The Secret Antenna

Bob Harry G3NRT proves that not all April Fool's articles are a joke. Sometimes they can be made to work!

Some years ago in a radio magazine (though not *PW*) there appeared an April Fool article describing a rotary clothes line as an antenna. I didn't find it amusing, for at first sight the rotary washing line is only a short vertical with a capacity 'top hat'. In fact it's not too dissimilar to the sort of antenna used on 1.8MHz operation by mobile operators.

So to prove a point, I took my TS-520SE into the garden, connected the output to the base of our own rotary washing line, threw out a length of wire as a counterpoise and worked a Hungarian station on voice using s.s.b. The contact was so good, I received a 55 report. So, satisfied I returned indoors and to Amateur operation using less exotic antennas.

The years passed, and I thought no more about the idea, until one day my wife said it was time to replace the rotary line. The memory of that single contact energised me to see whether 'improvements' could be made to effect a better radiator before the clothes line was replaced. As it was to be replaced, I was effectively free to do whatever I liked to it.

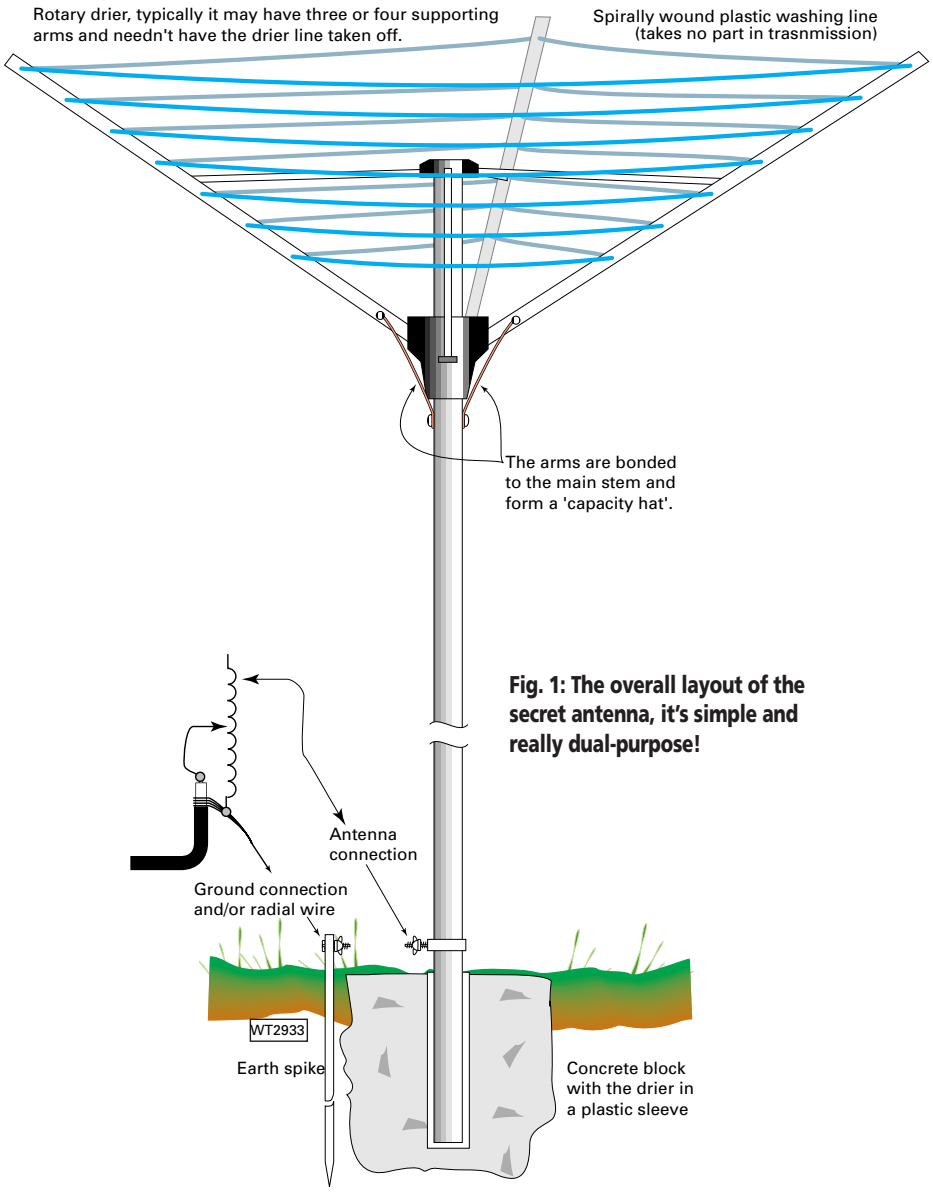

Fig. 1: The overall layout of the secret antenna, it's simple and really dual-purpose!

Vertical Metal

The type of rotary washing line I refer to, has a vertical metal tube, some 35mm in diameter. Some go into a ground-piecing spike, but ours was resting in a plastic tube embedded in a chunk of concrete surrounded by grass. Each of the four metal arms, was 1440mm long, and spread outwards and upwards at an angle to support the line. The plastic washing line is wound in a spiral form around the frame, giving a great deal of 'space' while taking up little real-estate.

The plastic tube insulates the rest of the metal line from the earth. My first move was to drill two holes in the vertical portion and the each of the spreaders and link them electrically with short lengths of copper braid. I now had a short vertical with - depending on how you viewed it - a short vertical antenna with a capacity top - or a slightly longer one with several bent top parts.

I connected the inner connection of some coaxial cable, via a car exhaust clamp, to the bottom of the support pole. I then connected a simple counterpoise about 5m long, connected to the screen of the cable and laid it out on the grass. The other end of the cable was connected through an s.w.r. meter to my trusty TS-520SE - 25 years old and still going strong!

The reason for using the old TS-520SE 'war-horse' was because it possessed an adjustable pi-network, matching the transmitter's output to whatever impedance was presented to it. Most modern transmitters are designed to work into a 50Ω load and shut down if the load impedance is too high. As I didn't know what value of feed impedance I would be encountering, I thought that it would be easier to use the older rig.

Suburban Garden

Assessing antennas in a suburban garden is difficult if not near impossible because of size and area constraints. Professionals

usually have acres of land and lots of expensive test equipment, which I did not have. But I did have a multi-band vertical antenna that I normally use. Like my transceiver (and myself) the vertical is venerable, and only covered the 'old' bands of of pre-WARC days (3.5, 7, 14, 21 and 28MHz).

I reasoned that comparing this 'old' vertical antenna with the clothesline was as fair an assessment as any. I even connected a similar length of coaxial cable to both the new antenna and the vertical, so that cable losses would equal (or at least very similar).

My first check was to measure the s.w.r. at the transmitter point to the new 'antenna'. I found just under 2:1 was typical for 14 21, and 28MHz, but a little under 3:1 was evident on 7MHz, with an absolutely awful 4:1 on 3.5MHz.

Listening on the bands and switching between antennas showed the clothesline to be several S-points weaker than my main vertical, but I found it rather difficult to assess accurately. Signals would fade, or stations would stop transmitting just as I was making a comparison. It was difficult to be certain about the efficiency of my clothes line antenna.

Definitive Answer

Not discouraged by my inability to find a definitive answer, I contacted my friend **Rob G6BDV** who, as well as being the owner of a switched attenuator, lives about 500m away. At such a close distance reception would certainly be by ground-wave and therefore free from fading. This, I thought should make definitive readings easy to evaluate.

With Rob's help we carried out a series of signal strength comparisons. Rob placed the attenuator in series with his antenna and made adjustments it to give the same S-meter reading from signals from both my antennas. So, when I switched antennas he readjusted the attenuator to get the same S-meter reading. This way the S-meter merely provided a reference point the difference between the signals was the difference between the two attenuation levels.

The results are shown in **Table 1**. To allow for readers who may not be familiar with decibels (db) I have added a third column, which converts the dB reading into the equivalent power that would be needed to make the clothes line antenna produce the same signal strength as the vertical.

Although poor on 3.5 and 7MHz the clothes line was only 5dB down on 14MHz and was better than the vertical on 21MHz. This improvement reversed on 28MHz, where it was down by 10dB. So, on 3.5MHz, to make up the 25dB difference in signal strength I would need a staggering 316W fed to the clothes line antenna, for every 1W fed to the reference vertical!

"Sorry old man - QSB caused by flapping washing".

Band (MHz)	Gain (dB)	PWR equiv. needed (W)
3.5	-25	316
7	-20	100
14	-5	3
21	+5	0.3
28	-10	10

Table 1: Signal strength comparisons. (See text for more details.)

More Efficient

The figures in Table 1 show that the clothes line antenna becomes more efficient as the frequency goes up, until, on 21MHz it's actually more effective than my vertical antenna. Then on 28MHz I again needed 10W fed to the clothes line for every watt to the vertical. The tests were carried out on an empty line. When damp clothes were hung on the device, it changed the s.w.r. slightly but had no noticeable effect on performance. But enough of numbers, would the secret antenna (as I now thought of it) get QSOs?

Calling CQ on 14MHz - using the (reference) vertical antenna - I contacted a Swedish station and received a 57 report. Switching to the clothes line the report changed to a 53 one. To try to improve performance I tried adding extra ground wires but no improvement followed.

I then realised I was making the mistake of treating the secret antenna as if it was like my vertical - insulated from earth. It obviously was not; the bottom of the vertical metal tube formed a capacitor, with the plastic sleeve as a dielectric, and earth. There was also unknown resistance between the base and earth. Whilst I could do nothing about the resistance, if I put a coil between the feed-point and earth (cable outer braid and counterpoise) the capacitance would then become part of a parallel resonant circuit.

Band conditions were not good at the time of these tests and the best band was 14MHz so, I selected this band for testing. I connected a 7µH coil across the feed-point to the washing line and with a couple of short leads with crocodile clips tapped up and down the coil for best s.w.r., adjusting both the tap to the antenna and the coaxial cable, as shown in **Fig. 1**. Once the best s.w.r. was found the clips were replaced with soldered wire connections. Everything was mounted in a plastic sandwich box to provide weather proofing.

Returning to the shack I tuned to 14MHz and found a s.s.b. contest in progress, and I quickly worked stations in European Russia, Romania, Ukraine and Sicily.

They all gave me 59 reports! Well, of course these were 'contest 59s', but none of the stations spoke those classic words "You're 59 - please repeat my report and serial number."

Improved Performance

Adding the coil improved the performance on 14MHz but it made the antenna effective on one band only. Later, I removed the coil and reconnected a shorter coaxial cable directly to the antenna. I had a contact on 14MHz with a station south of Hamburg who gave me a report of 59 on the vertical and 5/6-7 on the secret antenna. It is a matter of choice whether single band working is worth sacrificing the other bands.

The antenna comparisons and contacts on 14MHz indicate that the secret antenna should give reasonable performance for its size on all the bands from 14-28MHz without the complication of a matching unit.

A well known High Street chain of shops sells 'rotary airers' of various shapes and sizes, the most expensive costing £70. One advertisement in a recent *PW* offered an h.f. vertical for the same range of frequencies at £99.95. You do the maths!

The secret antenna is very good value. If you have a small garden or restrictions on the erection of antenna, you would be a fool not to try the 'secret antenna'! **PW**