You say you can't see the sky for all of the wire crossing your property. Do you feel that it might be cheaper to own stock in your own cable company? Well K2OT has one solution to make it all better.

A Single Wire Antenna For 160, 80 and 40 Meters

BY HANK STECKLER*, K2OT

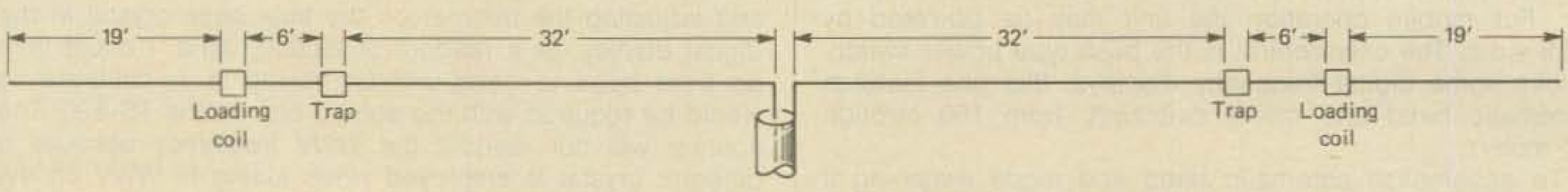

Fig. 1—The original antenna tried by the author. The traps are Model T-8040 and the loading coils are S-160 (Antenna Specialists).

With the acquisition of a TS-820, I acquired the capability to operate on the 160 meter band for the first time in my amateur career. Naturally, curiosity got the better of me, but what to do for an antenna? I was using parallel dipoles for 80 and 40 (actually parallel inverted V's), but the thought of another set of wires extending about my property turned me, to say nothing of the XYL, off.

It was then that my thoughts turned to some form of single wire antenna such as a trap antenna. However, to the best of my knowledge no manufacturer makes a trap for an antenna that covers 160, i.e., a trap that is resonant on 80. Being a lover and not an athlete, the thought of making a weatherproof trap was not appealing. Then I remembered the principle of the "choke decoupler"[1]. This uses just a pair of coils in the antenna, instead of a coil and a capacitor in a parallel tuned circuit, as does a conventional trap. The idea is that the coil, if it's reactance is high enough, will act as an r.f. choke and isolate the inner and outer sections of the antenna from each other at the higher frequency band and act as a loading coil at the lower one (assuming a two band antenna). One company, Antenna Supermarket, makes both a trap for an 80 and 40 dipole (T-8040) and a loading coil for a shortened 160 meter dipole (S-160). Could the two concepts be combined in a single antenna?

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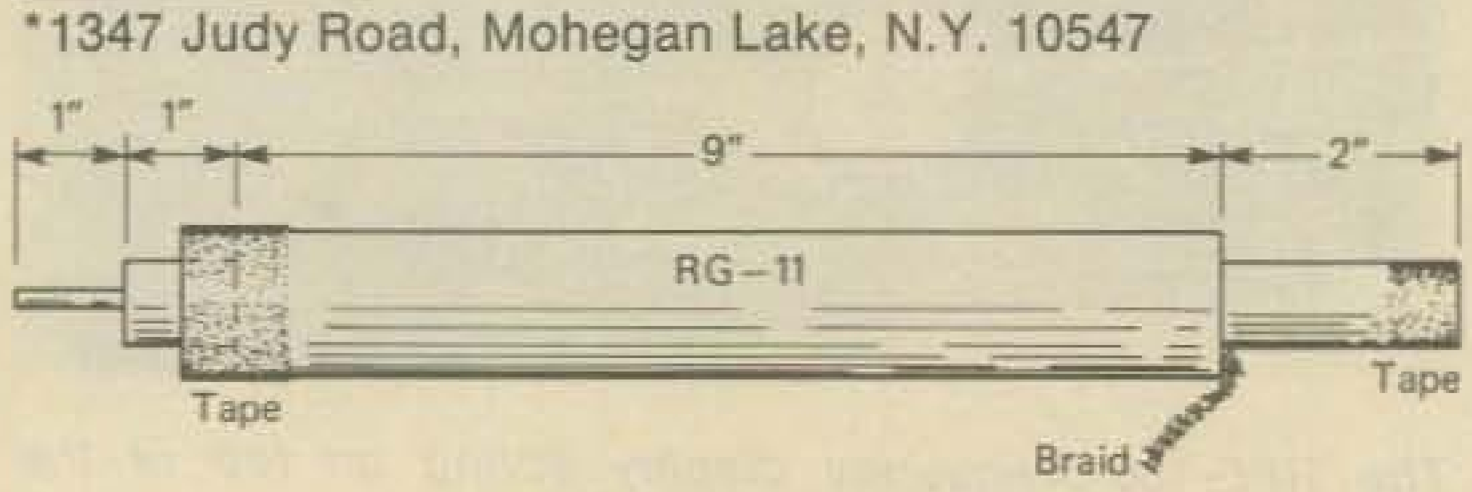

Fig. 2—The coaxial capacitor.

Fig. 1 shows this first attempt. The dimensions were set in accordance with the manufacturer's instructions. After some length adjustments, good s.w.r. was obtained on 40 and 160. On 80 the s.w.r. had a minimum at 3.5 MHz. Since I am a phone man, I tried to raise this frequency by shortening the lengths between the traps and the loading coils. Shortening them from the original six feet by as little as one foot produced absolutely no effect on 80! Stymied, I contacted the manufacturer, who suggested that the inductance of the loading coil (147 μH) was too low to provide enough reactance (3510 ohms at 3.8 MHz) to give choking action. If this was so, where did the 3.5 MHz resonance come from? Possibly it was second harmonic resonance of the 160 resonance. This will be a high impedance one. I use about 60 feet of foam RG-8 to feed the antenna, which is about right for a ¼ wave Q section. This may have transformed the high impedance to a low one, and hence given a good s.w.r. at the low end of the band. However, changing the length of the feedline had no effect on the s.w.r.

In any event, I considered these results unsatisfactory. The only thing I could think of was to turn the loading coils into traps by adding capacitors across them. But where to get high voltage capacitors? Then I remembered the trick of using coax to do the job[2]. Checking the voltage ratings of coax[3], I found that solid dielectric has a much higher breakdown voltage than foam. I used about 4½ inches of solid dielectric RG-58 across each loading coil, which will be resonant at about 3.8 MHz. I now got a double resonance effect on 80, one at 3.5 MHz, the other at 3.9 MHz. What was this caused by? Anyway, applying 2 kw PEP blew out the coax capacitors.

Clearly, solid dielectric RG-8 or RG-11 was what was called for. (Never end a sentence with a preposition? In the words of Churchill—"This is a rule up with which I shall not put.") As expected, the local Radio Shack store did not have solid dielectric coax, but they directed me to a CB store, that fortuitously had some in RG-11. When I told the salesman I needed about two feet, he asked for what? I replied for a multiband trap dipole. He had no idea of what I was talking about, but graciously gave it to me free.

Before beginning the reconstruction, I decided to read in more detail about traps. One article[4] pointed out that the traps should be resonant slightly lower than the lower band edge to give the broadest s.w.r. curve within it. Another good reason would be that power is never applied to the trap at its exact resonance, thus reducing the voltage that the capacitor must handle. With these considerations in mind, a capacitor as shown in fig. 2 was built. At the left end, where the inner conductor will be attached to one end of the loading coil, be sure to trim the outer braid off and tape around it. At the right end, where the braid will be connected to the other end of the loading coil, be sure to trim off and tape up the inner conductor. These steps will prevent any corona discharge problems. If RG-8 is used, remember it should be solid dielectric, the length shown as nine inches should be about six inches. With these lengths, the resonant frequency will be a little below 3.4 MHz.

Fig. 3 shows the final antenna. Except for the dimensions, and the addition of the coax capacitors in parallel with the loading coils, it is similar to the original antenna. Although not shown in the drawing, it is actually somewhat in the form of an inverted V. This might have a slight effect on your lengths if you put up a straight dipole or an inverted V with an acute angle.

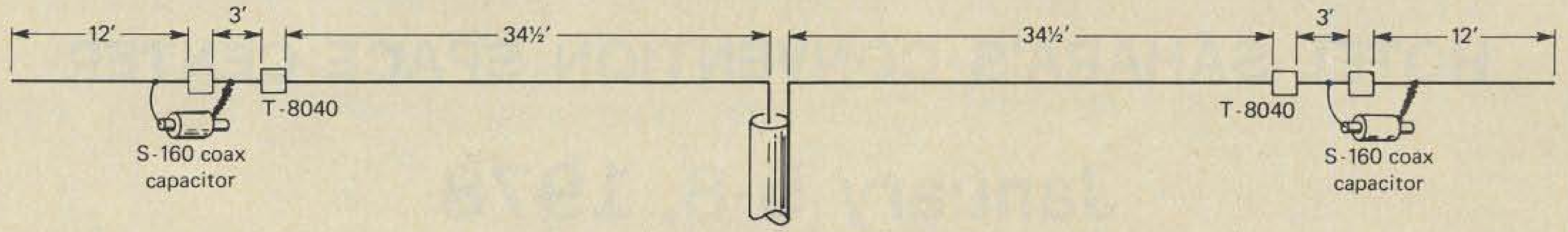

Fig. 3—The final antenna.

Fig. 4 shows the s.w.r. on the three bands. Forty is completely covered with an s.w.r. of under 1.5. Eighty has the most interesting curve. It can be seen that the double resonance effect is still present. There still is a low s.w.r. at 3.5 MHz and a perfect match at 3.9 MHz. Thus, by making use of this effect, this band is also covered with an s.w.r. of less than 1.5:1. If desired, the eighty meter three foot sections can be lengthened to four feet to eliminate the peak in the s.w.r. curve. If you find it necessary to adjust this antenna, always start with the 40 meter innermost sections first, then go to the 80 meter sections, and finally to the endmost 160 meter sections. As expected for a short antenna, the curve for 160 is very sharp. The minimum is at 1825 kHz, the "DX window" for the band. However, the first 75 kHz of the band is covered with an s.w.r. of less than 2:1.

In summary, for a total length of about 104 feet (including traps) a single wire antenna for 40, 80, and 160 was achieved with good s.w.r. It should be a good antenna for anyone with a rig that covers 160 through 10 meters and who already has a tribander for 10, 15, and 20. ■

References

[1] *CQ*, Oct. 1975, *"Antennas,"* page 24.
[2] *QST*, May 1975, *"Hinks and Kinks,"* page 45.
[3] *ARRL Antenna Book*, 13 ed., page 91.
[4] *CQ*, December 1973, *"Antennas,"* at pages 90 and 92.

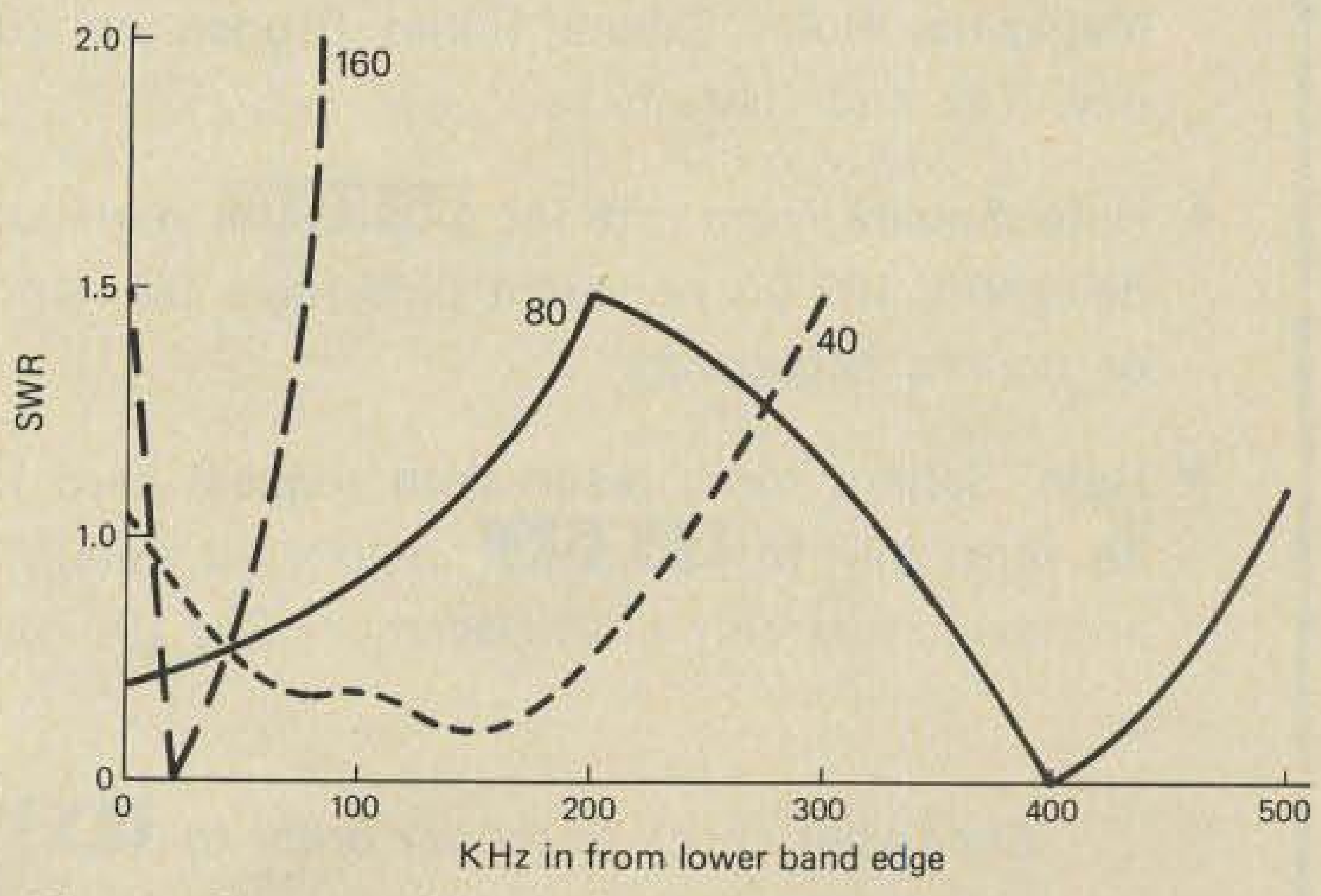

Fig. 4—S.w.r. vs. kHz in from the lower edge of the band for 160, 80 and 40 meters.