The Three-Quarter Wave, Current-Fed Antenna

BY JACK R. ROTHWELL,* VE7TK

EFFICIENCY, simplicity, and low cost are the three most desirable features of an antenna. Now add the features of versatility, broadband characteristics, and a combination of both low and high angle of radiation and you have the wonders of the three-quarter wave, current-fed antenna.

An immediate advantage of this antenna is that it can be connected directly to your transmitter, because a low impedance of 40 to 60 ohms exists at its feed point. With this arrangement, the use of a low pass filter connected between the transmitter and antenna is recommended.

Marconi type antennas require the use of a good ground or radials, and the ¾ wavelength antenna is no exception to this rule. Do not let this dissuade you from using this antenna, however, for a good water pipe ground will work very well. The writer uses this type of ground, along with several ground rods here and there, in the back yard. Good grounds may be obtained by burying large metalic objects, or by using several ground rods, and then by running a No. 10 aluminum or copper wire underground back to the ham-shack ground bus.

The formula for the ¾ wavelength antenna is:

$$\text{¾ wave in feet} = \frac{702}{\text{Freq. (mHz)}}$$

$$\text{EXAMPLE: } \frac{702}{7.2\ \text{mHz}} = 97.5\ \text{feet}\ (97'\,6'')$$

*P.O. Box 3359, Vancouver 3, B.C., Canada

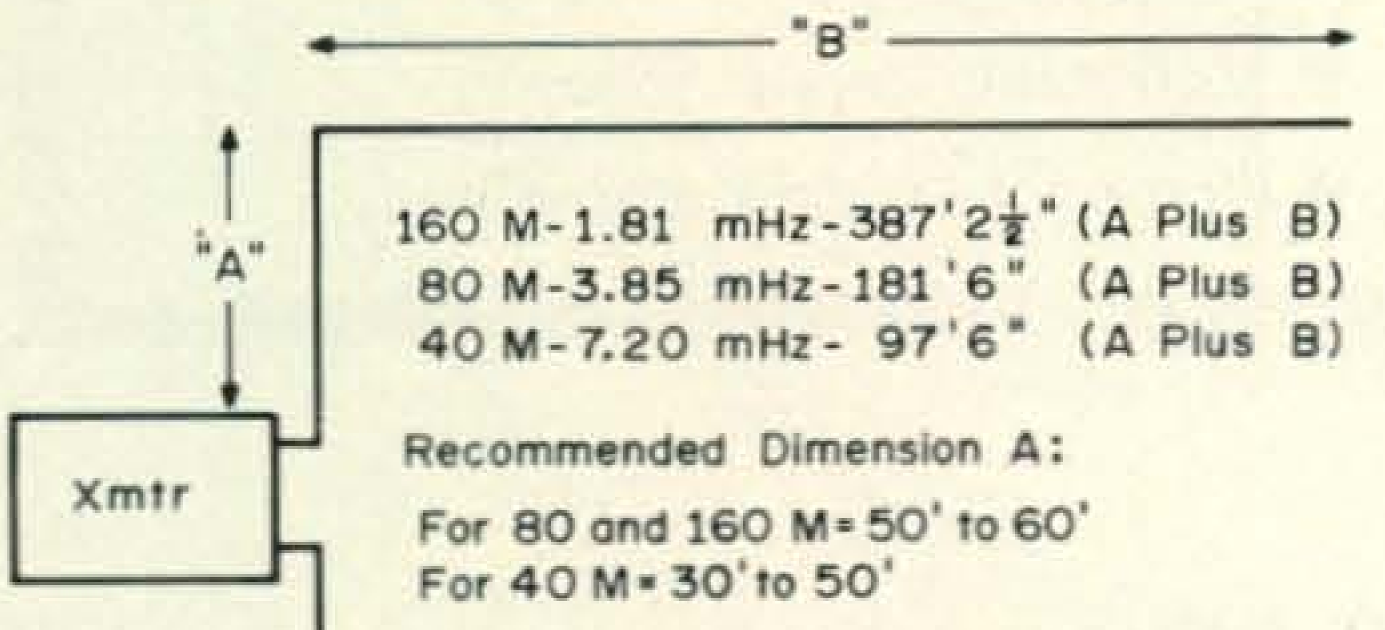

Fig. 1—L-configuration of ¾ wave current-fed antenna having broad-band characteristics.

The antenna may be run partially vertically and horizontally. Refer to fig. 1 which shows a simple inverted *L* configuration. Some frequencies and their dimensions have been selected at random in fig. 1 to illustrate the antenna. You will note that it is recommended that dimension "A" run vertically for 50 to 60 feet on 80 and 160 meters and for 30 to 50 feet on 40 meters. This length is the minimum recommended, for it seems to give the antenna both a good low and high angle of radiation. If it is not possible to obtain these vertical heights, a gradual upwards slope of dimension "A" will still give good results, but it will tend to decrease the high angle of radiation. It should be noted that although the lengths shown in fig. 1 are from the formula, as well as from actual practice, bends, turns, and nearby wires will cause the antenna to resonate higher in frequency. Therefore, allow an extra amount of wire before pruning the antenna to your selected resonant frequency.

Tuning is done in the same manner as with any dipole. The use of a grid dipper, an s.w.r. indicator, and, if possible, an Antennascope or noise bridge will do the job nicely. The use of at least an s.w.r. indicator is required to tune the antenna to the desired frequency. The advantage of tuning the ¾ wave over the dipole is that only one end need be raised and lowered in tuning. It is preferable to keep the transmitter end fixed and to adjust the far end during the process.

When you have completed the tuning of the antenna, you will have a very low s.w.r.—provided, of course, that you are using a good ground. The s.w.r. should be lower than 1.5 to 1 for most of 40 meters, and not much higher at the extremeties of the band. The same broad band characteristics will be found on 80 meters, although you might find an s.w.r. of about 2 to 1 on the extreme frequencies, depending upon where you center the resonant frequency Wide frequency excursions may be made on both bands with very low standing wave ratios.

In fig. 2, you will see that the antenna has been made into a two bander by using a capacitor of 250 pf to resonate the low band. On the low band, the antenna acts as a ⅜ wavelength series-tuned Marconi, while on the high band it is the ¾ wave current-fed antenna. In this arrangement, the antenna should be cut and tuned for the high band, with the capacitor serving to resonate it on the low band. The writer has used the ⅜ wavelength series tuned Marconi on 160 meters for several years with good success on s.s.b. and c.w.

For the record, the ¾ wave antenna will produce good results on 10-15-20 meters, too. Because of the smaller dimensions, it serves as a vertical with a low angle of radiation and gives a good account of itself for long haul. There is good high-angle radiation, too, that offers very respectable ground-wave coverage. Typical high band dimensions are as follows:

20 Meters - 49′6″
15 Meters - 33′6″
10 Meters - 24′6″

The 15 meter vertical may be used as a ¼ wave for 40 meters

A problem at VE7TK was to remove some of the many sky wires in order to allow birds safe passage in their flight through the yard. A more important problem was to eliminate some of the QRM from the XYL, who believes that our "wireless sets" should be "wireless."

For my part, Carl Mosley's tri-band beam more than adequately handles my high-band requirements. But it occurred to me that a triband for 40-80-160 meters would certainly help clear up some of that overhead wire.

At this point, I was not convinced that the ¾ wavelength antenna would perform as well as a dipole, particularly on 40 meters, so a test was the immediate requirement. Little did I know that the results would be so startling

My longest antenna was the previously mentioned ⅜ wavelength, 160 meter Marconi, 190 feet long. This was tuned to a ¾ wave on 80 meters for the test. This antenna was not too high, varying in height from 20 to 25 feet. It was tested against a diplole 30-feet high. The reports favored the ¾ wave, from 1 to 3 S-units, on both local and distant stations. The locals reported the largest change in signal strength, but every check favored the ¾ wavelength.

On 40 meters, I somehow managed to find space to erect a ¾ wave inverted *L* running

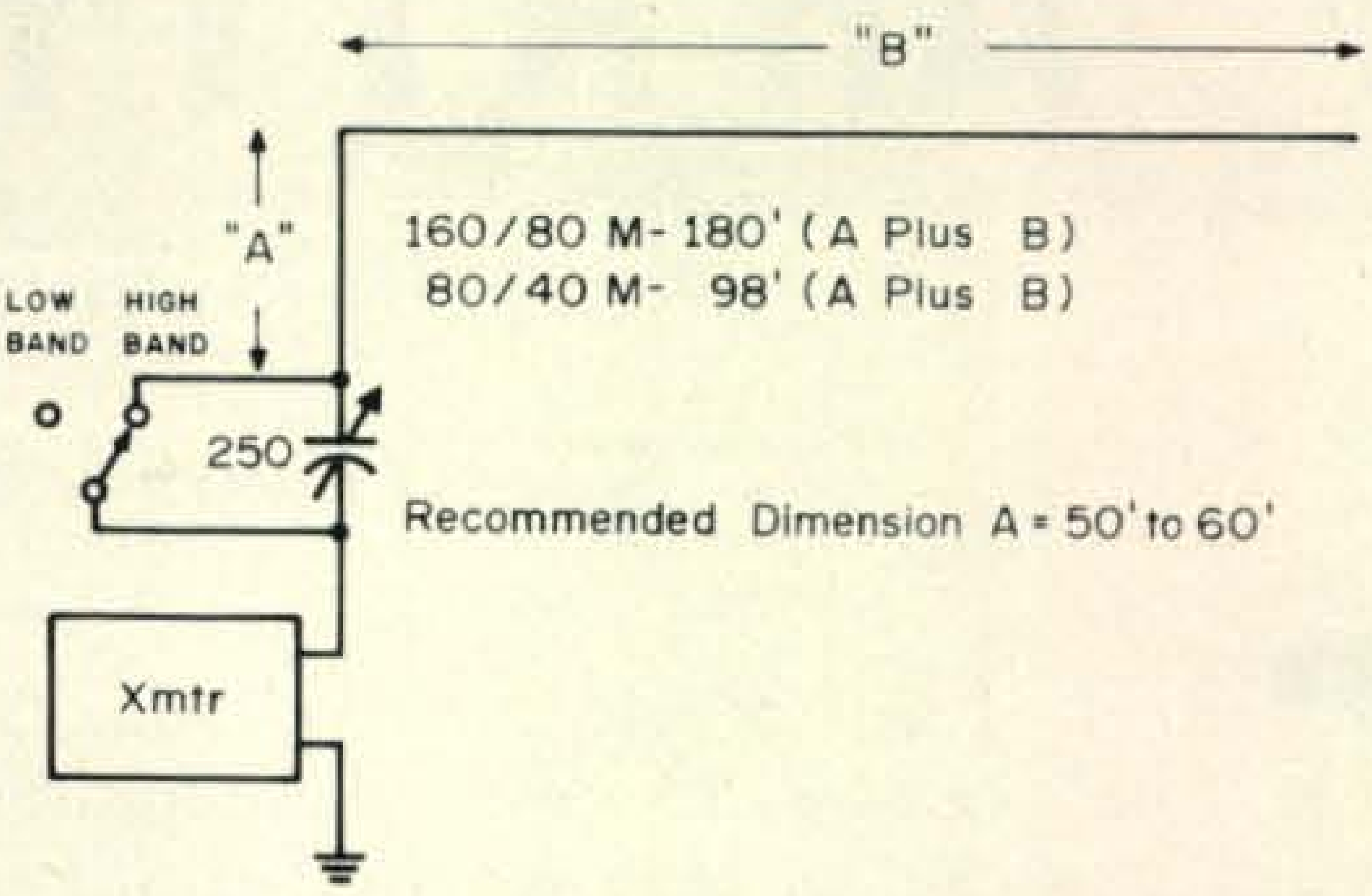

Fig. 2—Antenna modified for two-band operation by addition of variable capacitor.

27 feet vertically and the remaining 70 feet horizontally. In many cases it was 1 to 2 S-units better than the 50-foot high dipole that it was tested against. In other cases there were reports of no noticeable difference, but no check ever favored the dipole over the ¾ wave.

I attribute the success on 80 meters to the excellent high-angle radiation characteristics of the antenna. Some reports on 40 meters would be due to the same reason, while other reports would be due to the directivity of the dipole versus the apparent non directivity of the ¾ wave.

The tests convinced me that the worst I could do with a ¾ wavelength was to break even with the dipole, so down came all my low-band antennas and up went the tri-band in fig. 3 to join my Mosley tri-bander. I now have a good collection of various lengths of used and expensive coax cable that will collect dust in the basement.

[*Continued on page 92*]

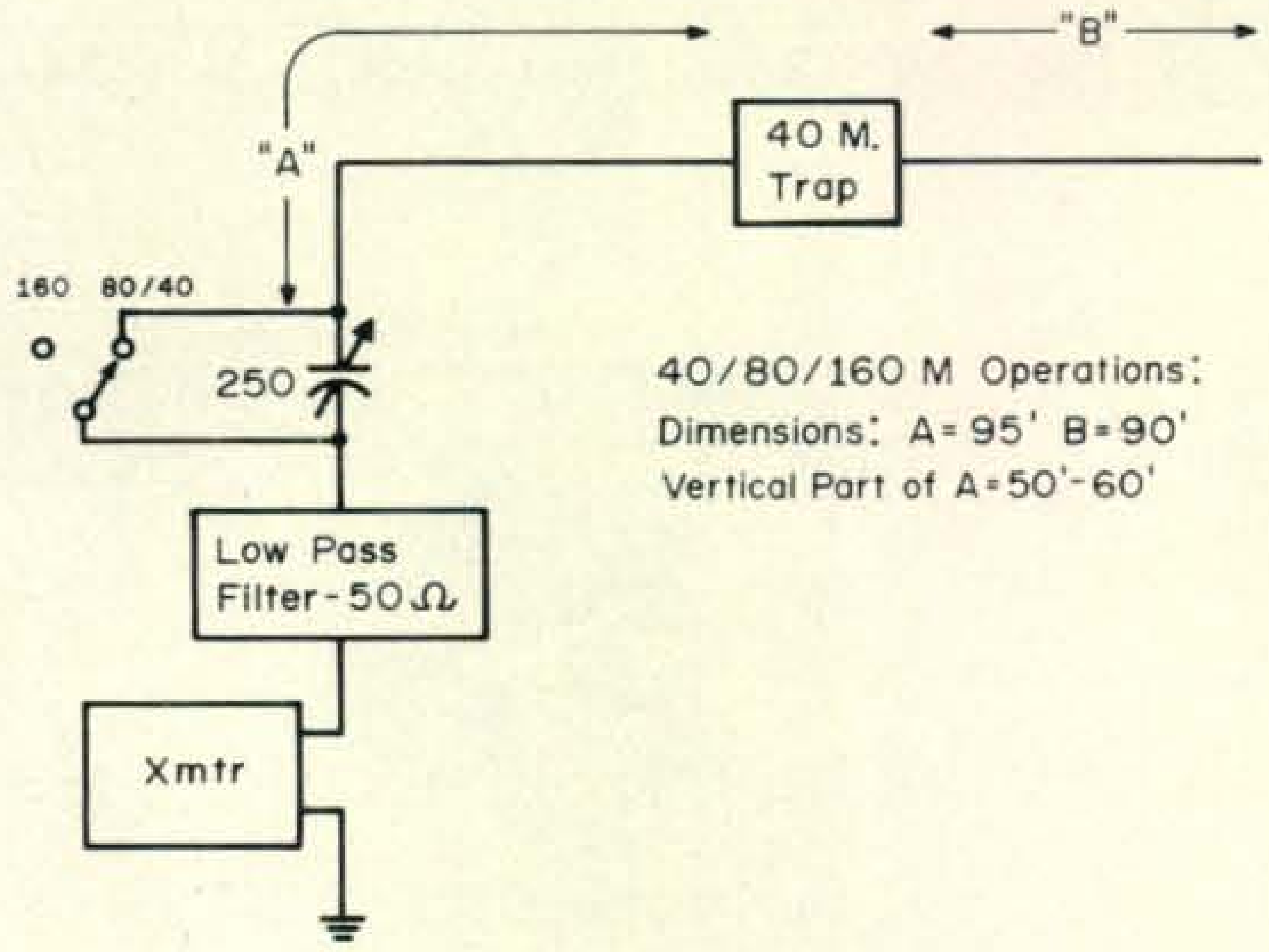

Fig. 3—The additon of a high-Q trap at the appropriate ¾ wave point will allow tri-band operation: ¾ wave on 80 and 40 meters, ⅜ wave on 160 meters. The overall length will have to be adjusted to compensate for the loading effect of the trap.

Oscar-6 News *[from page 40]*

range circle at 0352 and 0406 GMT.

8. Orbit #1735 is found to cross the equator at 0545 GMT at 133.6° W. Long., and its path just touches the range circle between 0555 and 0556 GMT.

The results of this example are summarized in Table 2 and are shown graphically in fig. 1.

By remembering that each orbit in a south-to-north direction crosses the equator 115 minutes later and 28.75 degrees longitude further west than the previous orbit, equatorial times and points of crossings as well as within range times can be calculated for any orbit, starting with the initial orbital data contained in Table 1.[4] ■

[4]For additional orbital plotting instructions, see "Australis - Oscar-5 - Where it's at"; Danielson, W. and Glick S., *QST*, October 1969, pg. 54. Also "A Simple Approach to OSCAR Communication's Calculations," Brown, C. W., *AMSAT Newsletter*, Sept., 1972, p. 16 and "The Oscalator," Scherer, W. M., *CQ*, Aug. '65, p. 54.

¾ Wave Antenna *[from page 43]*

The new antenna was raised with the first 51 feet in a vertical plane and the remainder in a horizontal plane, with two bends shortly after the trap.

Reception with this antenna seems to be substantially improved over the dipoles, particularly on 80 meters.

Because of the lack of space at this QTH, I was unable to test a ¾ wave 160-meter antenna, which would be about 387 feet long. I feel certain that it would outperform a dipole on this band, based upon the results of my tests on 80 meters.

The ⅜ wave on 160 has given a good account of itself in the past, and I'm now pleased to have it incorporated into the tri-bander.

The tri-bander has given excellent results in all departments, with very low s.w.r., good broad-band operation, and very adequate signal squirting and inhaling.

In constructing any of the antenna systems shown here, use a No. 12 or larger for 2 kw PEP while a No. 14 will be adequate for powers up to 1 kw PEP.

In the tri-bander, I used a Hy-Gain 333-366 trap because I happened to possess two; however, a trap from a Mosley TD-2 would be preferred for high-power operation, as it is rated at 2-kw PEP—compared to the 1-kw PEP for the Hy-Gain on 40 meters.

It is easy to "role your own traps." Complete information will be found on page 492, in the 18th Edition of the Radio Handbook, by Wm. Orr, W6SAI, published by Editors and Engineers. Reference to the ¾ wave antenna is made in the same publication on page 485.

Multi-band operation with the ¾ wave antenna is possible by inserting traps at the appropriate ¾ wavelength points. Some sacrifice in performance could take place, because traps shorten the physical length of an antenna. If such thoughts are contemplated, it is necessary to start the adjustment at the highest band and to work down to the lowest.

Whether you want a single, a dual, a tri, or a multi-bander—as the expression goes—try it . . . you'll like it. ■

Q & A *[from page 12]*

Bias Supply

"I need a bias supply for a rig I am building. It should be capable of up to —100 volts or so. Can you suggest a circuit? It should be adjustable."

See fig. 3. Be sure you use an isolation transformer. A transformerless scheme may give you some trouble.

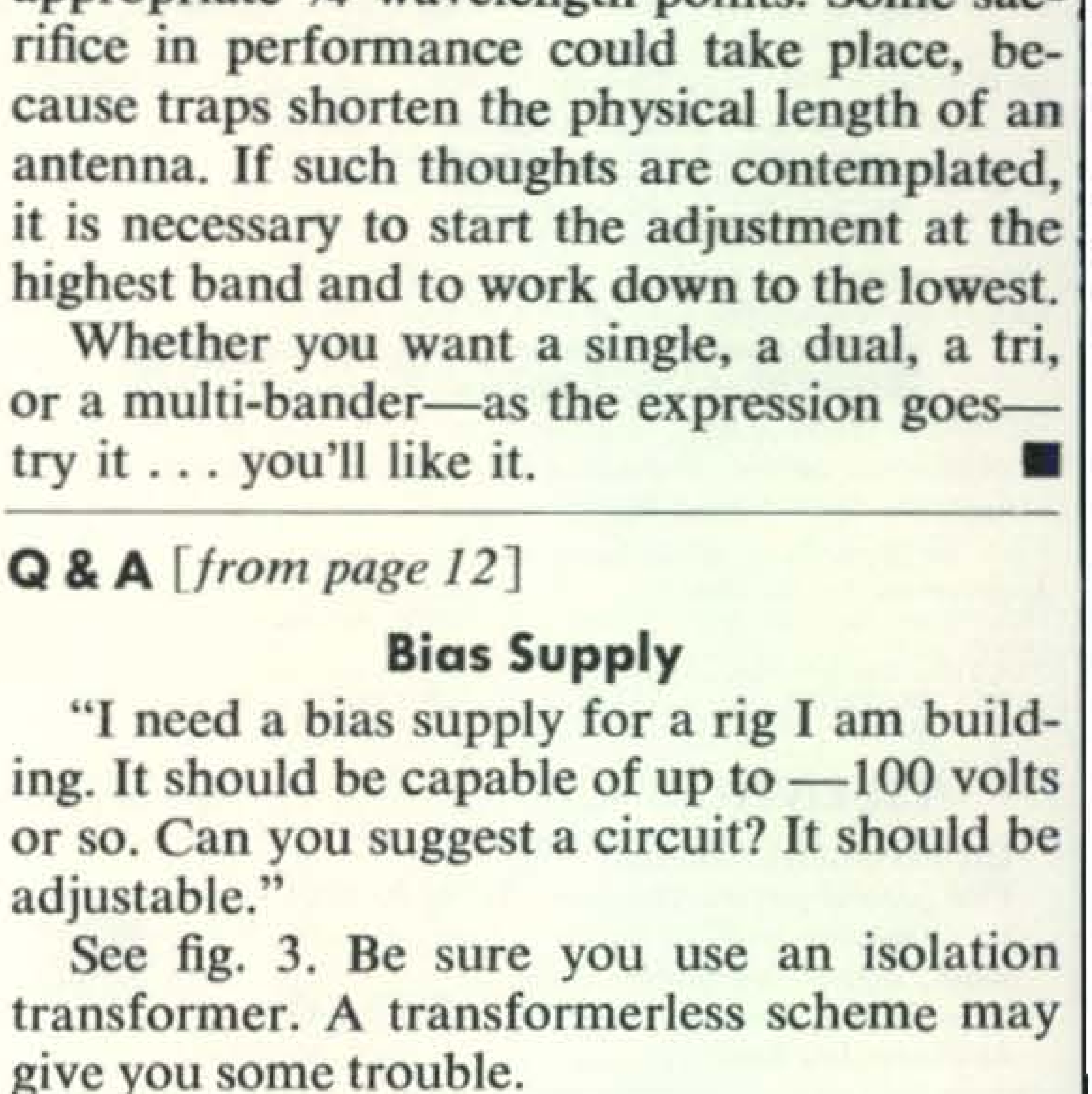

Fig. 3—A bias supply for 75-100 volts. Adjust R for required voltage.

UHF Tube

"I am going to experiment with a friend of mine in the 420-450 mHz band using c.w. and voice. For our final we would like to use a tube instead of transistors (if they'll work anyway). Your suggestion as to the tube we might use and where we can get more information will be appreciated. We'll run around 25 or so watts."

Well, I suggest that you might be able to use Eimac's type 7211, a planar triode. Write Eimac, Division of Varian, 301 Industrial Way, San Carlos, Calif. 94070, for applications info.

Tube Substitution (6GX6)

"Please tell me what tube I can use to substitute for a 6GX6?"

Use the 6GY6 or the 6GW8.