Antenna Workshop

Plumbing For Traps

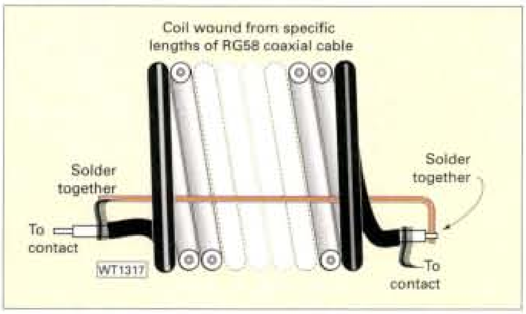


Fig. 3: Choose the length of coaxial cable from Table 1 and wind and connect it in the form shown here. (See text for more detail).

Charles Reynolds GW3JPT has been down to his local plumbing parts suppliers and here are some traps that he has constructed in the outflow of his antenna!

Having produced antenna traps for many years, I have been urged to share the technique by friends and members of my local radio club. Although I have been making traps for a long time, I have not seen a great deal of information about how to create them for particular bands. So, I'd like to present my method that I've developed over the years.

Finding a design for an antenna creates many questions: Will it fit the site? Where do I get the materials? Will it work effectively? These are but a few of the ideas that spring to mind. In most cases the physical layout of the site sets the limits on the type of antenna that you can use. Which, in many cases, will be a dipole of some sort or perhaps a long wire if enough garden length is available to erect one.

Although it's possible to put traps in a long wire to create resonant sections for several bands on one length of wire, I'm going to concern myself with a dipole antenna with a similar set of traps in each leg as shown in **Fig. 1**. The top antenna configuration is shown with just one trap in each leg, and has two main bands of operation.

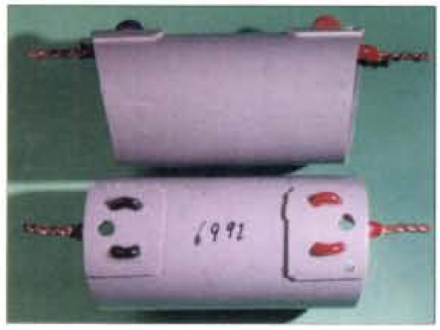
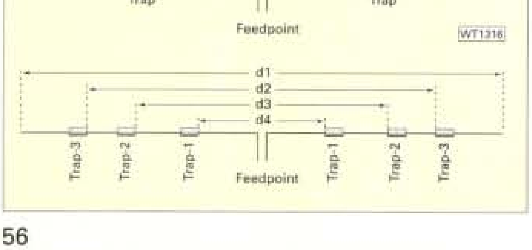


Fig. 2: A pair of completed traps for 7MHz in 'side' and 'top' view. The design is so repeatable that the resonant frequencies of the two traps are only separated by 6kHz (the hidden value being '6998').

F_t (MHz)	L (mm)	F_t (MHz)	L (mm)
3.750	2980	18.110	730
7.000	1640	21.200	640
10.075	1200	24.900	530
14.175	900	28.850	500

Table 1: Lengths of RG58 coaxial cable needed to make traps for different bands. You may need to modify these dimensions by a few millimetres depending on the exact coil dimensions involved.

Fig. 1: The general layout of a dipole antenna. With only one pair of traps, d2 represents the λ/2 value of the frequency to which the traps are tuned. With the multiple trapped dipoles the presence of one or more traps within each resonant length changes the overall length somewhat, but the same principle holds.



Antenna Trap

If we consider that there is no trap in the antenna then the main (λ/2) resonant frequency has a wavelength of d1, which as the length is maximum, will have the lowest resonant frequency. Now let's move upwards in frequency. What happens when we reach the resonant frequency of the trap?

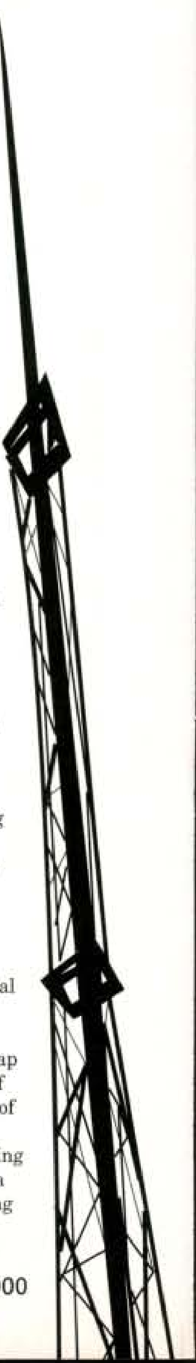
The trap itself now acts effectively as an insulator removing the outer wire lengths. If we arrange that the antenna length, d2, is resonant at the same frequency as the trap is, then we effectively have a (λ/2) resonant antenna on this higher frequency as well.

So, the antenna can be resonant on **two totally non harmonically related** frequencies. And of course we can extend this idea by putting more traps, resonant at different frequencies, in each antenna element, to create a 'single' dipole that can be resonant and effective on any combination of the traditional and the WARC bands (at h.f.).

Traps marked 'Trap-3' are resonant at the lowest frequency and those marked 'Trap-1' are designed for the highest frequency. But how are the traps made to be resonant at one design frequency? How can we ensure that the design is repeatable?

My first attempts at making traps, were of the same form that I suspect many others have tried, they were made using heavy gauge copper wire and very high voltage capacitors. However, I found them not particularly repeatable and were also quite expensive to make. I needed to find an option that was both cheap to make and was repeatable without needing professional style methods. I have overcome both drawbacks with my traps presented here. So, you may ask what is 'my secret'?

The answer is that my secret is to create the traps using known length of RG58 coaxial cable wrapped around and placed inside lengths of the plastic piping, now available in all good DIY outlets. As the piping is of known size, my designs are repeatable. The piping is easily worked, needing few tools and, of course it's waterproof for use in all weathers as shown in the example of **Fig. 2**!

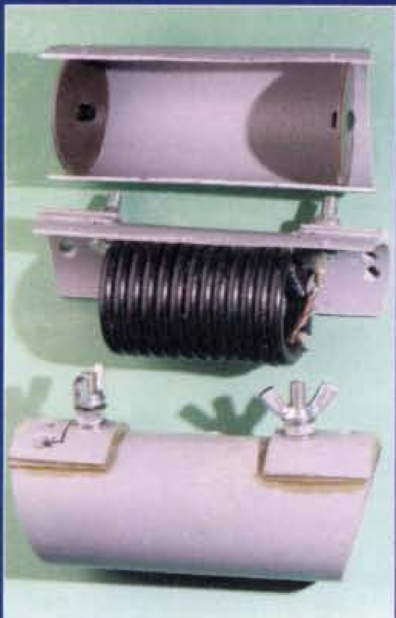


How Is It Done?

So how is it done? How can you use length of coaxial cable as small effective antenna traps? Well, the answer lies in coiling them up on (or inside) the plastic piping. Let me describe how to make the trap for 7MHz as an example. As shown in the listing of **Table 1** you will need a 1.64m (plus 'ends') length of clean fresh RG58 coaxial cable.

I use a section of (two inch) 50mm diameter tubing as the outer for the trap and a section of (one and a half inch) 36mm diameter as the former for winding the trap on.The former that I use for winding the traps, is just a short length of the 36mm diameter

CHAS REYNOLDS GW3JPT EXPLAINS HOW HE CONSTRUCTS HIS OWN ANTENNA TRAPS



A trap split to show the 'insides', compare this to the drawing of Fig. 5.

Detail of the end where the coaxial braid is connected to the element. Note the piece of outer insulation used to cover the join of the inner conductor to the short length of heavy copper wire, and the strain relief holes in the 'top' lip.

Two variation of 7MHz tuned traps, one internally coiled and one still on the original former. With these versions extra care is needed to ensure that they are fully sealed from the weather.

Showing the strain relief holes in operation with the wire forming the elements.

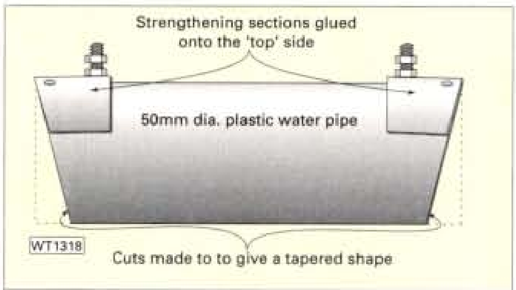


Fig. 4: Side view of a completed trap using screw terminal. The holes in the fortified areas act as strain relief points.

plastic pipe. Cut a lengthwise slot in one end about six to eight millimetres wide and about 25-30mm long.

The slot forms the 'clamp' to hold one end of the coil whilst it is being wound. To wind the actual coils for each trap, choose the length of RG58 coaxial cable (Table 1), prepare as shown and insert one end of the coaxial cable in the slot cut in the pipe former.

Wind the coaxial cable around the pipe, keeping the cable and turns quite tight together. But it's important to note, that if you over tighten the turns, they become difficult to remove later. Whilst still holding the free end on the coil securely, overwind the whole coil with a wide insulating tape (if possible wound with the opposite twist, this helps to lock the coil turns together).

Firm Grip

Take a firm grip on the coil and remove it from the former, if the winding operation is successful, the coil will remain in shape. Now take a length of heavy single gauge copper wire, place it inside the coil and solder one end to the coaxial cable's braid at one end of the coil. Slide an length of insulating material along the wire to cover up the area around the soldered joint (I use a length of the outer insulation cut from a length of RG58 cable).

The other end of the short length of copper wire should be soldered to the inner connector of the coaxial cable at the other end of the coil. The resonant frequency of the trap can now be checked, using either a dip oscillator, or my preferred option, using one of the MFJ Antenna Analysers with a single turn coupling coil around the trap.

A degree of tuning may be done by positioning the copper wire within the coil The final result of winding the coil should be of the form shown in **Fig. 3**. If the coil tuning point is far away from the design frequency, then a new coil should be created with fewer turns (if the resonant frequency is low) or more turns (if the resonant frequency is too high).

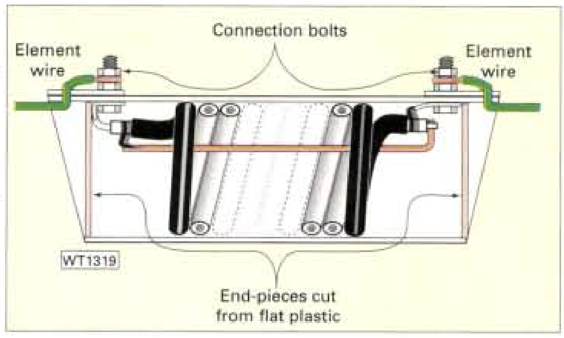


Fig. 5: Cross section through the completed trap of Fig. 4.

Minor changes of frequency (upwards) may also be achieved by unwinding slightly more of the braid back at one end of the coil. This reduces the overall capacitance and so moves the frequency upwards slightly. When you're happy with the resonant frequency of the trap, it may be placed inside the new outer casing made in the shape and form shown in **Fig. 4.**

Before sealing the tube all parts should be given a good coat of a sealant especially around the places where holes go from the outside through to the chamber of the trap. When the sealant has dried then carry out a final check on its resonant frequency, retuning if needed and seal the end of the chamber with a round 'plug' made from a piece of flat plastic.

If you have problems getting hold of flat plastic, try splitting a section of large diameter tubing lengthways, putting it in almost boiling water to soften it then quickly clamping it between two large flat pieces of wood until such time as it has cooled down. The heating and clamping may be carried out again if the piece isn't quite flat afterwards. I've found that a suitably sized hole cutter make a quick and easy endplate that may be sealed with hot-melt glue after being glued into position.

Word Of Caution

A word of caution, hot water and plastic can both cause severe injuries. Always use tongs and thick gloves when handling hot pieces of plastic.

The various other photographs with this article show stages of the manufacture of my traps. Go on have a go - trap your antenna to make it more effective on all bands. *PW*