THE 6-METER BENT H ANTENNA

BY W. O. ENDERLE,* W6GNV/4

A stacked folded dipole for six meter operation.

THERE are a number of very successful commercial and home brew antenna types in regular use on six meters. The Yagi style beam in four or five element configuration is probably the most popular in the greater Washington D.C. area at least, although there are a number of operators apparently having good fixed station results with simpler antennas such as the Squalo and Halo. My particular problem, which I am sure is not uncommon, was that I wanted a horizontally polarized, omnidirectional antenna for roundtable or net operations to supplement my 5 element Yagi, and I wanted some gain as well. Another long run of expensive coaxial cable did not appeal so I hoped to work out a design that would make use of an existing antenna coupler and some ordinary TV twinline. Finally, I wanted to install it in the attic where I could forget about wind and rain, and make use of rafters for support.

Construction

The design of an antenna that met the above requirements took considerably longer than it did to construct it. Actually, it was built and installed one Saturday afternoon. The antenna can be verbally described much better than it can be photographed. It consists (see fig. 1) of two horizontal 600 ohm folded dipoles (3 parallel conductors per each dipole), stacked vertically one above the other at a distance of about four tenths of a wavelength (for gain), and each bent 90 degrees in the middle (for an omni pattern). The two dipoles are connected together, in phase, by an electrical half wavelength of twinline, and its length determines the actual vertical spacing of the parallel dipoles. The antenna manual I referenced gave a velocity factor of 0.82 for ordinary TV twinline, and thus an electrical half wavelength computed out of my slide rule to be 94½ in. at 50.4 mc. An open wire type phasing line, with a larger velocity factor, would allow greater spacing of the two dipoles, and slightly greater efficiency, but the difference would probably not be noticeable. Stranded copper wire (7 × 22) was used for the antenna conductors, and the length of each dipole element was figured at 110 inches. This design is not particularly frequency sensitive, at least in comparison with a Yagi, and an inch one way or the other in dimensions will not be critical. The insulators and spacers were fabricated from flat pieces of Plexiglass (old C-47 windshield), but for attic or other inside location where water can be disregarded, masonite or even dry

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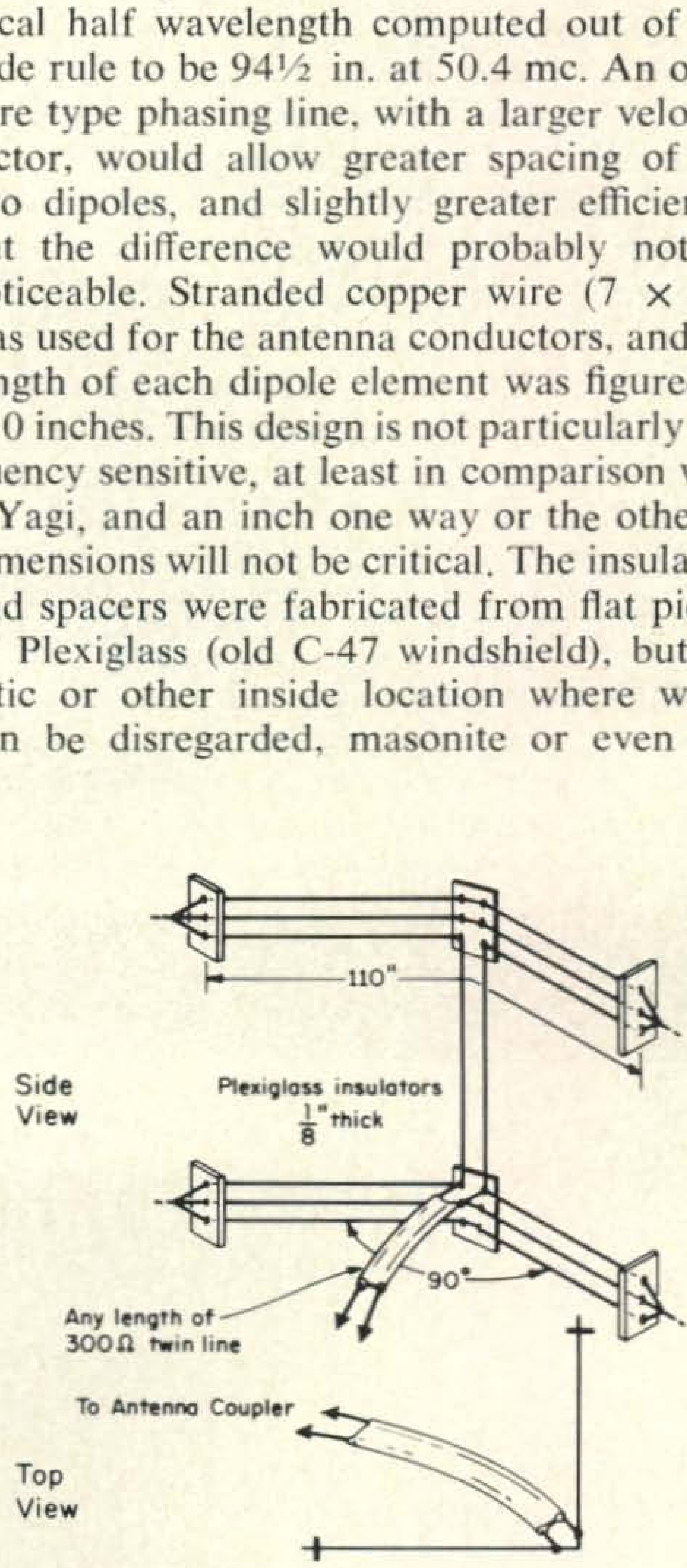

Fig. 1—Layout of the bent H stacked dipoles. The insulators, made of plexiglass, space the dipole elements one or two inches apart. The phasing line is 300 ohm ribbon 94½" long with one twist for proper phasing.

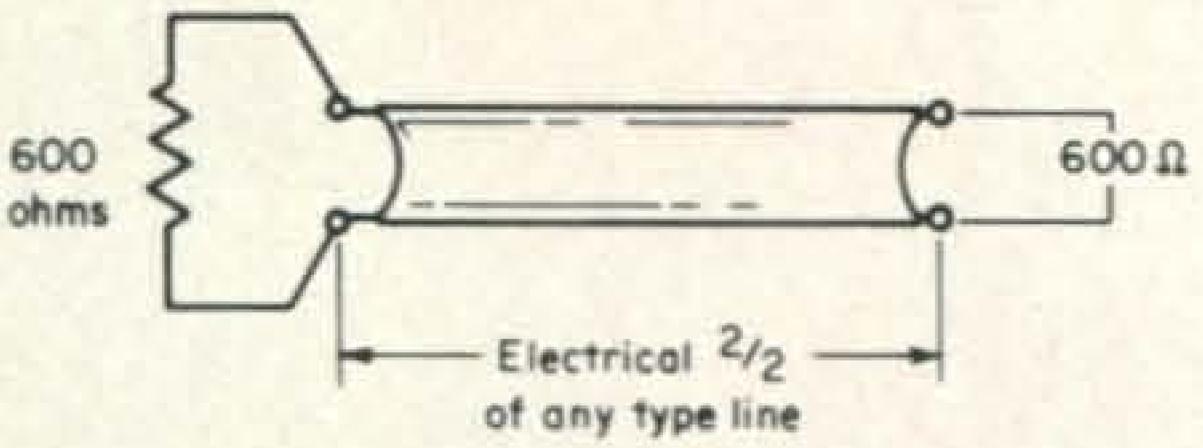

Fig. 2—Simple sketch illustrates how an electrical half-wave line of any type repeats the impedance connected to it.

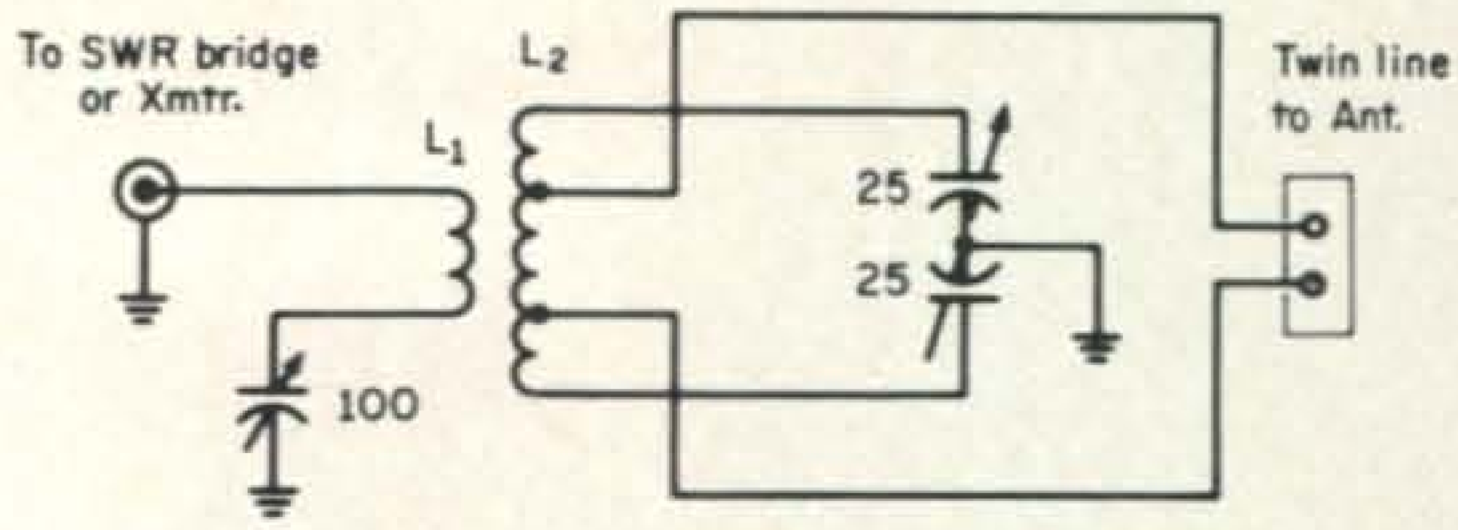

Fig. 4—Circuit of an antenna tuner to match the 300 ohm twin lead to the 52 ohm unbalanced source.

L_1—2t #14, 3" dia. over the center of L_2.

L_2—7t #12, 1 ½" dia., 2" long, tapped at the second and fifth turn.

hardwood could probably be used with no problem.

Theory of Operation

As far as the theory of operation is concerned, those persons familiar with a Squalo or Halo will not have any qualms about bending a dipole and wondering if it will still work. The rest of the design was based on obtaining gain and matching the antenna to the feed line without complexity. Transmission line theory says that the impedance connected to one end of an electrical half wavelength line is repeated at the other end. (See fig. 2.) Hence the 600 ohm or so of the upper dipole is presented at the bottom end of the phasing line where it is then attached in parallel with the 600 ohms of the bottom antenna. (See fig. 3C) The resulting 300 ohms or so of impedance is thus a good match for a random length of TV twinline down to the antenna coupler or to a balun, and thence to an s.w.r. bridge and the rest of the station. Don't forget that the phasing line beween the two dipoles must be twisted 1/2 turn before it's connected to the bottom dipole in order for the pair of them to act as a broadside array.

Although the proximity of the two dipoles to one another, the fact that they are bent, and the fact that they will possibly be near some house wiring in the attic will all affect their impedance to some extent, I think you will find that the s.w.r. on the feed line is well below 2 to 1. In any case, the losses in twin line are much less than in coax and I have found no evidence of hot spots after feeding mine with a class "C" a.m. kilowatt for a couple of late QSO's. Further confirmation of a low s.w.r. is the nearly identical antenna coupler settings for a 300 ohm resistor substituted at the antenna terminals of the coupler.

The Bent H is far superior to a standard design, full sized lazy H antenna in the latters best direction, which has been installed for some time at this QTH. The center of the Bent H is about 15 feet higher than the center of the big lazy H, so the comparison is not entirely fair. However, an ordinary folded dipole was far outclassed by the big H so I feel that a reasonable standard of comparison has been selected.

Either an antenna coupler as shown in fig. 4 or a simple coax balun (fig. 5) should accomplish the transformation from the unbalanced output of the s.w.r. bridge or transmitter to twinline feeder. I have not personally tried the coax balun, and am only providing its dimensions for convenience.

The Bent H has seen regular use on Army MARS, AREC, and Rebel Nets in the Northern Virginia area. I certainly hope you have as much pleasure in building and using one as I have had. ■

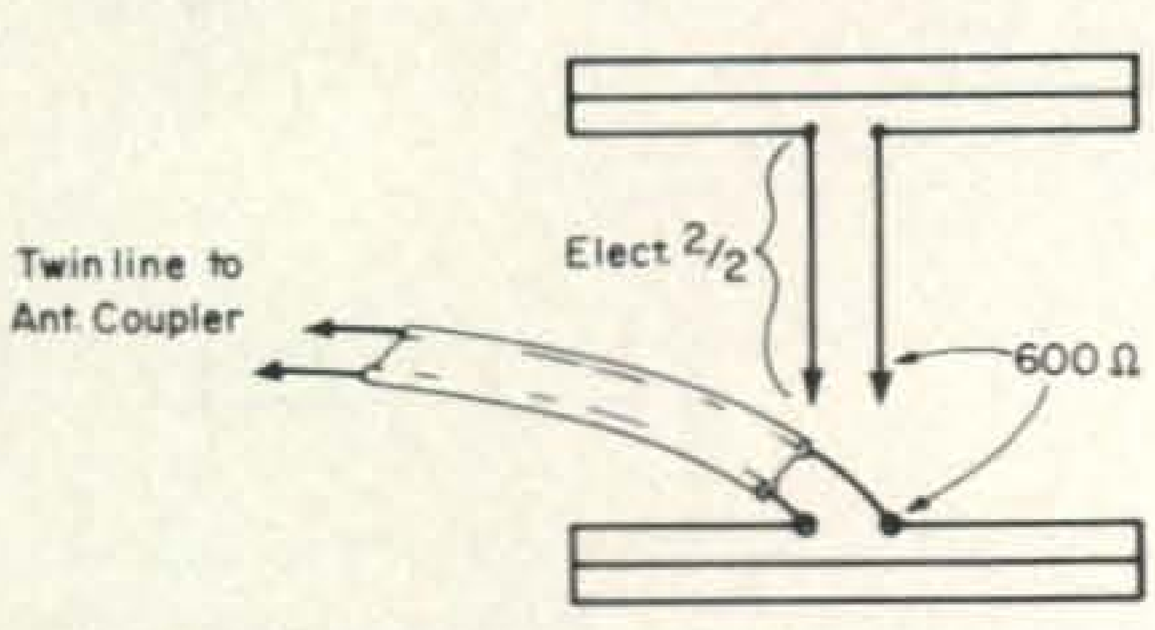

Fig. 3—Illustration of two 600 ohm folded dipoles are paralleled by the phasing line to match the 300 ohm transmission line.

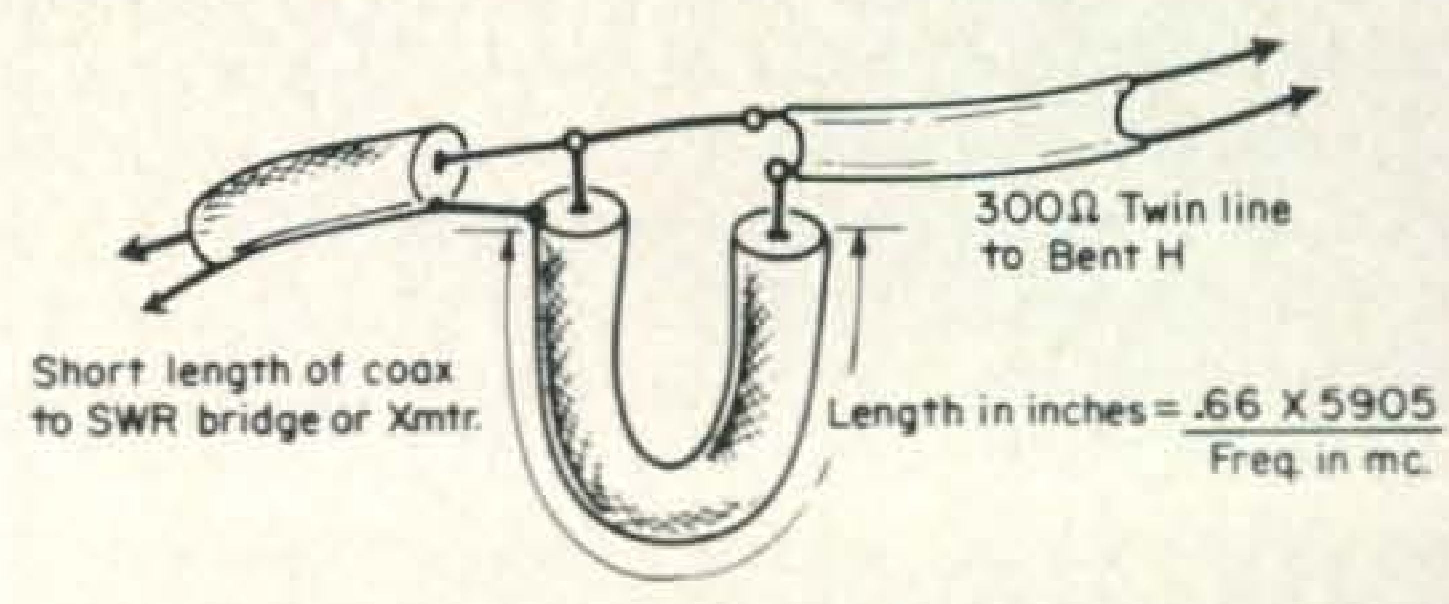

Fig. 5—Arrangement for a balun to convert from 300 ohms balanced to 75 ohms unbalanced (4:1 transformation). Fifty two ohm line can be fed without any problem, however. The balun length by the formula shown is about 77" for 50.4 mc.

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