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The 20-Meter Double Bobtail

I have just discovered a new antenna which I think will be of great interest to many hams who have had trouble with radials but want to use phased verticals. I have never seen such an antenna, so I think this is the first description of a really interesting array.

I started out to make a 20-meter Bobtail in the classic way, because I do not have room for a 40-meter full Bobtail. My yard is only 73 feet wide, and it takes at least 132 feet for a 40-meter version. The antenna I was starting was the one shown in Fig. 1, and has been reported to have a gain of from 7 to 10 dB over a dipole at the same height. The pattern is shown in Fig. 2, and is broadside to the line of the antennas.

My yard is filled with trees, and I was concerned because the east half of the antenna would be running through the leaves of a large apple tree. I planned to use insulated aluminum wire to prevent the leakage into the leaves. I thought of aluminum wire, even size #8, as being light. However, I found that the 66 feet needed would, because of the insulation, weigh four pounds! That is a lot of weight to hang on the top of a pair of flimsy verticals.

I decided to try half of the antenna, which was in the clear, realizing at the same time that there would be no cancellation of the two horizontal wires and that the thing might not work well at all. See Fig. 3.

I installed radiators B and C, using 16½ feet of aluminum tubing, and mounted them on a pipe in the ground with U bolts and the usual mounting plate. It refused to tune properly. I remembered reading that if much metal were used in the mounting it would cause trouble because the bottoms of the radiators were at a voltage point. Of course, if you use wires suspended from wooden poles, as shown in Fig. 1, (D and E) then you will pull the wires down to a stake.

I sent to Sears for some fiberglass fence posts and epoxied two together for a very rigid mount, as shown in Fig. 4.

Sears sells two weights of fence post. The heavy, 48" green ones, catalog number 32G10434C, cost $1.99 each. They weigh 1 pound 2 ounces apiece (They also have 60" posts.)

For the coil, I used a 14-MHz coil from an old BC-610 transmitter and a 150-pF capacitor. It tuned the center of the phone band at midscale. It would be possible to use Air Dux or a hand-wound coil and tap up about two turns for the coax feed. These coils, incidentally, are available from Fair Radio Sales, Box 1105, Lima OH 45802.

At the top of each radiator I attached a ground clamp of the alligator type and fastened the end of the wire in the holder on the clamp.

I found that 66 feet of Belden 8000 antenna wire (or antenna wire available from Pace-Traps, Box 234, Middlebury CT 06762) weighed only 9 ounces, or 4½ ounces for 33 feet, if you build the bobtailed Bobtail.

A field-strength meter can be used at the antenna to peak up the tuning, but I evolved a more interesting way, requiring no help at the other end of the coax. I have a pair of 100-mW CB walkie-talkies on channel 15, and I held down the transmit button with a rubber band on one and fastened it to one earphone plugged into my transceiver, which was set at 14.275 MHz. The other I carried out to the antenna, and listened to the noise on 20 meters as I peaked up the tuning capacitor.

There are two other ways of doing this. One is just to plug in a line to the phone jack and carry a headset or speaker out to the antenna, and the other is to use a piece of four-wire rotator cable with two wires connected to the swr bridge and the other two to the keying jack on your transmitter. Set the off-resonance current to a safe level and then peak the tuning up to the center of the desired band. At the antenna, just key the transmitter and quickly dip the tuning capacitor and a series link capacitor for minimum swr.

I did not have a suitable link capacitor, which could be a 400-pF receiving type, so I used an L network to tune the link after I peaked up the tuning coil with my walkie-talkie method.

In the drawing I show some radials, which happened to be in the ground near where I mounted my driven radiator, but I could have just used an eight-foot ground rod, because the

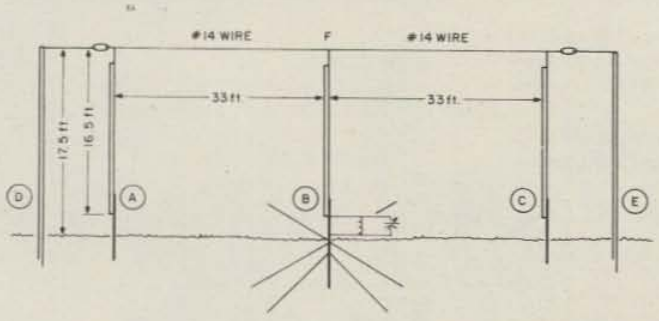

Fig. 1.

Bobtail does not need much of a ground. The high current is a quarter wave above ground and the ground losses are much less than with ground-mounted verticals.

The secret of the Bobtail is in the fact that the current maximum is at a quarter wave above ground, and that is where the maximum radiation is. Ground-mounted verticals have their maximum radiation at about ground level and therefore require a more extensive ground system, and are more affected by surrounding objects.

I found out several amazing things from this experiment. I had rather expected that the antenna array might end-fire, since the other antenna was a half wave out of phase by ordinary phased verticals standards. I listened to a California station which was 20 over 9 on my N/S delta loop, and when I switched to the verticals it was S5. I have my delta loop vertically polarized, and in the daytime I have S9 noise from my power line only 12 feet behind the antenna. When I switched to the Bobtail, the noise was completely gone, nulled out by the side rejection. It was astounding. This improved rejection causes me to believe that the Bobtail is more efficient than the ground-mounted array.

The tuning is not critical, and tuning to the center of the band gives good results.

When I first connected my 20-meter truncated Bobtail I was crestfallen. It was so quiet that I thought it was not working at all. The loss of the power line hiss, the lack of static or any electrical noise, and the weakness of the mostly western stations at night made it seem like the sort of blackout one hears when there is a solar flare and the band is dead. However, signals from the south were strong.

I called a friend who lives about six miles from me, KA8CGE, and he reported the delta loop was about 10 over 9 and the Bobtail was only about S7. I got out my county map and saw that he was west-southwest of me, showing that the pattern was quite narrow—perhaps 60°. See Fig. 2.

I made a test with WA4OLP in Duluth, Georgia, near Atlanta, and he reported that the Bobtail was stronger than the delta loop by about 10 dB.

That night, I called KC4USV at McMurdo Sound, Antarctica, and they gave me a report of 5 by 5 on the delta loop and 5 by 7 on the Bobtail. Remember, this is only a two-element Bobtail, and the three-element version with the cancellation of the horizontal sections could have been about S9. KC4USV was also S7 here, as the propagation was rather poor. Considering that they have a Collins 2-kW station and mine was only a single 3-500Z driven by a Hallicrafters SR160, I thought I was doing rather well.

I believe that this antenna could be current fed by running coax up the quarter-wave radiator of tubing and feeding the top wire at point F. I tried it that way first, actually, but it failed to tune correctly. After I had taken it down in disgust, I realized that previously I had disconnected one of the verticals, a fiberglass Columbia Products antenna top section, at one foot from the top to make it tune better as a ground-mounted vertical. I had clipped the center wire through the insulation, and thus had only the top 12 inches connected instead of the complete 16½-ft. antenna. It had been so much trouble that I had no desire to completely remount the array, and just went to the voltage feed. Now I believe that the other way will work. This would make the antenna tuner unnecessary.

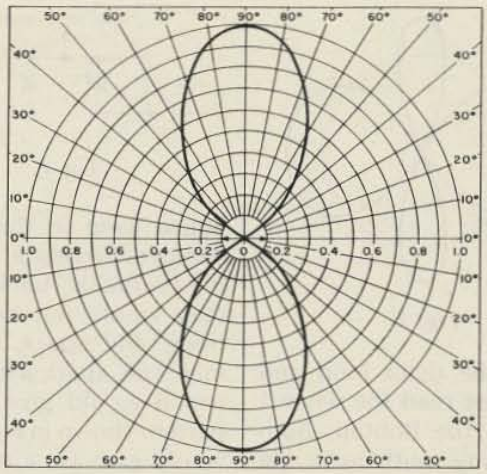

Fig. 2.

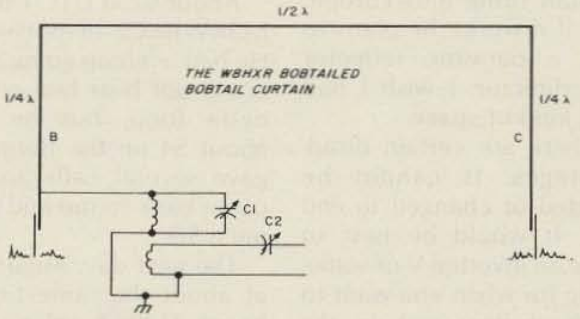

Fig. 3.

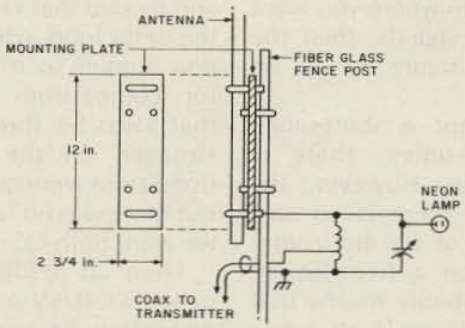

Fig. 4.

I did not intend this article to be one which extolled the well-known but seldom-used Bobtail, but my accidental discovery that two elements worked so well made me realize that here is the answer to the problems of 40-meter phased verticals. Since the full 40-meter Bobtail takes more room than the average ham has available, and since the ground-mounted verticals take such a large radial ground system, using only two of the verticals in the "bobtailed Bobtail curtain" seems the answer to a dream. The high position of the high current section should make the signal at least an S-unit better than the ground-mounted verticals, and in the many years I spent with two phased verticals running phone patches for Antarctic stations, I never had so completely nulled out noise on the sides of my antenna, nor had such rejection of west-coast stations as well as those in between.

WA7NHU gave me over

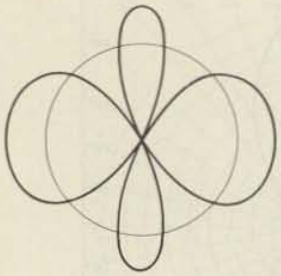

Fig. 5.

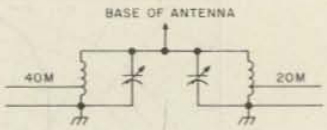

Fig. 6.

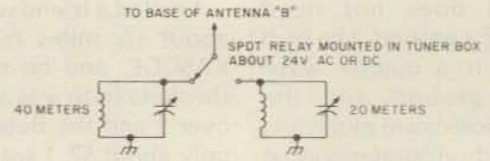

Fig. 7.

S9 on the delta loop and could not read me when I went to the Bobtail. Both were firing south/north. He is in Hereford, Arizona, and is so enthused that he is going to put up a full 40-meter Bobtail firing into Europe, and if it works, he plans to add a parasitic reflector and director. I wish I had that kind of space.

There are certain disadvantages: It cannot be rotated or changed to end fire. It would be best to have an inverted V or something for when you want to work stations not in the beam, or have two Bobtails. But if you have one firing in a direction where you want the best signals, then the two-way figure 8 will be good.

It is not a short-range antenna unless there is short skip. However, the fact that there is no cancellation of the horizontal section on a two-element array probably means that there will be high angle reception in the near distance.

The good results are not from gain in itself, but in the lowered angle of take-off, compared to a dipole. This advantage shows up on paths in excess of 2500 miles. Close-in there often is no great improvement.

About a week after I tried the two-element shortened Bobtail, I decided that I really wanted an antenna which would fire east/west since I had more interest in those directions than north/south.

I could not put up an antenna in that direction because trees and my house were in the way. I decided, therefore, to move the verticals back where they would not be in the trees, and space two elements 66' apart, a full wave, which would give me the pattern shown in Fig. 5. This would give me a nice lobe E/W and a narrow one N/S. This I did, with the following results:

About 0750 UTC I heard JA3KWJ/AC2 in Botswana. He had a pileup going and I could not hear him on the delta loop, but he was about S4 on the Bobtail. I gave several calls and he came back to me and gave me a 5-9.

The next day, August 15, at about the same time, I heard ZL2ASX calling CQ, and went back to him. We had about a 20-minute chat, and he said that I was S2 on the delta loop, which I had now turned so it was E/W for comparison. He said that I was S5, three S-units stronger, on the Bobtail. Conditions were quite poor, but there was no fading and we were both Q5.

Then at 0900 UTC I called KC4USV at McMurdo Station, Antarctica. Conditions were very poor, but the band was completely silent, so we conversed for 22 minutes. He said that I was not moving his meter, but that I was solid copy. The delta loop had stronger audio than the Bobtail. I was surprised until I checked the pattern. McMurdo is about 15° west of south, and is probably just outside the south lobe in the null.

I also found that Florida stations were weak on the Bobtail but strong on the delta loop. This rather confirms the pattern. Miami bearing is 167°; Atlanta is 187°.

I wish I could turn my array to fire NE/SW off the ends, but I can't. At least I have found an antenna which bears further investigation. I have decided that I will now add a center radiator and make it a full Bobtail as in Fig. 1. At least I can work South Pole Station and part of the South Pacific, and north, I can work into India, Pakistan, Mongolia, Central Russia, and the North Pole area.

I just couldn't resist trying out the full Bobtail, especially since I hear rumors of China showing up. The long range of the antenna means little or no interference from strong western or eastern stations, as I will null out or skip over most of them.

Of all the high-gain antennas, this is the simplest to construct for 20 meters that I have ever found.

So, I moved my Bobtail north about 6 feet to clear the trees and added a third element, so it is now as shown in Fig. 1. I tried it for only two days, and conditions are only fair, but I found some interesting results.

Last night I worked KC4USV, and while he was only about S5 to me, he gave me S8. The skip had moved west and was good into Grand Rapids, Michigan, where W8YCI reported him as 30 over 9. However, Pete at McMurdo said I was phone-patch quality.

Earlier in the day, I worked Tony WB4KKL on Captiva Island, Florida, and as I was 40 over 9, he would not believe I was barefoot. This was at 4:20 pm local time. I put on the linear for a few seconds, and he said I was 52 over 9. We talked about antennas for an hour.

At 0740 UTC, I worked G5CAX in Potton, 50 miles north of London, and compared the E/W delta loop with the Bobtail. I was 5/5 on the delta loop and 5/7 on the Bobtail, showing that the pattern is wide enough N/S for a good signal at 48°.

I plan to leave it this way for several weeks for a better evaluation.

There is one other thing I believe is worth trying. The 40-meter version should also work on 20, with a four-lobe pattern as shown in Fig. 5, with two coils, using separate feedlines, and without a relay as in Fig. 6. The coils should not react any more than a multiband dipole does.

With two half-wave verticals on 20 at one wavelength spacing this should be a really hot item. By orienting the array to fire northeast, there should be good lobes in all four DX directions on 20.

If some younger ham with some space should try this out, I am sure that *73* could use an article on the results. After 60 years of hamming, my mind still dreams up antennas but my energy reserve is getting lower. They certainly are fun, though. If you try the relay method in Fig. 7, the relay should have good insulation, as the rf voltage at that point is high.

A small wastebasket or plastic jar can be turned upside down over the coil and capacitor to protect them from rain and snow, and the bottom left open. The bases of my verticals are about 10 inches from the ground, but that is not critical. The ground lead should be as short as possible. Any leads from the coil become part of the antenna.■