Antenna Workshop

Roger Cooke G3LDI, turns to looking at the hardware needed in maintaining supports and masts in a safe, stable condition. This subject tends to be forgotten about until after the accident. With his advice, you can perhaps prevent the accident happening too!

Putting up antennas can, and should, take a large amount of time. The Americans have a saying: "If your antenna did not come down last winter, it wasn't big enough". Whilst this is quite funny and also in some cases very relevant, it can be very soul-destroying.

I can speak from personal experience. When I lived at Wymondham Norfolk, I had a four section crank-up tower, which was supporting a home-made three-element beam, and stacked above that on a 6m 'Dural' mast was a three element beam for the 21/28MHz bands. This tower was guyed with blue rope, and I left for work one morning only to see the weather deteriorating into a gale.

The gale progressed and of course worsened, then around 10a.m. I received the inevitable telephone call to say that the tower structure had collapsed. The blue rope that I'd used and thought adequate, had stretched under the wind loading. The tower was no longer braced by the stretched rope, which had allowed the top but one section to fold over. The result was that the very top section with antennas, rotator etc had plunged into my neighbour's garden.

Luckily no-one was outside at the time and so, there was no human damage, unlike the mast and antennas. The top of the mast was buried almost a metre into the ground! Around that time, there was an excellent article in *Radcom* by **Michael Gale G3JMG** who was a yachtmaster. That was one article that I printed out and kept. If you can obtain the original article in the March 1970 issue, then make it a priority, as it's an excellent reference.

Most of what I am writing is the result of many years of applying Michael's article, although it started as his material there's my own experiences added too. Even though I have drawn heavily on the original article, as it's so important when erecting antennas that I feel sure Michael will not mind!

Little idea

Most Radio Amateurs, when putting up a wire antenna on posts, or a tower with a beam on top, have little idea of ropes, knots and rigging. My guess is that few even have much of an idea of the proper way of doing it. Own up - who hasn't just made use of a hastily made random, 'granny' knot? Or perhaps, you've used a couple of ordinary knots at best in the rope that 'just happened' to be at hand, when you did the job?

Just because something's wanted quite quickly, doesn't mean that you shouldn't plan and organise it properly. Time may be a deciding factor when erecting the antenna, but this is false economy. In general, the more time spent putting the antenna or tower up properly will save money, time and heartache later!

Ropes & Guys

So, let's now have a look at some of the ropes, guys and stays that you can use, and what are the limitations of each type. As you would expect, in general use, the strongest form of guys are made from steel. These guys, should be made from good quality steel, preferably stainless. Each support length, again ideally, should be broken up into non-resonant lengths with large insulators at the junctions.

Steel guys, although strong, tend to be very heavy and before use, have to be treated with grease to prevent water ingress. This may be a really messy job, but it's very worthwhile. As well as being heavy, they need attention every year to maintain them, re-applying grease and checking them for corrosion and other damage.

Making up guys using steel wire is also heavy work, and three clamps are needed on each end **Fig. 1**. If you have broken a guy into three lengths that gives you six ends to cope with and eighteen clamps to fix. Because steel ropes are not particularly elastic and at any one temperature have a fixed length, it's desirable to fit turnbuckles to allow the tension to be adjusted over time or to take up any slight stretch.

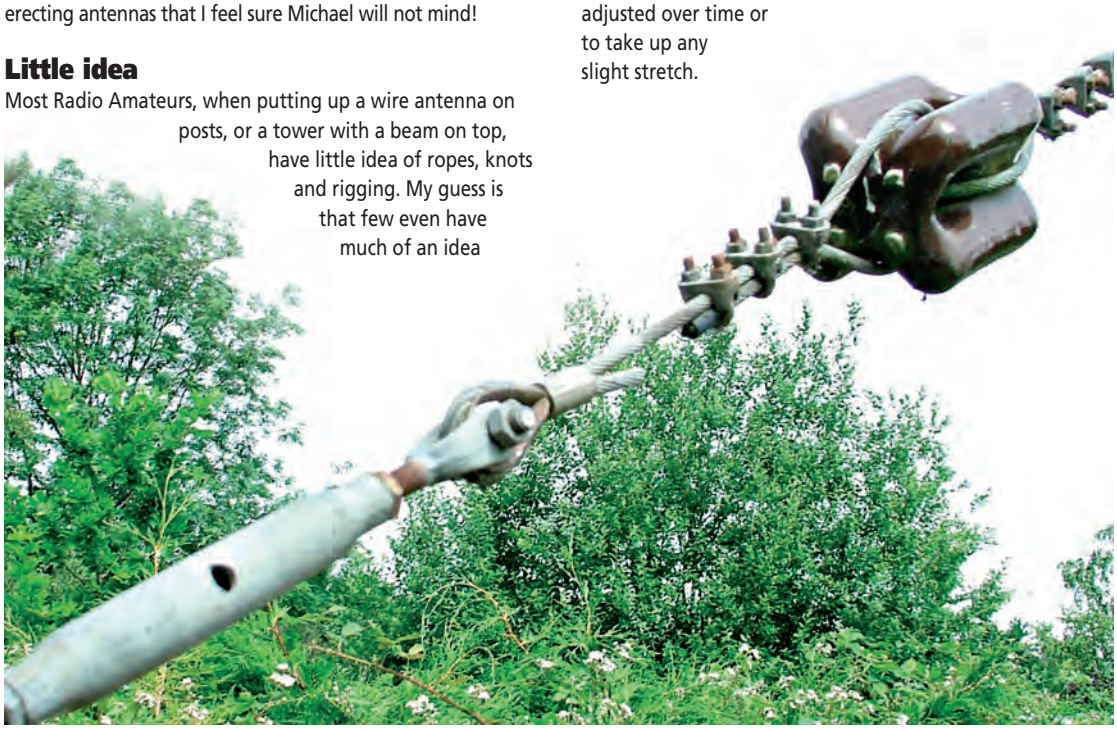

Fig. 1: A close-up shot of the bottom end of a wire support rope where it attaches via the turnbuckle to a ground anchor. Note the three clamps on the two loops passing through the insulator. The commercial clamp is put on with such pressure as to form cold-weld junctions of the sleeve and rope for security.

Turnbuckles, shown as a 'family' of three in **Fig. 2**, are effectively two rods with opposing threads cut so, that as the middle section is rotated in one direction the overall length shortens. And if the centre is turned in the opposite direction, then the overall length will increase, allowing the tension in the rope to be adjusted.

Nylon Ropes

Nylon ropes are to be found in all colours, sizes and in either woven or twisted, styles. Nylon has been used, for many years to produce ropes and was one of the earliest synthetic materials formed into ropes as it was available in very long individual fibres.

For its size and weight, nylon is one of the strongest material, but it does absorb moisture and also stretches. Because of these two limitations nylon is really most suitable for halyards, but not for really for permanent guys.

Terylene - Polyester

Terylene or as it's also known as polyester is a man-made filament derived from oil. These filaments, similar to nylon, may also be spun or woven into ropes but these size for size, they're not as strong.

Also known as Dacron, polyester does not stretch much under load, and is also available as pre-stretched form. Although this form is more stable in length, it's fairly expensive. Either type of polyester rope is suitable for both halyards and guys.

Polythene Fibre

Polythene is another man-made fibre that's also derived from oil. It's also known as Courlene and is normally a bright orange, though it's also now available in other colours. Polythene, is hard, wiry and feels slightly greasy or soapy to the touch. When formed into ropes, it's not as strong as nylon or polyester ropes of the same sizes.

While under load, polythene stretches a little less than nylon but much greater than polyester. Because its surface is 'slippery', polythene is difficult to use, and knots and splices do not hold easily. Polythene lines and ropes have largely been superceded by Polypropylene ones.

Polypropylene Filament

Like polythene, polypropylene is yet another filament manufactured from an oil base. It's still one of the most popular all-round general purpose ropes on account of its overall performance and price. It has about 90% of the strength of Terylene yet is only half the price. Under load it stretches slightly more than Terylene but nothing like nylon or polythene.

Phillystran Preferred

There is a 21st century material for ropes that's preferable to all those above. It's called Phillystran. It is strong, lighter and easier to use than steel, and won't stretch. This is used commercially and would be by far the best to use. Unfortunately, for the average Amateur, it's very expensive. So, the decision to use this is not to be taken lightly. A 6.1mm diameter rope with a 950kg breaking strain costs almost £2 per metre. Then you would also need grip kits for the ends at around £8 a time!

If, like me, you are still using the polypropylene then you should really get to grips (sorry about the pun!) with some basic knots and splicing. This can turn a mess into something really professional and attractive and I shall deal with that topic another time.

Fig. 2: Three support wire ropes each with their own adjusting turnbuckles, are attached to a substantial steel plate (via D-shackles). A single large concrete ground-anchor provided security for ropes.

Thimbles & Shackles

Tying off the guy rope to the nearest fence-post or tree is fine in the short term, but the rope will chafe and eventually wear badly. Using a suitable thimble prevents or reduces wear and also spreads the load. They are available in different sizes, depending on the size of rope used. Make sure that the rope sits in the trough of the thimble comfortably.

I use the galvanised thimbles (as seen in **Fig. 3**) as these are reasonably priced. But you can obtain nylon versions that are more expensive and will not rust at all. If you do use the galvanised variety, inspect them from time to time and replace any that do have rust as this can also damage the rope.

Fig. 3: Various bits of metalwork to be found in good mast and antenna installation. Top-left are the D-shackles, with three 'eye-thimble' to their right. All of the items shown are available from marine chandlers or motor-parts suppliers.

There are many shackles available in galvanised form, the D-type is the most common (Fig. 3). Shackles also come in various sizes and you should select the one most suitable for the job in question.

I again use the galvanised types, and of course you should make sure that you inspect them and grease them so that corrosion does not prevent you from releasing the shackle. I've learned that lesson the hard way! Once a shackle is tightened, preferably with a bar through the hole in the pin, you can secure it with a piece of wire through the hole.

False Economy

I managed, many years ago, with 'el-cheapo' pulleys that were really meant for washing lines, but I've since found that this is false economy. They don't last and soon corrode. When sourcing pulleys, **Fig. 4**, a visit to the ships chandlers is a wise move here.

Choose a pulley according to the weight that you will be hoisting. The smaller 2-3 inch pulleys are amply suitable for wire antennas of the dipole variety.

Fig. 4: Simpler parts for installing wire antennas, on the left are two support rope pulleys, shown alongside various insulating supports for the ends of the antenna. (A commercial dipole centre is shown lower right for size comparison.).

However, if you are hoisting a large amount of wire, such as a V-beam several wavelengths long or a rhombic of similar design, you may need a larger pulley to give an advantage. It's seldom necessary to adopt the block and tackle design, though this system will make it even easier and lighter to haul. However, this would be expensive on pulleys and the marine pulleys are not cheap!

I've run out of space for this issue, so I'll have to deal with knots and splicing in next month's Antenna Workshop. See you then! **PW**