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A Foldover Cheapie

Bowing to the cost of living

A few years ago, I fell heir to several 21-foot (standard-length) pieces of galvanized-steel water pipe, one 2-1/2-inch piece, a 2-inch piece, and others ranging down to 1-inch diameter. The various sizes and long lengths made them much too bulky and heavy for masts and rotor supports in the ordinary way, so they just lay outside my shack to be tripped over occasionally.

Some time later, having to scoot to the top of my 60-foot tower to repair cables and replace guy wires, I got an aerial view of these pipes. Wow! They looked like one of those expensive foldover towers I had seen

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advertised in a recent issue of *73*! Deciding that this was "an inspiration from above," I set out "to restack" the pipes vertically so that I could talk *over* them rather than *about* them. There seemed to be plenty of clear area in my yard near the shack where a foldover tower would fit neatly to the ground.

(A survey of space is absolutely necessary should you decide to try this project. The foldover will be no good to you if the antenna folds over into a tree or onto the roof. Also, be careful to align the base so that the butt of the mast does not swing up into the side of your shack as the mast is lowered.)

The basic structure, shown in Figures 1A, 1B, and 1C, is simple and straightforward. Two sections of pipe are telescoped together and hinged near the base. A hand-operated boat winch provides the power. The assembly can take more sections for added height, and these may also be telescoped to prevent top-heaviness and/or add to structural strength, as well as permit greater ease in lowering the antenna in bad weather. A double pulley may be added for more power, or the hinge point raised to provide greater leverage.

I am no engineer, but I can report what worked for me; the purpose of this article is to expose you to a cheap method of building yourself an otherwise-expensive addition to your station. Pay as much attention to the concept as to the step-by-step procedure and let your imagination help you build the assembly which will be exactly right for you.

The job begins with finding an old 55-gallon oil drum. I got mine from a local farm chemical dealer. Similar drums may be found at oil company storage areas or wholesale cleaning companies (often free for the asking). The drum serves as a modular base for your tower. Next, cut the top out of the drum with a cold chisel. *Don't* take your trusty blowtorch to the top. Many chemicals will produce toxic fumes which could make short work of you, and oil drums tend to explode or burst into flames when exposed to a torch, so do it the hard way. After completing this step, knock several large drain holes into the other end of the drum. This allows the water to drain from the concrete you will pour into it, resulting in faster, and more even, curing. Finally, dig a hole large enough to bury the drum vertically with the top rim just even with the ground. Any projection above ground decreases counterbalance weight for the tower.

The Mast Support

Prepare the base support by clamping a 3″ x 3″ wood spacer about 3′ long between two 10′ 3″ angle irons (Figure 2) and drill a 5/8″

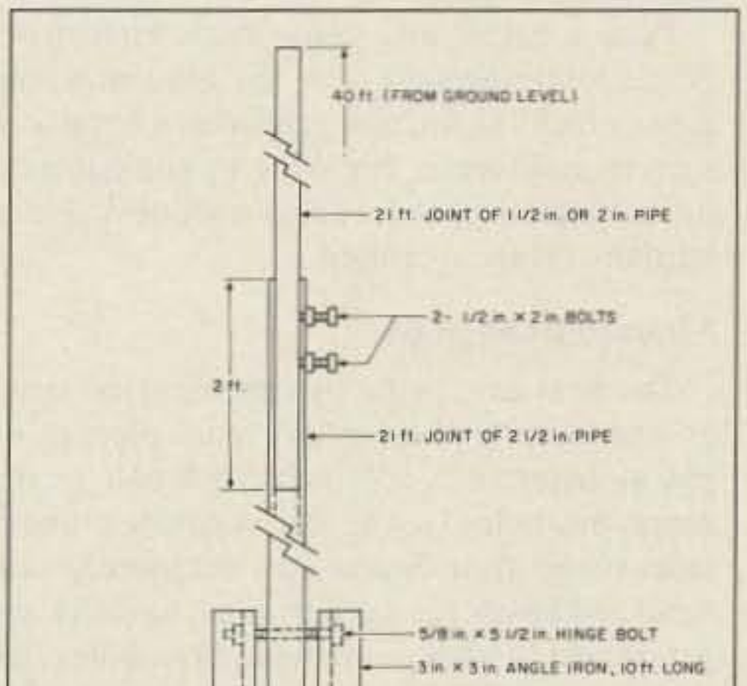

Fig. 1A. Mounting of tower base showing front view of mast-supporting angle brackets.

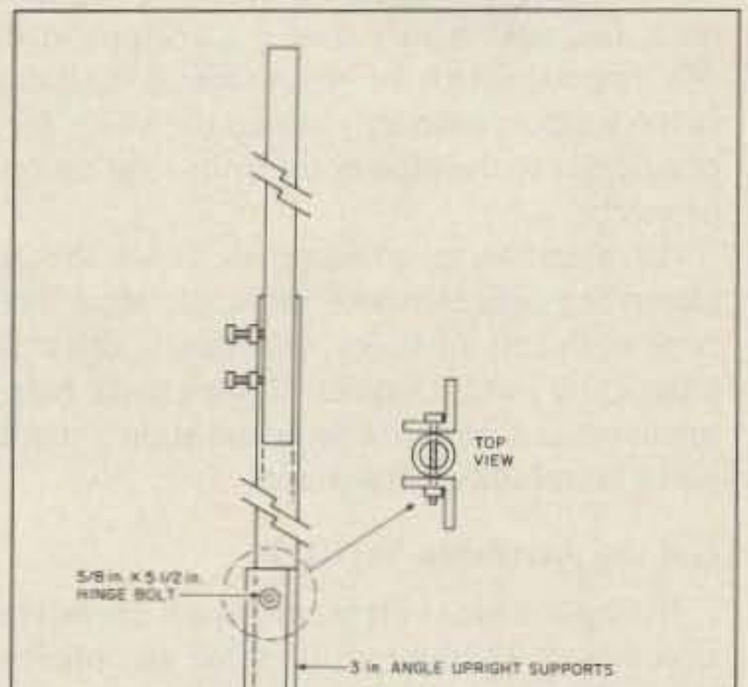

Fig. 1B. Side view of mast-supporting angle brackets and winch installation.

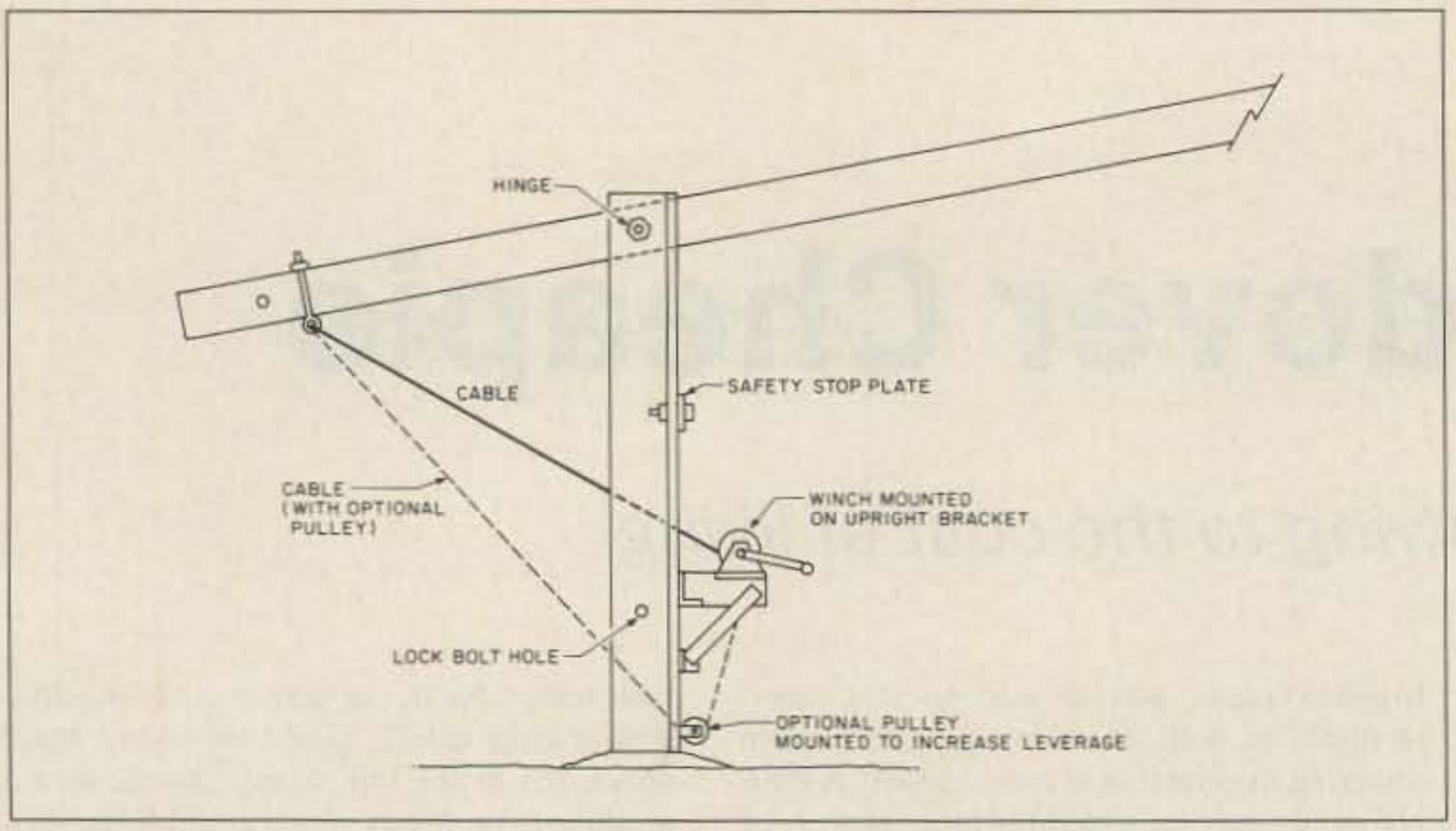

Fig. 1C. Winch assembly for the foldover.

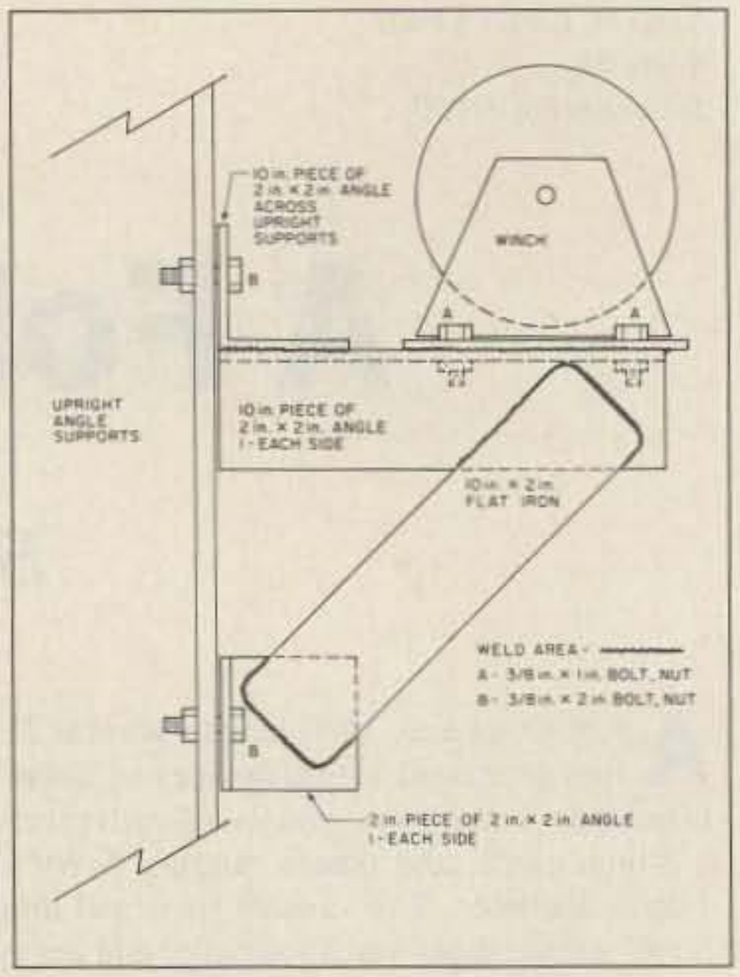

Fig. 2. Details of winch installation.

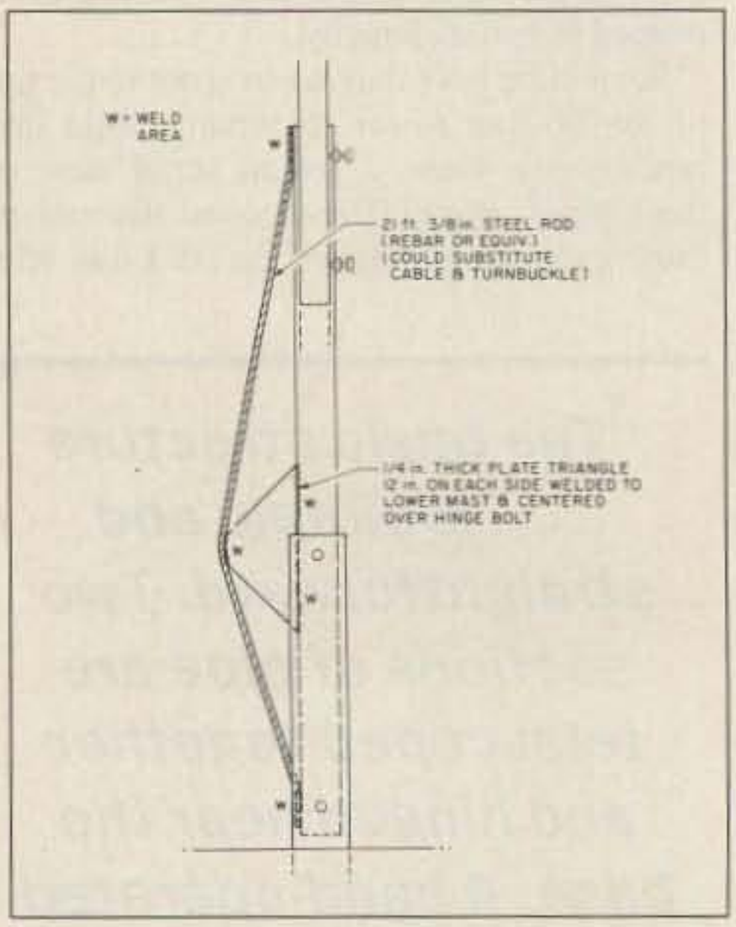

Fig. 3. Truss for lower mast section. Use this when adding another section to the tower.

hole through both pieces, about 3″ from the top end. Stand the assembly in your buried drum and mark the level of the ground, using a level or straight edge across the rim of the barrel. Measure up from 6″ to 12″ and drill another 5/8″ hole. This bottom hole will take the locking bolt that will hold the mast vertical once it is raised; the top hole is for the hinge pin for the foldover operation.

Lay the bottom pipe for your tower along the support assembly and mark the pipe at the drilled holes. *Exercise caution here!* There should be around 6″ between the ground-level mark on the support assembly and the locking-bolt hole, and the bottom end of the mast must fall within this space. Carefully drill 5/8″ holes through the pipe to match the holes in the support assembly. Keep the holes perpendicular to the pipe or the bolts won't align properly.

An alternative procedure would be to clamp the pipe between the angle irons and bore both sets of holes, but this is difficult unless you have adequate clamps and a helping hand. It is hard to clamp and align a round piece between two flat pieces.

Get the Assembly Vertical!

It's a good idea to treat metal which will be in contact with concrete the same way professional tower-installers protect base mounts on commercial towers. An aerosol can of auto-body undercoating can be used. (This is not an option if you are inserting galvanized metal into concrete.)

Now, mix , then pour, about four 60-pound bags of concrete into the drum. You could pour dry mix into the drum and drench with water, but this way it could be weeks before the concrete will be moistened enough to cure. While the concrete is still wet, stand the support assembly upright in the center of the drum, and work it down through the concrete until it hits bottom.

Balance or brace the assembly upright until it can be secured. I used old pieces of TV guy wire and tied it off in three directions. Once it is firmly secured, take your level and make sure the assembly is vertical. Now add sand, dirt, pebbles, or whatever, to the drum, and fill to within 12″ to 16″ of the rim. *Check your base assembly again to make sure it is still vertical.*

Mix up four to six more bags of ready-mix (as needed) and finish filling the barrel, rounding it off at the top so water will not collect around the mast. Tamp the soil around the barrel, using leftover soil, pebbles, and concrete as necessary to secure the base solidly in the ground. Now make a final, careful check of the plumbness of your assembly and make any last-minute adjustments needed. A very slight bit off vertical here, and your mast could end up looking like the Tower of Pisa!

Take a break and come back tomorrow. Any fooling around with the base now can cause cracks in the concrete where water can seep in and freeze, breaking up the concrete or making all your leveling worthless. Let it harden at least overnight.

Mounting the Mast

The next day, begin by removing the spacer and putting the bottom mast pipe in its place. Insert a 5-1/2 inch 5/8″ bolt in the hinge-pin holes, using flat washers on both sides of the mast. Screw on a nut loosely, and raise and lower the mast by hand to check the action and to make sure the bottom holes line up properly. If they do not, clamp the mast firmly upright and drill through the whole assembly.

Mark where the bottom of the mast comes to on the support assembly, and a few inches above the mark securely bolt a piece of 2″ x 8″ quarter-inch flat iron stock across the flat sides of the angle irons; this piece will stop the mast from swinging further than the vertical position.

With the mast bolted in the vertical position, drill a 3/8″ hole in it about 10″ from the bottom and insert a 3/8″ eyebolt with the eye facing the direction in which the tower will fold. Your winch cable will be fastened to this eye. Use either a welded-eye type bolt or have the eye welded shut. A heavy load can stretch an eye open—and such a mishap can allow a mast being raised or lowered to plummet to the ground with your prized quad and rotor!

The Winch

The winch should be mounted on the same side the tower folds on, at a height that allows easy cranking of the handle. It all works most smoothly if the cable winds up at or near the height at which the eyebolt is attached to the mast—10″ to 18″ above ground level. My tower has the winch at about waist-height which allows cranking without getting down on your knees, but creates another problem: poor leverage. I had to mount a pulley at the base of the support assembly (see Figure 1C). Feel free to experiment, but beware; I had trouble finding a pulley small enough but sturdy enough, and with the cable tracking over the pulley, and with the mounting of the pulley so that it was not in the way of the mast when vertical. It really is simpler and more economical to mount the winch as low as can be cranked comfortably when kneeling.

When you have decided on a position, mount the boat winch mounting bracket (see Figure 2). You may have an easier method of mounting the winch. Certainly, if you have access to a portable welder, this job can be done much more quickly. Just be sure the winch is centered between the angle-iron supports. The simple bolted arrangement is neat, but I personally suggest that you take the assembly to a welder and then bolt the welded assembly to the supports. (There is other welding that can be done at the same time—see "Adding Height," below.) In any case, the winch assembly must be sturdy. There is a great deal of stress involved in raising and lowering the tower, so this is no place to skimp.

Adding Height

When you have satisfied yourself that your assembly works as you wish it to, it is time to add height to the mast. With it lowered and touching the ground, bore two holes about a foot apart with the top hole about 2″ below the top of the mast (see Figure 3). While you are having your winch welding done, you also can get 1/2″ nuts welded over each of these holes. You could fabricate a clamp for this job to replace the welding. Raise the mast parallel to the ground and slide a 21-foot section of 2″ pipe about two feet into the larger pipe. Screw 2″ bolts into the welded nuts to hold the two pipe sections firmly together. Now you have a 40-foot mast which is adequate for most amateur use.

I have an ATB-34 and a CDE rotor atop my version of this tower and felt more comfortable lowering the top section about halfway into the lower section, resulting in a 30-foot tower. A third section of, for example, 1'1/4″ pipe attached in the same manner, could produce a 60-foot tower. If this is tried, I would suggest welding links of chain, or inserting eyebolts around the top section of pipe about two feet from the top, to allow attachment of guy wires—especially if any substantial antenna array is to be mounted. Getting it up there is one thing, but getting it to stay is another!

I have tried several modifications of this assembly, all the way to 50 feet without guys, including a 6-dB vertical atop stacked 7-element, 2-meter beams. It stayed fine, but I couldn't stand the swaying in the wind as well as the tower did, although the base never budged. However, guy wires would be a necessity in my book if an expanded version of my design is built. It is simple enough to disconnect the guy wires for tower lowering.

Extending the tower to 60 feet or more produces very heavy loads on the winch, even with light arrays. The optional lower-section truss brace eliminates much of the sway and bending when raising or lowering the tower. Over 40 feet you also will need the optional pulley system shown in Fig. 1. This slows operation of the foldover but doubles the effectiveness of the winch. Another possibility would be to build the upright support assembly longer. This will add counterbalance weight—and could also allow the use of larger pipe.

Conclusion

My Foldover Cheapie has been in service for nearly eight years without any problems. It is a perfect platform, even at 20 feet, for antenna experimenters. (At 20 feet you could perhaps use a 30-gallon drum or perhaps no drum at all.) A drum makes sure of enough base weight, and requires about a sixth as much concrete as would a plain hole in the ground. It also helps keep the tower from settling into the ground and cracking skimpy layers of concrete.

A final comment: *Don't try to lift too heavy a tower and load.* You risk breaking the cable and worse. Slide the top section down a little and try it out. I doubt that my range with the ATB-34 is much different at the 36 feet I use that it would be at 40 feet.

Many older hams will enjoy this type of structure because it will allow them the independence of maintaining their own antenna systems. This might make a nifty club project to help some of your older members. It also is an ideal assembly for hams living in areas subject to seasonal high winds. ■

Parts List

2	10′ pieces of 3″ x 3/8″ angle iron
1	21′ piece of 2-1/2″ steel pipe
1	21′ piece of 2″ steel pipe
2	5-1/2″ 5/8″ steel bolts with nuts and washers
2	2″ 3/8″ steel bolts with nuts and washers
1	piece of 1/4″ flat iron stock, 2″ x 10″
1	used 55-gallon drum
1	1000-pound boat winch with cable
2	2″ 1/2″ bolts with nuts and washers
10	60-pound bags of premixed concrete

For Winch Mount

1	piece of 1/4″ flat iron stock 6″ square
2	pieces of 1/4″ flat iron stock 10″ x 1″
3	10″ pieces of 2″ angle iron
2	10″ pieces of 1″ x 1/4″ angle iron
4	2″ 3/8″ bolts with nuts