antenna and rotator preventive maintenance

Here's graphic proof that Ben Franklin's Advice about a pound of prevention is still true

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Most amateurs agree that the antenna system is the heart of any station. Much has been written on the emphasis that should be put on erecting the best possible radiating system to compete on the crowded bands. I'd like to add some footnotes to the antenna literature in the area of preventive maintenance.

The initial investment in an antenna and rotator is substantial. How many times have you heard fellows say on the air, "Sorry, my antenna's stuck on Europe. Big storm passed through, and I haven't had a chance to go up the tower and fix the rotator." With a little care and forethought, you can ensure reliable operation during the worst weather, even if you use the more inexpensive equipment.

The following notes explain how to avoid the disappointment and down time that can occur with stuck rotators and vibrating antenna elements during the winter months.

the antenna

It's pretty discouraging to come home, anticipating an evening of hamming, and find your pride and joy in bits and pieces all over the back yard. Beam antenna elements are usually made of aluminum alloy. Unless they're given the proper treatment, they just won't withstand the rigors of weather. Airframe manufacturers know this—aluminum

alloy is used extensively in this application. Where in the aircraft the aluminum is used determines the amount and type of treatment it's given before installation.

Most amateurs don't have the facilities for giving aluminum the correct treatment for withstanding environmental effects. The treatment is quite involved and includes chemical and electro-chemical techniques. It is quite expensive, also, if used for small quantities of metal.

One thing you **can** do, before hoisting your antenna to the top of your tower or mast, is give it several coats of zinc chromate paint. Put on as many coats as you can, and work it into every nook and cranny. For each coat of zinc chromate properly applied, you can count on at least six months of corrosion-free operation.

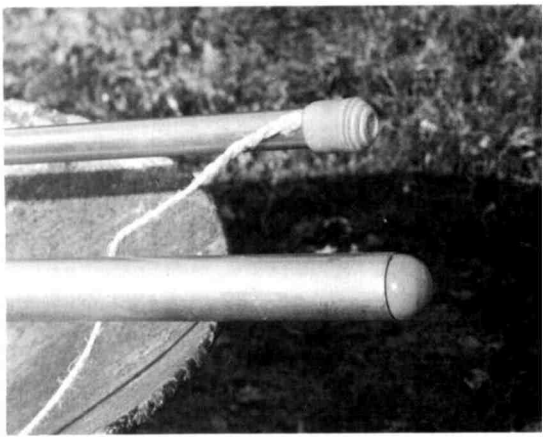
Now let's look at metal fatigue caused by vibration.

Tie a small weight on the end of the twine and drop it through the element.

taming the elements

No pun is intended in the heading of this part of the story. Every time your antenna sings in the wind, it's doing something other than playing a B-flat chord. Tiny cracks develop in the metal. They get larger, and as the element ices up, the added weight loads the metal. Vibration causes the metal to crystalize with resulting fatigue. Take a close look at your tubing the next time it falls to the ground after a storm. Those hairline cracks radiating from the break are a result of crystalization.

Hold the twine in place with a rubber foot, tennis ball or sponge rubber ball.



vibration proofing

All that's needed to dampen antenna element vibration is some sisal twine and something with which to plug the ends. Measure the length of all your elements plus a little extra, say a foot or so. Drop the twine through each element, and secure the twine with rubber caps over the element ends. A tennis ball is good. It may look a little strange, but who cares what the neighbors think? It's solid enough to make a good seal and will hold the twine securely. Make sure there's no moisture in the elements. The twine will dampen the vibration by changing the bending-mode frequency to some harmless low value.

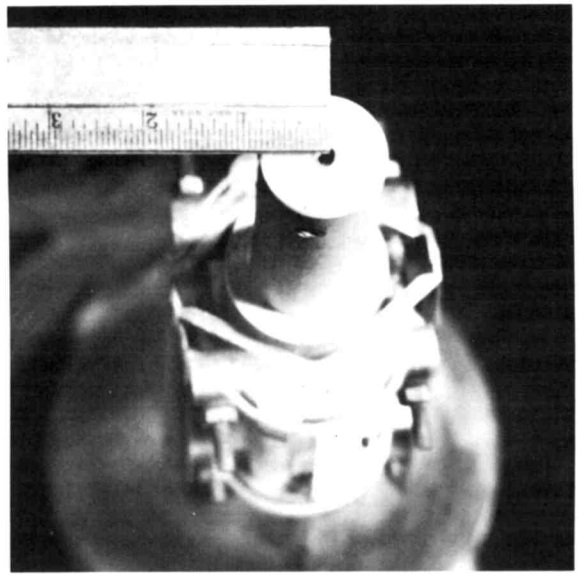
Another method is to pack the elements **loosely** with spun glass. Wear gloves when handling this stuff, though, because it can be pretty treacherous. It can penetrate your skin and cause all sorts of agony. Your boom can be sealed with a sponge rubber ball a little larger in diameter than the boom. Use the twine treatment here, also, and pull it up tightly. It will help keep your beam on a straight course and ease your jangled nerves

when your hear the wind wailing at 3 a.m. I'd like to emphasize that the spun glass **must** be packed into the tubing loosely. If it's packed too tightly you will zap the element.

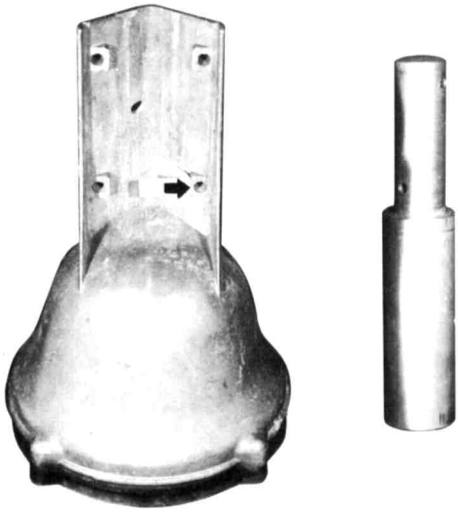
Another way of damping element vibrations is to fasten several rubber or plastic strips to the end of each element. Since the mechanical impedance of any rod-like element is high at the free end, an energy absorber at the end of an element will reduce the amplitude of vibration and minimize breakage. The energy absorber can be made from a five- or six-inch length of garden hose, split lengthwise every 90° and held at the end of the element with a hose clamp. These simple energy absorbers are most effective if they are clamped at the very end of each element, but to prevent changes in element electrical length and impedance, they should be placed so the free ends are about two inches in from the ends of the elements.

the rotator

Lots of stories have made the rounds about whether TV antenna rotators are strong enough to support amateur beams. The photos show my AR22 rotator, which was purchased, used, in 1963. At that time it had been in use for six months, and I've been using it constantly since. The reason it's down now is because I'm installing a new tower and two stacked five-element Cushcraft beams.



The top of the AR22 with reducer in place. The ruler was zeroed on the center. Right under the 1½-inch mark you can see the end of one U-bolt as it appeared with the rotor in the first direction; then it was rotated 180° and the U-bolts show again.



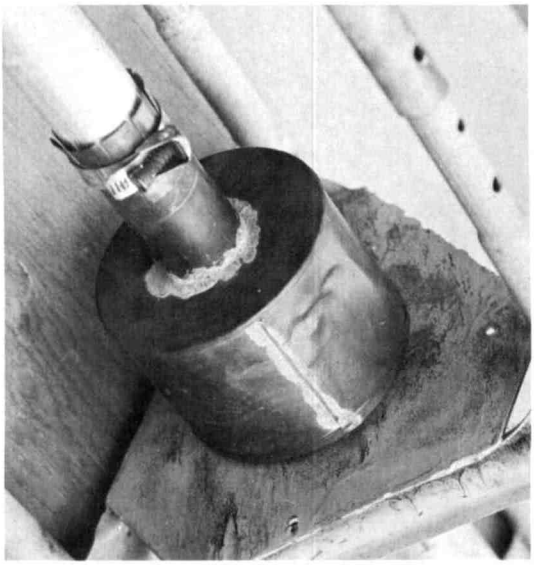
Rotator and reducer. The reducer is aluminum; large end is 2-1/16" in diameter and small end is 1½" diameter to fit inside mast. The holes running laterally were drilled through the mast to bolt the two together. Arrow points to one of four shoulders that may have to be filed off unless shims are used to center the reducer.

Given half a chance, I find that the AR22 rotator is very satisfactory. The secret is to eliminate the tremendous moment arm caused by a large mass of metal on a long length of mast above the rotator. Add to this the simple fact, sometimes overlooked, that any rotator must be perfectly centered with respect to its mast. Unless the correct diameter mast is bolted to the rotator, the eccentric rotation will load the rotator bearings, and you've got problems.

The AR22 manufacturer say that 1½-inch diameter pipe is correct. Maybe so, but I found this isn't true for my rotator. In my case, a diameter of two and one-sixteenth

inches is correct. I had a piece of aluminum stock turned down to this size, then had it stepped down above the rotator clamps to slip inside a 1½-inch mast.

It may be necessary to file down the edges of the shoulders where the U-bolts come through to properly seat the aluminum reducer. I didn't have to, though.



The hood or umbrella clamped on to the mast directly above the thrust bearing, which is out of sight and out of the weather; it's mounted on the plate welded to the tower cross-sections.

The picture with the ruler has been purposely double exposed to show that the reducer is, in fact, centered in the rotator. I made the first exposure with the rotator pointed in one direction, then I turned it exactly 180 degrees and made the second exposure. Note that there's no visible deviation at the end of the reducer. If there were, two distinct centers would show, and two outer edges would also show.

the thrust bearing

A thrust bearing located somewhere between the top of the rotator and the top of the tower takes all the weight off the rotator. The only load on the rotator will then be turning torque, which is as it should be.

If the thrust bearing is exposed to the weather, it's going to get loaded with snow and ice. (California amateurs can skip this part. However, does anyone know what smog does to aluminum?) I made a copper umbrella to cover the thrust bearing, as shown in the photo. It slips onto the mast and is fastened with an ordinary automobile radiator hose clamp. The same idea can be used at the top of the tower where the mast enters the tubing.

Instead of a copper umbrella, you could wrap a piece of soft rubber around the mast and secure it with the same type of hose clamp. This will form a skirt to keep out the weather. Be sure the skirt flares at the bottom, else it might get loaded with ice and stick to the tower. It might help to lubricate the mast-skirt interface with low-temperature silicone to avoid this minor problem.

ham radio

"Yuh can't can't get thru a pileup like that . . . yuh gotta better chance out here on the edge."