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Building Long Yagis for UHF

– some pitfalls to avoid

Beware of the "something for nothing" offer! With this thought in mind, the long yagi antenna is being placed under suspicion. Would you believe a 48-element collinear array (24 driven elements and 24 reflectors), whose gain is approximately 16 dB, could be replaced with a single 13-element long yagi? In addition, the long yagi has: 1. Less wind resistance; 2. More directivity per pound of aluminum; 3. Greater ease of fabrication; and 4. Excellent mechanical stability. Certainly there is a temptation to believe that the long yagi antenna offers something for nothing when compared with other antenna arrays. What must be sacrificed to obtain the aforementioned advantages? Followers of the "Collinear Clan," read on!

The cautious amateur constructing a beam antenna intended for application in the VHF and UHF range would exhibit a tendency to cut the elements longer than necessary. This stems from the old adage, "It is easier to cut 'em long than to add a piece on." This is the philosophy that has helped give the long yagi a questionable reputation.

In an attempt to reinstate the long yagi in its rightful position, antenna patterns of a 13-element yagi were made. Fig. 1 shows polar patterns of the long yagi in horizontal polarization. Fig. 2 shows patterns with the yagi vertically polarized. Fig. 3 shows the reference dipole in the horizontal plane. Curve A is plotted in the same relative gain scale as

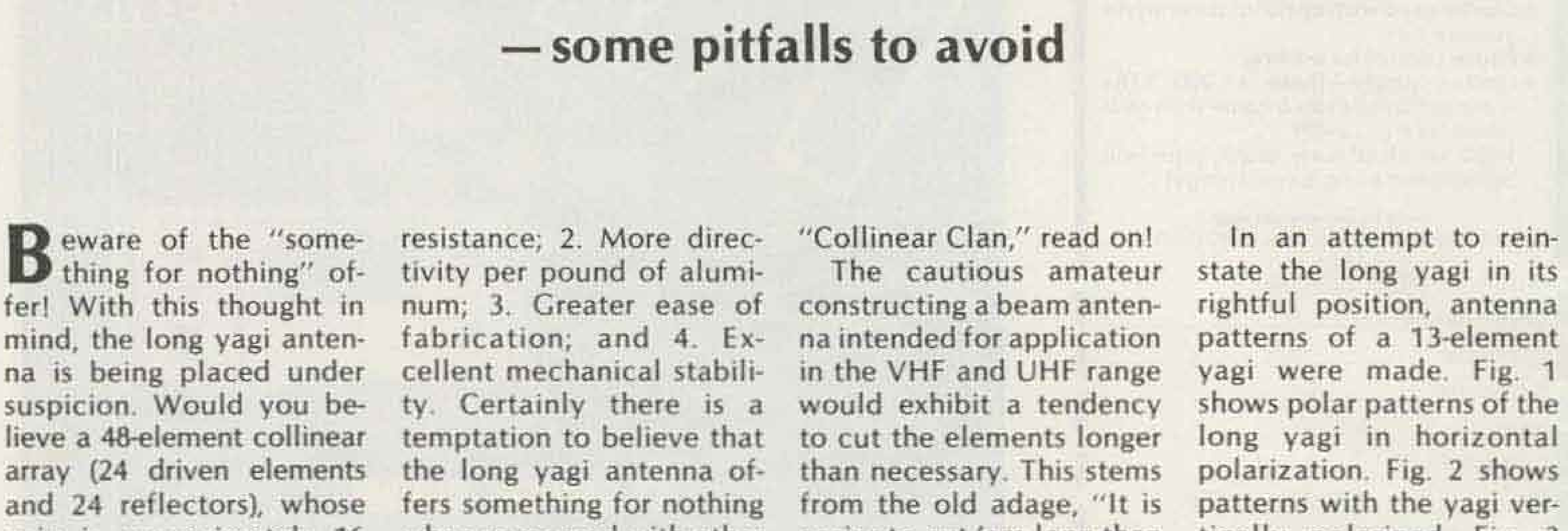

Fig. 1. Horizontal polarization radiation patterns for the 13-element yagi at 420, 432, 438, and 442 MHz.

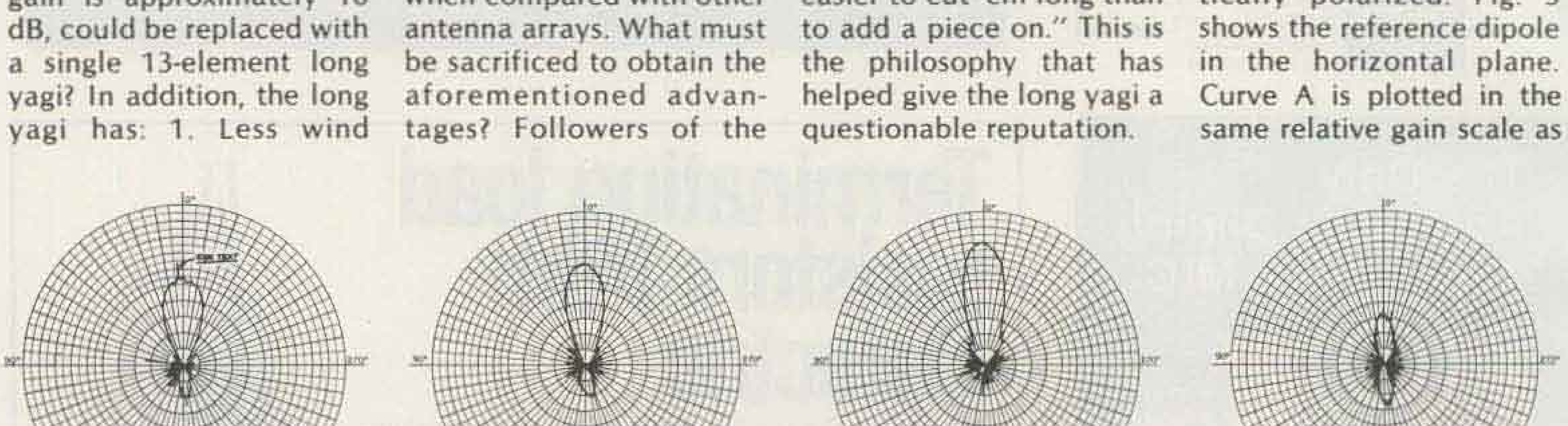

Fig. 2. Vertical polarization radiation patterns for the 13-element yagi at 420, 432, 438, and 442 MHz.

Figs. 1 and 2. Curve B is merely an expanded plot due to gain increase in plotting technique. The spike at the upper-left of Fig. 1 was produced by a search radar of an adjacent airport. A cool, windy fall day and the lack of more output from the signal generator kept the patterns from being of the picture-book variety. Fig. 4 shows the test setup.

Fig. 5 shows graphically the nonsymmetrical bandpass characteristics of the long yagi-type of antenna. The extremely rapid cutoff on the high side of the intended operating frequency has caused many an amateur to cast aside this type of antenna. This curve shows readily that it is unwise to cut the antenna to operate below the intended operating frequency.

The 438-MHz pattern in Fig. 1 indicates that the beam width at the half-power points is approximately 25 degrees. Gain measurements further revealed that 16 dB of gain can be realized without difficulty. This gain figure can be obtained over a frequency range of at least four megahertz. Four megahertz is approximately plus and minus 0.5% of 435 Hz, which is more than ample for ham frequencies. Just make sure that your beam design frequency is at or near the high end of the bandwidth desired.

Four long yagi antennas (Fig. 6) operating on 432 Hz, using 13 elements each, will yield a gain of 22 dB (assuming 16 dB per each 13-element yagi). To obtain this same gain with a collinear array, approximately 176 elements would be required (88 driven elements and 88 reflectors). At this point in comparison, does the singular feature of unnecessary bandwidth seem worthwhile?

If reasonable care is exercised during construction (Fig. 7) and *all* dimensions are adhered to within one sixteenth of an inch, then you can boast, "Have yagi, will radiate." ■

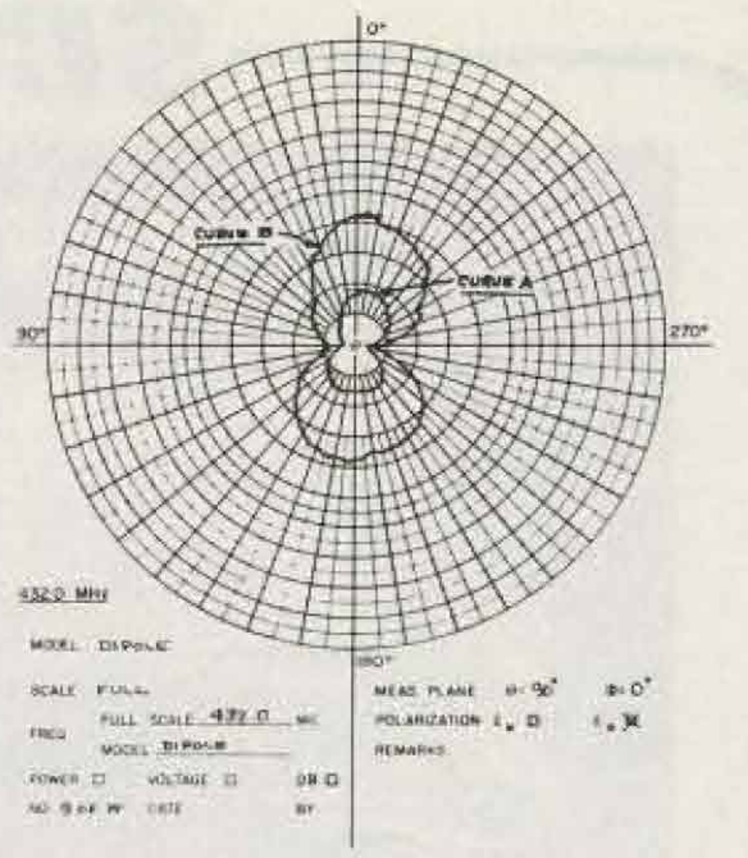

Fig. 3. Reference dipole radiation pattern in the horizontal plane.

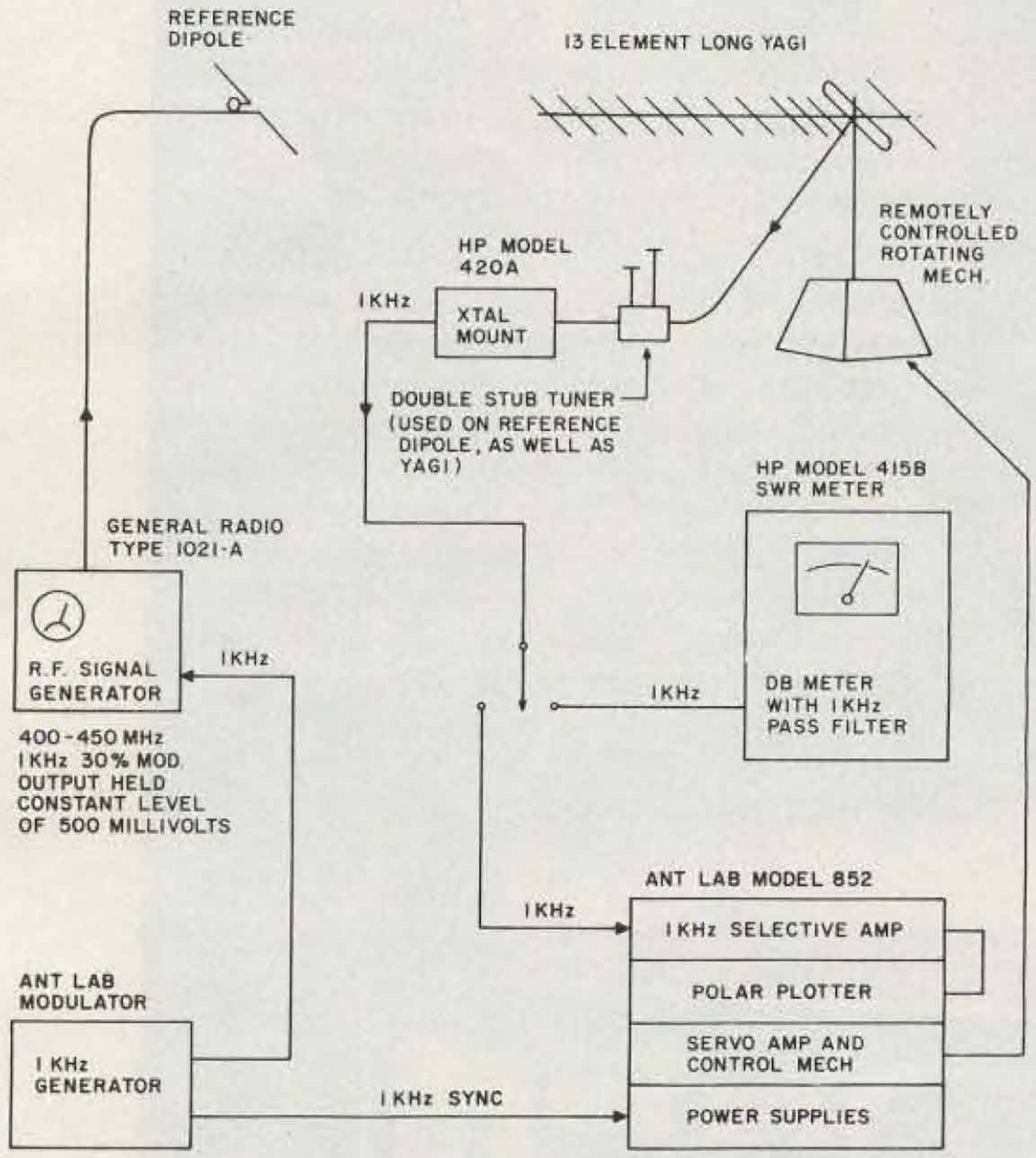

Fig. 4. Radiation pattern test setup.

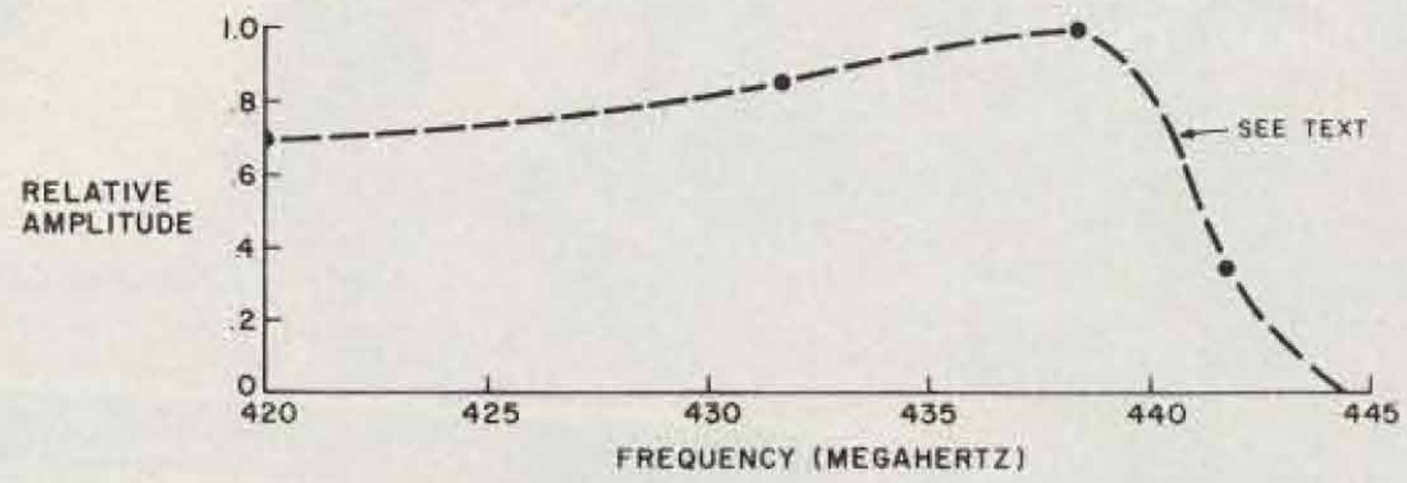

Fig. 5. Bandpass characteristics of 13-element yagi.

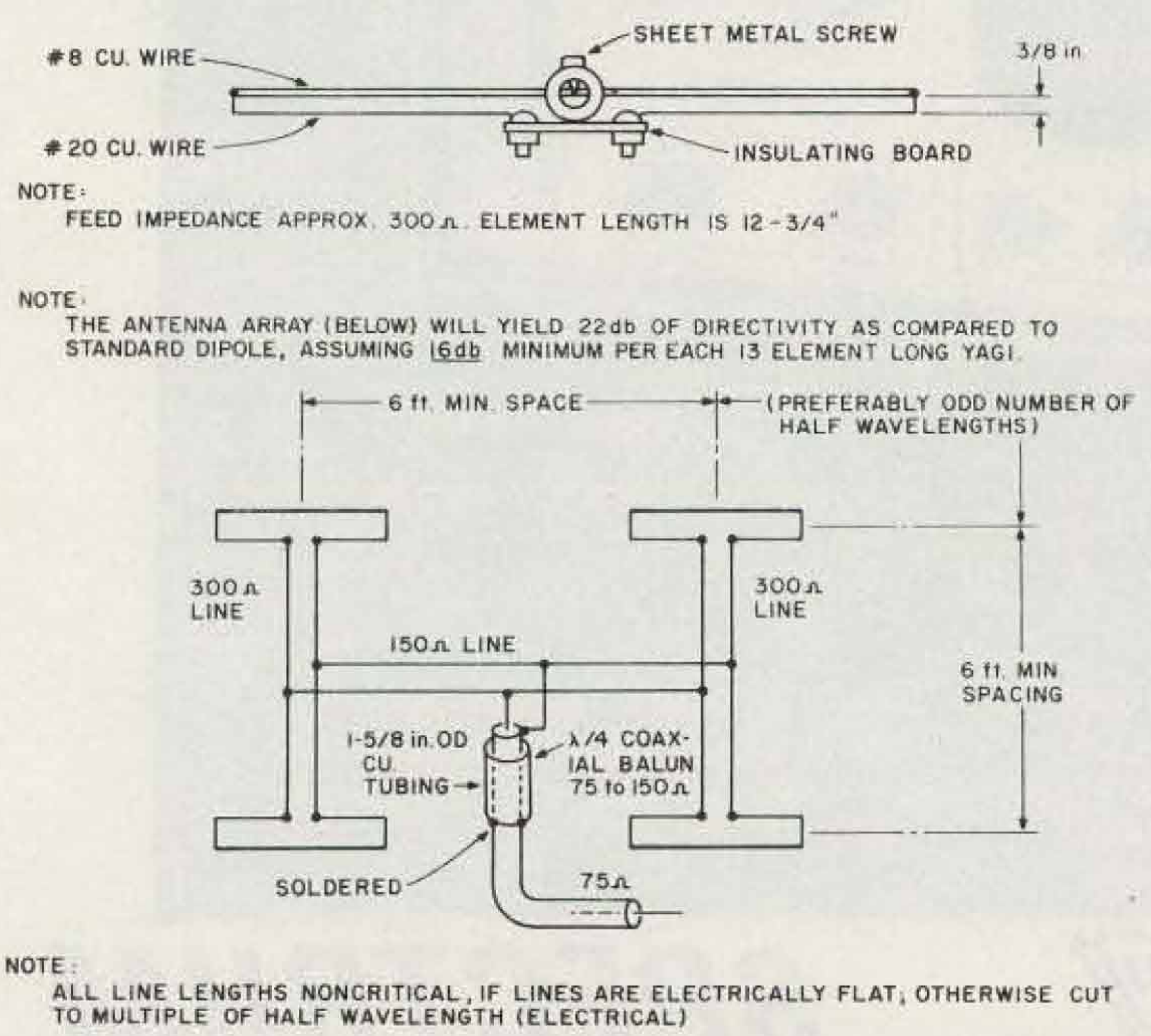

Fig. 6. Method of interconnecting four yagis.

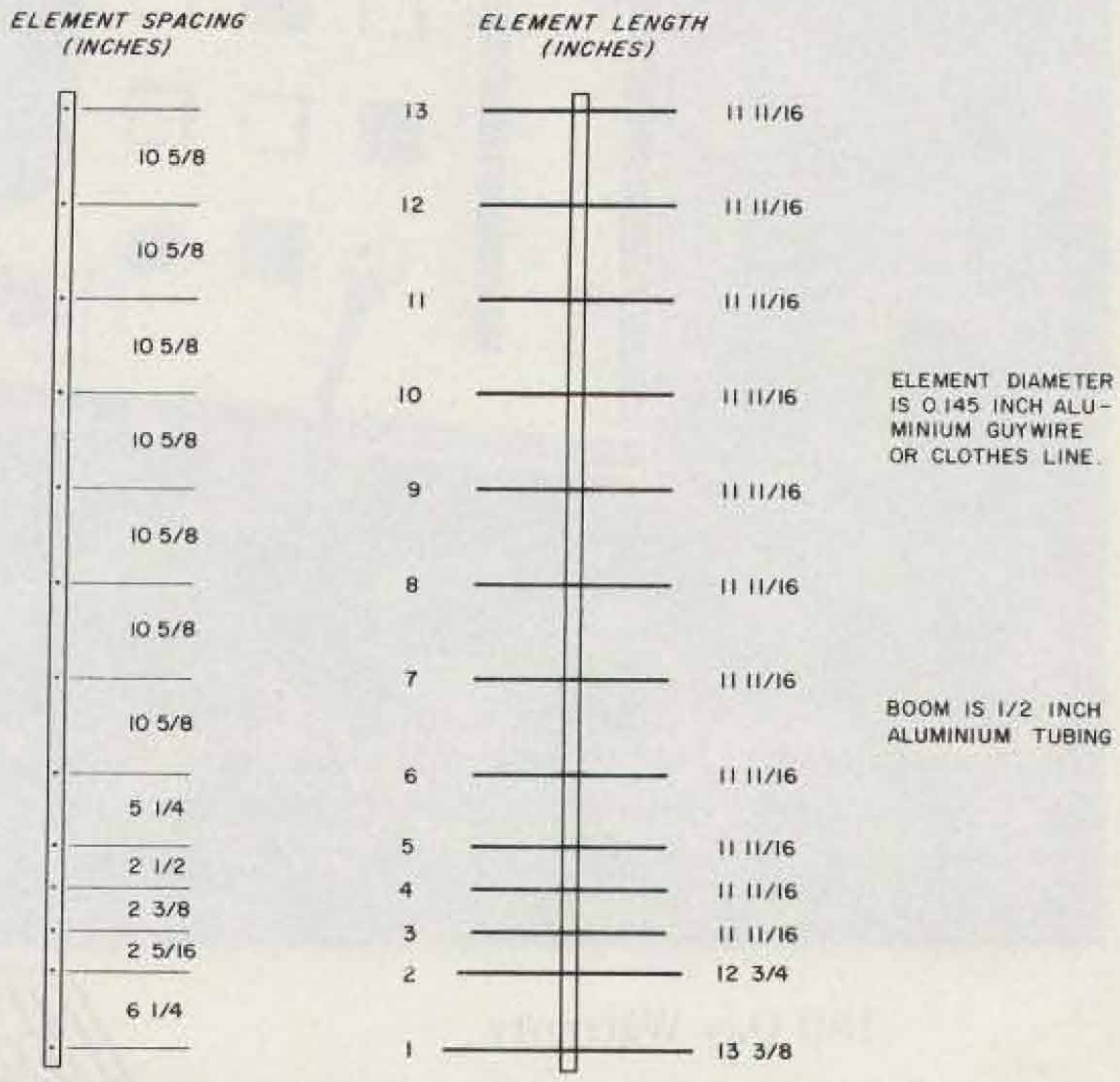

Fig. 7. Construction details for the 13-element yagi.