The wave, or Beverage, antenna can be used to get you on the lowest frequency amateur bands. Harold E. Davis shows how to do it, with some theory of operation thrown in for good measure.

The Wave Antenna

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The "wave," or Beverage, antenna is one with which many amateurs have been unfamiliar although there have been some recent references to it.

It has been the author's experience that this type of antenna has been very useful on some occasions.

Several years ago I decided to use the forty meter band to communicate with friends in California from my location in southern Michigan. Since my friends were not hams it was felt necessary to be able to put a phonepatch quality signal into the San Francisco-Oakland area.

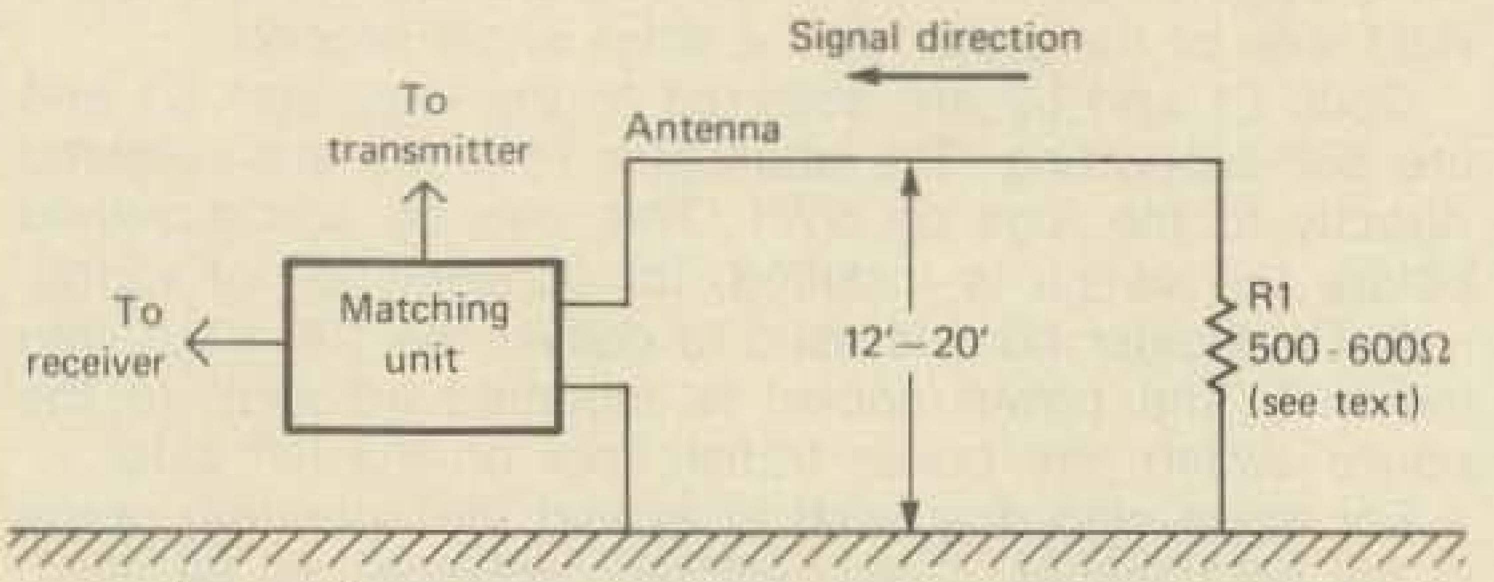

Fig. 1 – Installation of the wave antenna at W8MTI.

With the abundance of foreign broadcast stations on forty it didn't look very promising. The twenty meter band was out of the question because late evening, midnight or so local time, in Michigan, saw nothing but nearly dead band conditions. Seventy-five meters was totally out of the running for my purposes as all I had was the hundred or so watts of power from the CE-100-V.

So, back to forty meters as the only possible solution. The inverted vee and the short vertical that I had were of small use.

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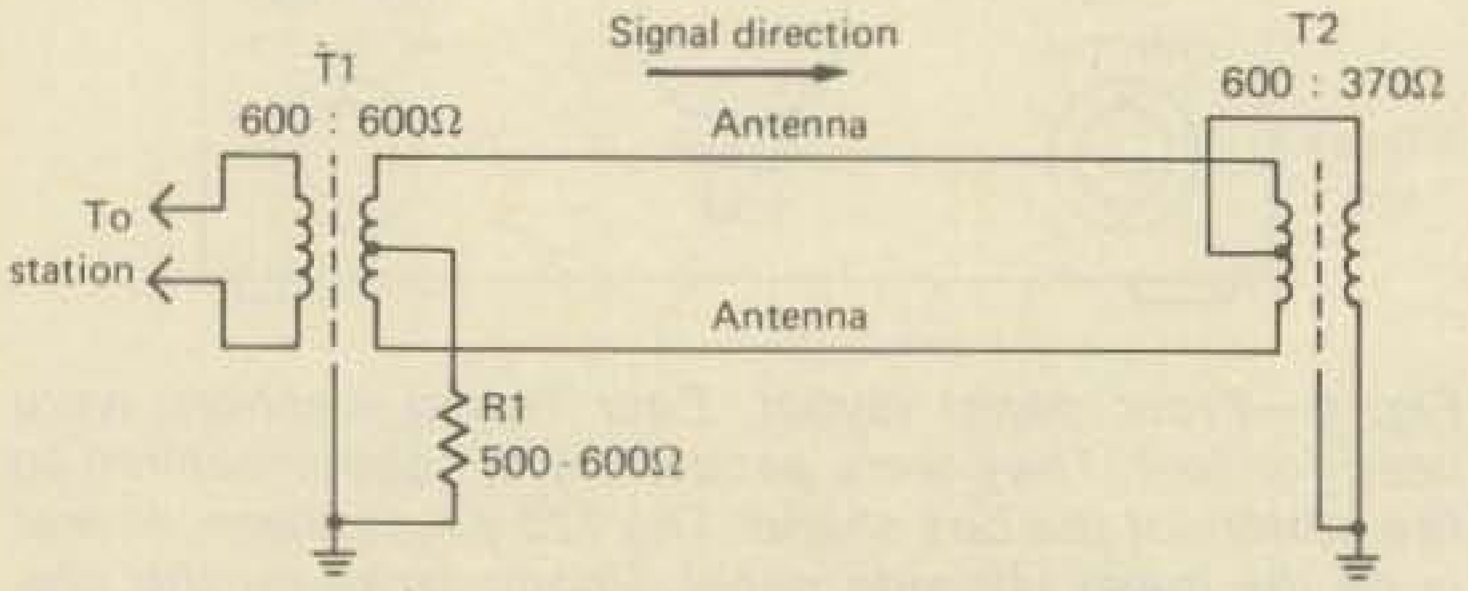

Fig. 2 – A possible configuration for use of the wave antenna for receiving.

While researching through a military communications engineering manual I discovered some interesting and useful facts regarding the wave antenna.

Putting this information to use proved rewarding in my purpose and at the same time proved the information to be true and applicable to amateur use.

Most of the following data was derived from the aforementioned manual and I hereby pass it along with a few additional comments of my own concerning my results.

Essentially, the basic wave antenna consists of a single wire of two or more wavelengths. I found about two and a half to be the best. The distant end of the wave antenna is best terminated in a resistive load of about five hundred ohms. The wire itself should be between twelve and twenty feet (4 and 7 m.) above the ground. I found the lower height fairly easy to maintain but, although twenty feet doesn't sound like much, when you're hanging a hundred meters of wire across a city lot it gets to be a challenge. Mine actually varied from slightly over twenty feet to about fifteen feet above ground.

The feed point should show about five hundred ohms and the terminating resistor should be well grounded. A crowfoot counterpoise was recommended but due to space limitations I resorted to three six foot (2 m.) ground rods. My termination resistor was a large carbon type of non-inductive characteristic, rated as 550 ohms at 250 watts. If the wave antenna is to be used for receiving only a much smaller resistor could be used, it being heavy enough to handle random inductive charges.

In any event, the terminating resistor must be capable of dissipating at least about 35% of the power being fed into the antenna from the transmitter.

My wave antenna was used both for transmitting and receiving but a slightly different arrangement is recommended if it is to be used for receiving only. More about this and other variations below.

How It Operates

The *wave tilt* principle is the basis of operation of the wave antenna. It operates thusly: as a vertically polarized wave travels over the ground, a component of the electric field appears which is parallel to the earth and in the direction in which the wave is propagated, i.e., the radio wave may be pictured as tilted in the direction of propagation. A voltage will therefore be induced in the antenna and oriented in this direction. By the same token, wave tilt action provides reciprocity when using the wave antenna for transmitting, that is, strongest radiation of a vertically polarized wave along the direction of the antenna.

Appearances of the vertical component while transmitting and of the horizontal component in the receiving mode are the results of wave tilt caused by the finite conductivity of the earth. These components due to wave tilt are greater over poor earth than over good earth and are very poor over sea water. In my case, the ground was somewhat poorer than I would otherwise have liked.

Because of the wave tilt factor and the relatively high impedance, this antenna proved quite efficient as matched against the inverted vee and the short vertical, the latter being the better of the two.

Inasmuch as the wave tilt effect is greatest over poorer ground conditions, the wave antenna is just not as effective over good ground and is definitely not recommended for use over salt marsh or sea water. Of course this applies mainly to its use as a transmitting antenna.

In my installation I used the configuration shown in fig. 1. Matching was accomplished with a tapped parallel tank circuit between the antenna relay and the antenna, thus providing a match for both the receiving and the transmitter.

The results obtained were significant although not scientifically recorded. This antenna was in use for several weeks

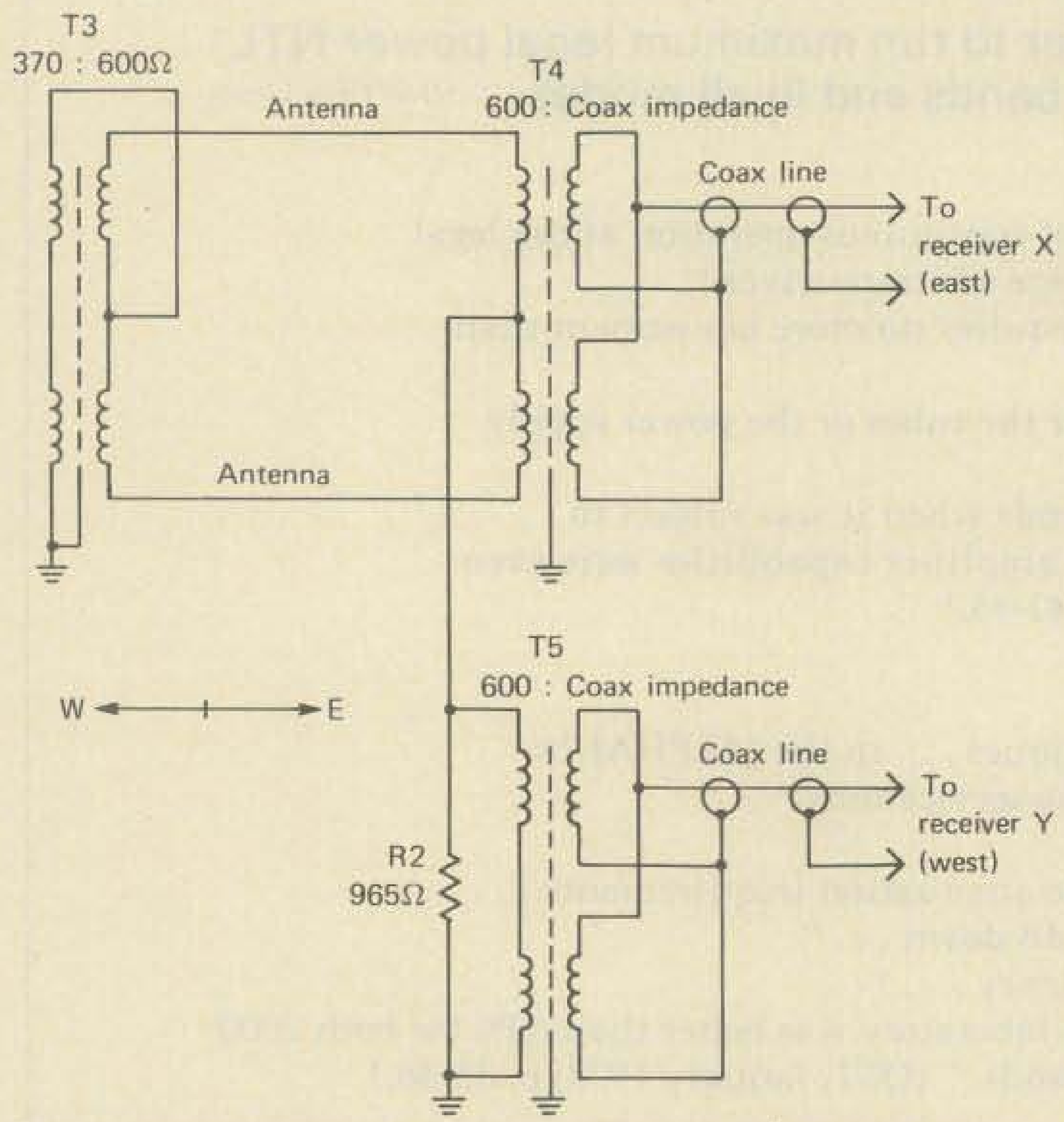

Fig. 3 – Installing the wave antenna for use with two receivers.

before a neighbor spotted it running across a very tiny corner of his lot. He proceeded to alter both the height and length of it.

During those several weeks I had a number of interesting results and some almost unbelievable signal reports from central and northern California and even some doubts as to if I was actually running only the 100 watts that I had or if I actually had much more. On occasion I was able to put in fair to good signals to the west coast even though band conditions were only poor to marginal.

The signals were almost always reported to be good enough for phone patch. I didn't make many contacts on this antenna outside the far west coast area and those that I did make were mostly in the Nevada and Oregon areas. Of course, this was my aim as my efforts were directed at reaching the Bay Area. There were times when I called stations that I could hear in other areas, mostly the third and fourth areas, but had no contact with any of them on the wave antenna. In many instances they were very strong on either the vertical or the inverted vee and all but totally disappeared when I switched to the wave antenna. This often occurred to foreign broadcast stations as well.

As luck would have it, I never made contact with my non-amateur friends in Oakland and they moved back to Michigan at about the same time my wave antenna project was so abruptly terminated.

The experiment did, however, confirm the information I had found regarding the wave antenna and which same information I confidently pass along to the antenna experimenter who desires useful and comprehensive information.

Variations and Considerations

For use as a receive only antenna, the two variations shown in fig. 2 and fig. 3 are recommended over the more basic wave antenna that I used for transmission as well as reception. In each case these antennas still operate on the wave tilt principle. These remarks apply mainly to lower frequency use of the wave antenna.

The wave antenna for reception consists of a pair of spaced wires supported approximately five meters above ground. As in the case of the basic wave antenna best efficiency is obtained at not more than two and a half wavelengths. Typically 500/600 ohm open wire line would be used. On 160 meters this would be nearly a quarter mile of line—not very practical for the inner city dweller but some ingenuity might overcome the problem.

The two wires operate in parallel with the ground return. If it is necessary to locate the near end of the wave antenna a couple of hundred feet away from the receiver, in order to reduce man-made noise or for any other reason, this may be done without detrimental effect.

Ordinarily, the wave antenna is terminated resistively at the end away from the receiver. That becomes the desired direction of reception. However, as shown in fig. 2, the direction of reception can be reversed or as shown in fig. 3 reception can be obtained in two opposing directions by using two receivers simultaneously or by switching one receiver between the two outputs of the antenna circuit.

In fig. 2 the signal builds up on the parallel line until it reaches the special impedance transformer which converts this balanced-to-ground signal and feeds it back as a balanced 600 ohm signal on the paired line to the receiving impedance transformer. The terminating resistor R is used at the receiver end and, again, as in fig. 1, serves to dissipate unwanted signals arriving from the opposite direction.

The configuration in fig. 3 is evident as a further development of that in fig. 2 and the same principles apply.

Wave antennas as short as one wavelength and up to two and a half lengths are generally effective but lengths in excess of two and a half wavelengths generally effect a decrease in signal strength. Any of these antennas may and have been used for transmitting as well as receiving and are useable over a wide range of frequencies. As mentioned above the termination resistor must be capable of dissipating at least a third of the transmitter's output power and it should be non-inductive. It should also be connected to a good artificial ground or counterpoise.

A valuable point to consider when designing a wave antenna is that by careful orientation a significant reduction in man-made noise and undesired signals from other sources can be realized. Sometimes the signal strength will be lower with the desired signal than it was with the inverted vee or the vertical but remember that most of the time the signal-to-noise ratio will improve and permit copy of a much weaker signal than would be possible on the other antenna.

In conclusion, this might not turn out to be your dream antenna. In fact it might even be a total bust. It's easy to construct and the lengths aren't critical, although directional location might be.

Whether this antenna turns out to be your boom or bust, you'll not know until you put one up and try it. ■