1 are for the Novice portion of the 21-MHz band. Figuring the element length is quite simple. The formula for the driven element is 468 divided by the frequency in MHz. The answer will be in feet. The reflector should be made five percent longer than the driven element, and the director five percent shorter than the driven element. These figures apply to the other bands as well.

The front-to-back ratio on my beam is excellent. The entire beam cost about $15. One thing for sure — with a beam 15 meters becomes a whole new world for the Novice. QST

February 1921

. . . L. M. Clausing, of the Bureau of Standards, describes how to get a high-pitched musical note out of a 60-cycle supply. He has a "current reverser" in the high voltage output from a transformer. Might be a little difficult to make, I'm thinking.

. . . "Rotten S.O.L." is the title of a yarn by The Old Man and this recounts his experiences at the Midwest Convention. He meets all the "greats" and has a ball. Well illustrated by Clyde Darr, 8ZZ, with realistic cartoons. Think miniskirts are new? Read this.

. . . Well, we have instructions for making an electrolytic rectifier. P. J. Furlong, 1FF, of Boston gives the horible details. He uses it as plate supply for a W. E. VT2. (Maxim had one with one hundred twenty test tubes. Allowing five minutes for cleaning each cell every-so-often, that comes out ten hours of messy work. I dunnit once!)

. . . Allen H. Wood shows how to make a simple wavemeter. It is intended for use in locating the long wavelengths, primarily. Just a coil and condenser. A note by the editor says this is a form of sensitizing circuit which will increase signal strength several X.

. . . The famous 2RK, station of J. Kenneth Hewitt, Brighton Beach, N.Y. is well described. This was a powerhouse all right, using a United Wireless 30,000-volt transformer, 2kW. 4-wire flat-top, 70-ft. high.

February 1946

. . . K. B.Warner talks about our various ham bands. He gives them a sort of personality, thinking of the 3500-4000-Kc band as a sort of "mother band." (I think of this band as an old fogy's haven, at least part of it!). The 7 and 14 Mc bands to him are populated by hardened warriors (with their mike gains wide open). Ten meter is "just slightly potty and very inventive."

. . . John Huntoon discusses war surplus gear at length and describes the process by which such material becomes available to hams.

. . . Byron Goodman, W1JPE, has a nifty little combination 28-Mc converter/receiver. For cw it works as a simple superhet. For phone, the output is piped into a broadcast receiver.

. . . "Dixie Jones Owl Juice" makes it appearance and he wonders how come all his dumb bunny ham friends came out of the war as Majors and higher while he was a lowly Captain.(Huh, I was just a Pfc. when I got out of WW1!)

. . . Paul Robbiano, W6PKM has Part II of his story of the enemy radar jammers developed during the war, at Harvard. Lots of trick antennas.

. . . What's this? W. W. Smith, W6BCX, one-time editor of the old *Radio*, spells out the glories and benefits of "Premodulation Speech Clipping and Filtering." Says it is possible to realise a gain of nearly 100-fold, as far as working DX is concerned. Of course there is a "slight" sacrifice in quality. Yeccchh! — *W1ANA*