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OLD ANTENNAS AND NEW BALUNS

Antenna types rejuvenated by the use of toroid baluns.

Anyone who has been in amateur radio for ten to twenty years will remember the days of elaborate "wire" antennas. Newcomers can also glance in some of the old antenna manuals and find them replete with "wire" antenna designs. Wire antennas as the name indicates, are simply more elaborate antenna forms than a simple dipole which provide some gain and directivity and which were usually constructed from wire hung between the necessary supports. The advantages to such antennas was primarily cost, since relatively high gains could be achieved for the cost of additional antenna wire. All sorts of collinear arrays, broadside arrays, curtains, etc., were developed and used successfully. The problems associated with such antennas were many and one of the primary ones was the often awkward feed point impedances of the antenna and the requirement for a balanced feed. Open wire lines had to be used to feed the antennas at impedances ranging from 150–600Ω and then the balanced open wire line converted via an antenna tuner to an unbalanced coaxial feed. For these and other reasons, eleaborate wire antennas have fallen into disuse. Nonetheless, for the amateur who has the necessary space and is primarily interested in working single-band DX, these antennas can provide very good service at minimal cost. Fortunately, the advent of the toroid balun transformers with variable impedance ratios has also eliminated the feed problem once associated with these antennas. The purpose of this article is not to re-present every type of wire antenna array developed. A few examples are given and the use of a toroid balun illustrated. One can, however, glance back in some of the older antenna manuals and magazines and find any number of elaborate wire arrays to which the same feed techniques illustrated here can be applied.

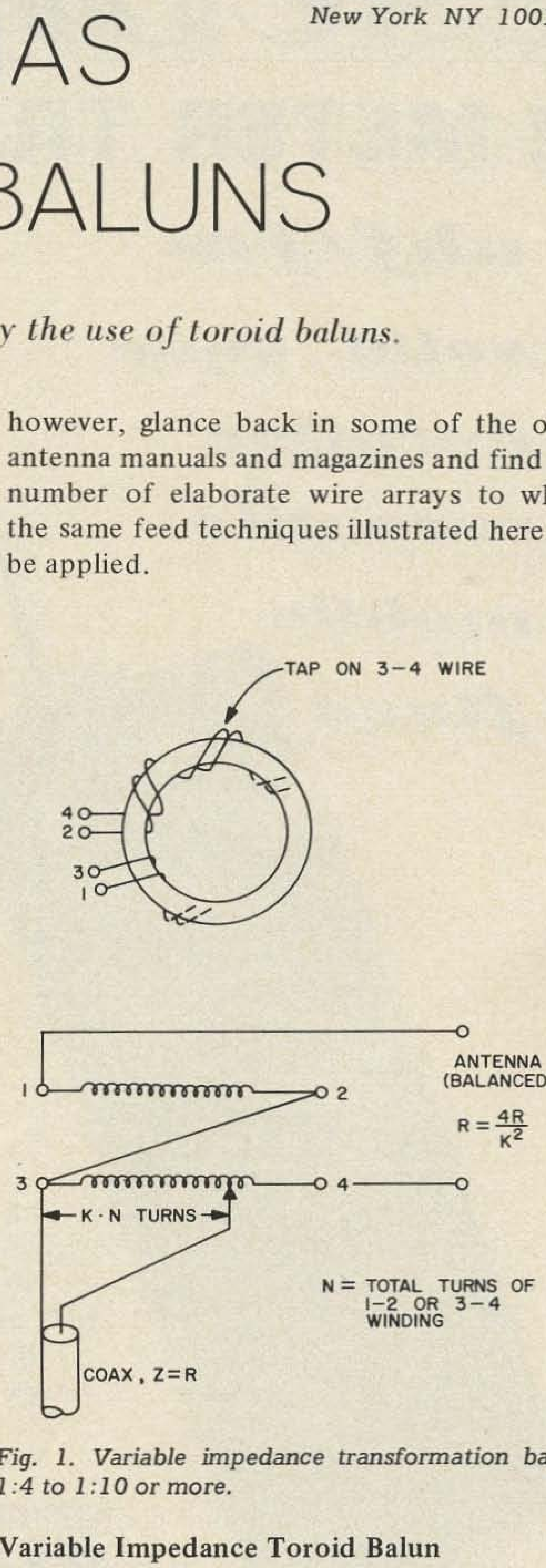

Fig. 1. Variable impedance transformation balun 1:4 to 1:10 or more.

Variable Impedance Toroid Balun

A toroid balun is usually thought of being a 1:1 or 1:4 ratio type unit. That is, going from 50Ω unbalanced to 50Ω balanced or from 75Ω unbalanced to 300Ω balanced. But any toroid balun kit can also be used as a variable impedance balun with transformation ratios greater than 1:4 possible up to about 1:10. Fig. 1, shows a typical toroid balun winding. The instructions contained in any balun kit can be used to place the initial windings on the toroid core for a 1:4 balun. Note that if the coil tap on the 3–4 winding is placed at point 4, one has a normal 1:4 balun. If, however, this tap is moved closer to the 3 terminals, the transformation ratio of the balun increases according to the formula shown. For instance, if the tap were placed at the quarter way winding point between 3 and 4, that is one quarter of the turns from 3 to 4 away from 4, the transformation ratio would be approximately 1:10. A 50Ω unbalanced input would be transformed to a 500Ω balanced output. In a similar manner, the other tap points can be figured out for any impedance transformation ratio.

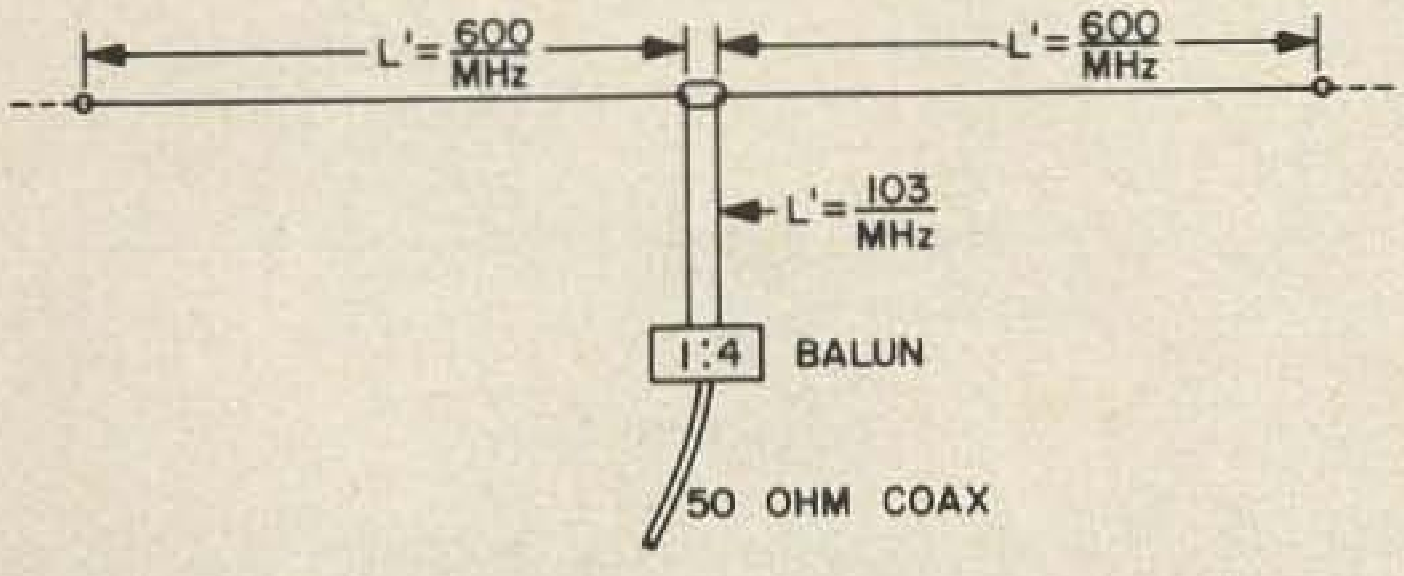

Fig. 2. Extended Double Zepp with balun feed.

Double-Zepp Antenna

The Double-Zepp antennas is a form of extended dipole as shown in Fig. 2, where the dipole elements are made as long as they can be while still having the radiation pattern of the antenna not split up and remain at right angles to the line of the antenna (in and out of the page). The gain achieved is an easy 3 dB. A small phasing section is still required at the center of the antenna, as shown, before the connection of a 1:4 balun.

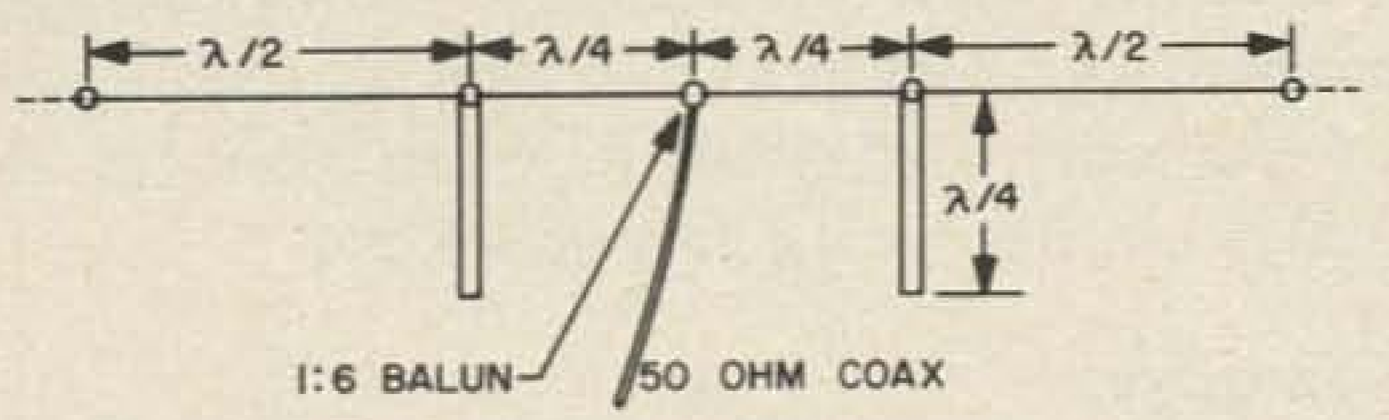

Fig. 3. Classic collinear array balun feed. See text for extending antenna to increase gain.

3/4λ Dipole

The 3/4λ dipole of Fig. 3, also has its main radiation at right angles to the line of the wire and produces 3–4 dB gain. This form of antenna may be somewhat easier to construct than the Double-Zepp since the balun (a 1:6 unit in this case) may be connected directly at the center of the antenna. The phase reversal stubs between the ½λ elements can be made of simple 300Ω twinlead shorted at the far end. The antenna can be extended with another ½λ element on each end (and a ¼λ stub to connect to the adjacent ½λ element) to raise the gain another dB or more. In this case, a 1:10 balun has to be used to feed the antenna.

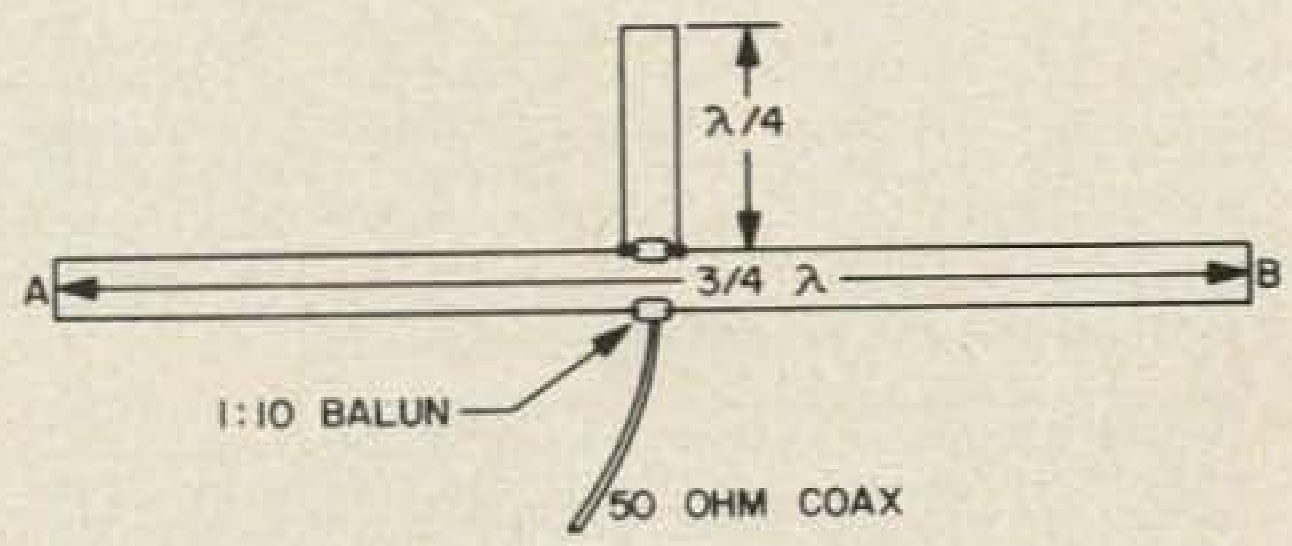

Fig. 4. 3/4λ folded dipole may be operated on two bands if desired by using stub switch.

Dual Band 3/4λ Dipole

The 3/4λ dipole shown in Fig. 4, can be used either as a single band or dual band antenna. Its total length is 3/4λ long at the lowest frequency band used. If used as a single band antenna, the shorted ¼λ stub shown is not required. If it is to be used as a dual band antenna, the stub is made ¼λ long

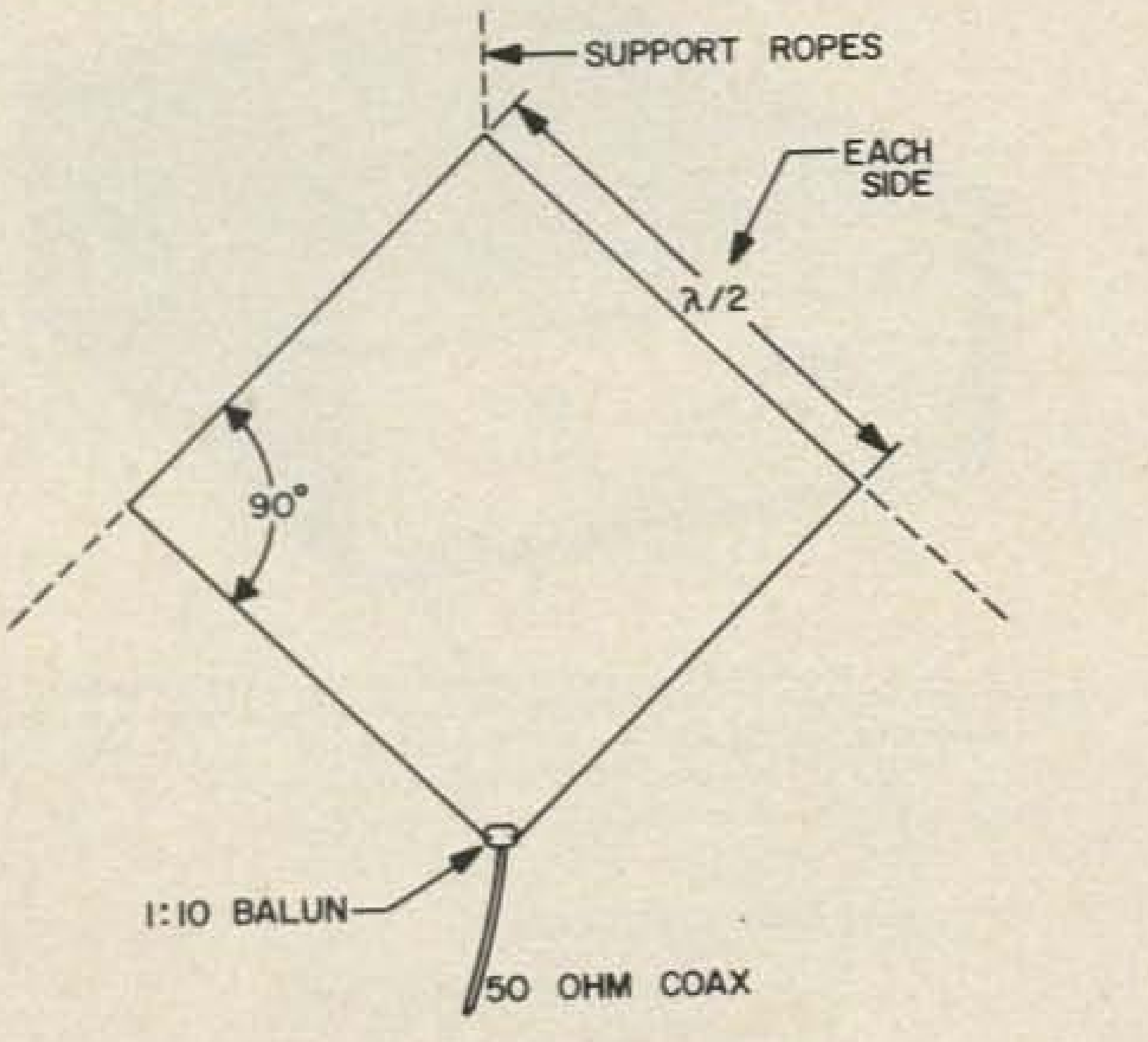

Fig. 5. Super loop or bi-square requires only single support and produces easy 4 dB gain.

at the lowest frequency band. On the next higher harmonically related band, the stub will act as a short circuit, since it becomes ½λ long, and allow the antenna flat-top to properly resonate. Whether used as a single band or dual band antenna, it can be fed via a 1:10 balun.

Super Loop

The large loop antenna shown in Fig. 5, can be mounted from a tower or other support. Its radiation is horizontally polarized and broadside to the plane of the array (in and out of the page). The gain is about 4 dB in both directions. It can be fed directly from a coaxial line via a 1:10 balun at the base as shown.

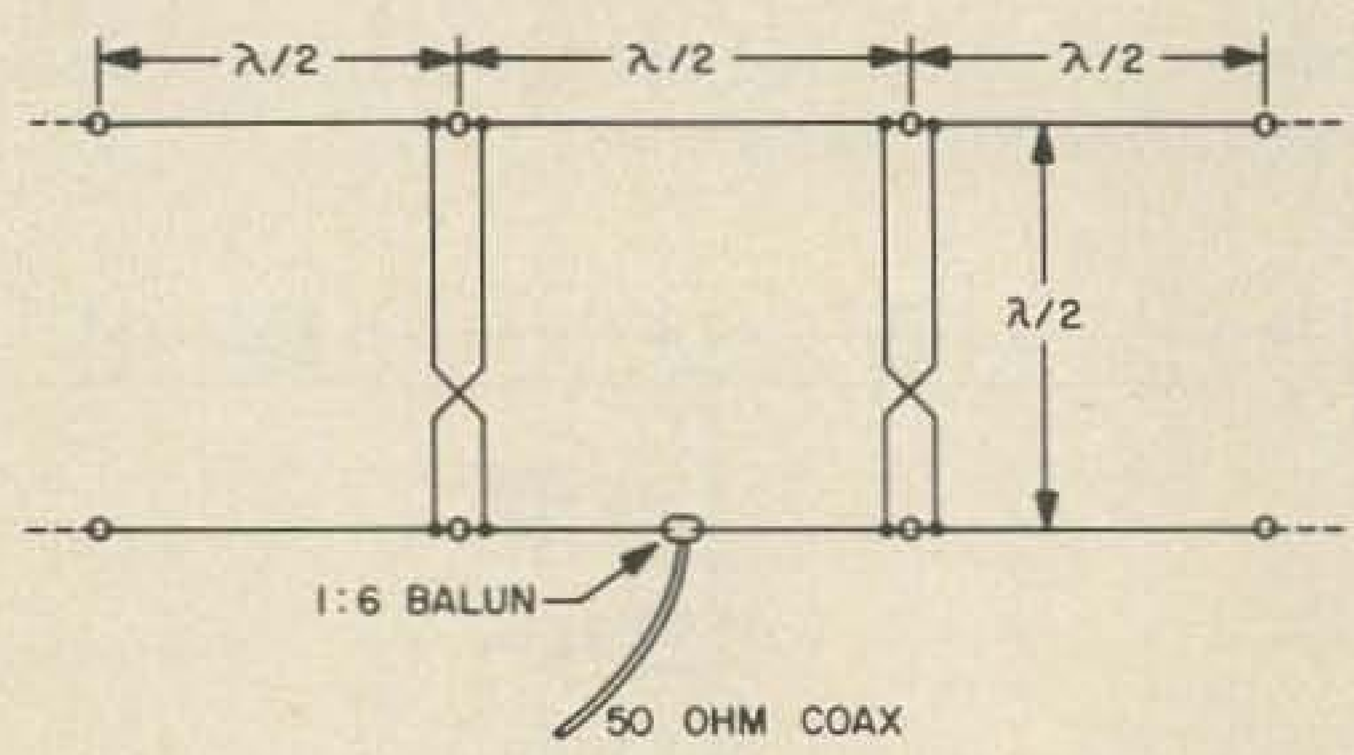

Fig. 6. The six-shooter array provides 7.5 dB of gain. Lower elements should be ¼λ high.

Super Loop

The array of Fig. 6, is just one small example of a curtain array including such types as Sterba, Bruce Arrays, etc. The gain that such arrays can provide become quite significant if one has the space to extend them one to two wavelengths. In this case, the array will provide a broadside gain of 7.5 dB in both directions. The antenna can be fed at the point shown via a 1:6 balun. The phasing line between the upper and lower set of elements can either be open wire line or 300Ω twinlead with a single twist.

Summary

Many other antenna forms which present a resistive impedance on a single band but of an awkward value can be fed via a properly constructed balun. Other antenna types which suggest themselves are V beams, rhombics, half rhombics and single tilted wire antennas.

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