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Let's Build a Tower

A few years ago the urge hit me to quit messing around with the assortment of wire creations that I'd always used for radiators, and start in on rotary beam construction. Undoubtedly a lot of other hams have come to the same decision and, like me, soon realized that buying or building a beam is just part of the bargain. It has to be rotated, and it has to be mounted up in the air. The cost of a good beam can be fairly reasonable, but by the time the tower and rotator are added the whole thing begins to look like a payment on the national debt. However, all is not lost if you can convince yourself that you can take a few simple tools and build the whole affair right in your own backyard. It takes a little time and patience but the savings are well worthwhile.

I won't go into the construction of beams or quads at this time, but it seems logical to first decide what kind of antenna you're going to build and then tailor the tower to that particular design. There is also the human angle to consider. I for one like to be both safe and comfortable while I'm on top. And there is the problem of real estate; which simply means you must keep your tower and its accessories within the confines of your own property. Keeping the cost factor in mind, the tower described here was built according to these requirements:

1. Wooden construction, using only simple hand tools and a hand drill. Metal construction would be fine, but would necessitate much more in both cost of materials and more elaborate tool requirements.

2. Completely self-supporting and capable of handling the load of three stacked full size beams in winds of 100 m.p.h.

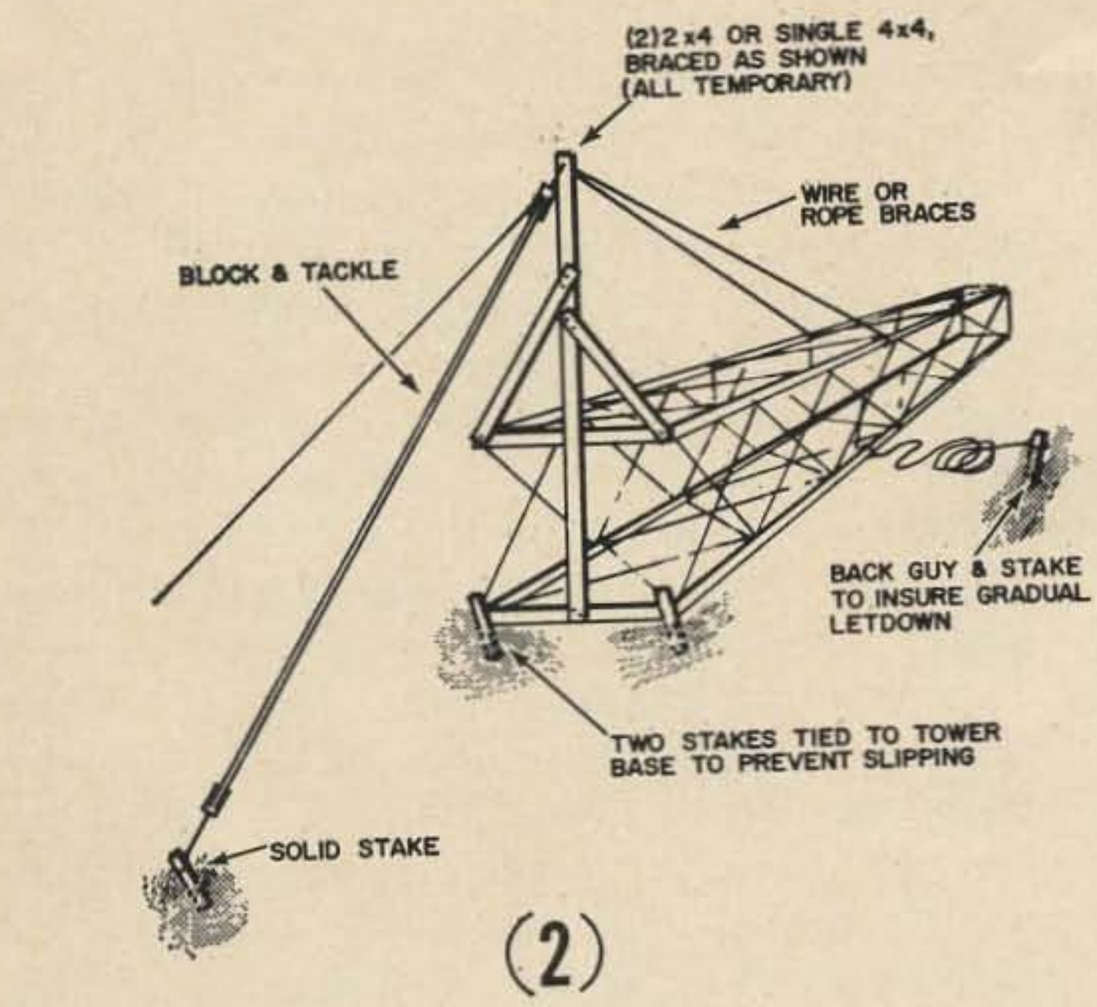
3. A wide working platform at the top, enclosed inside the tower, and with enough room for two or three men to maneuver comfortably and safely.

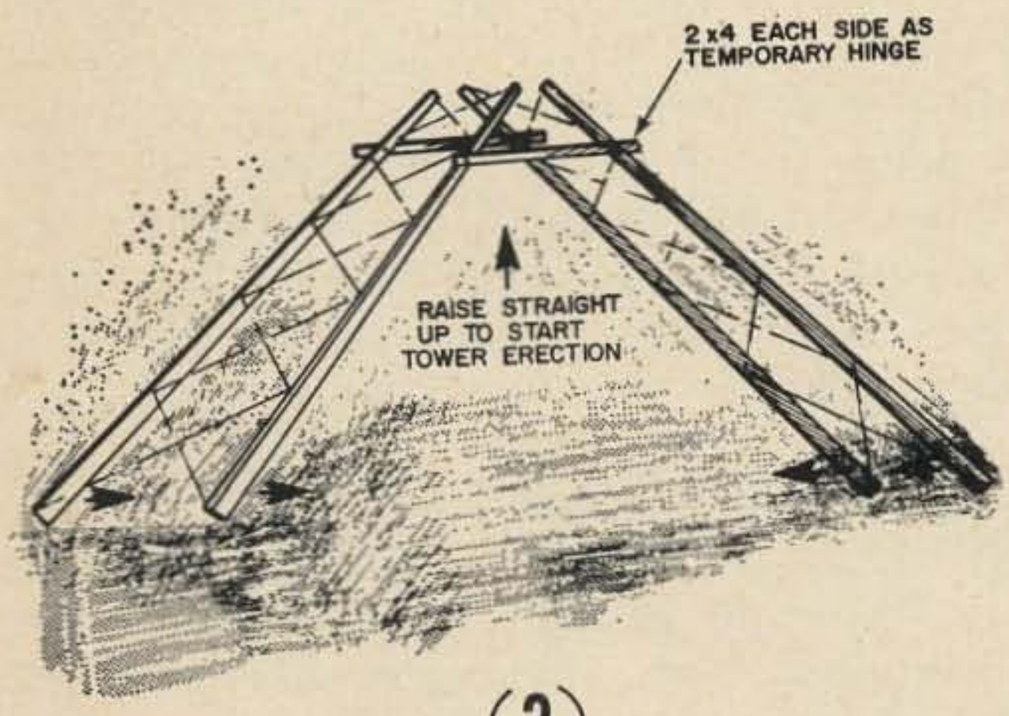
4. Easily built by one man and raised by four.

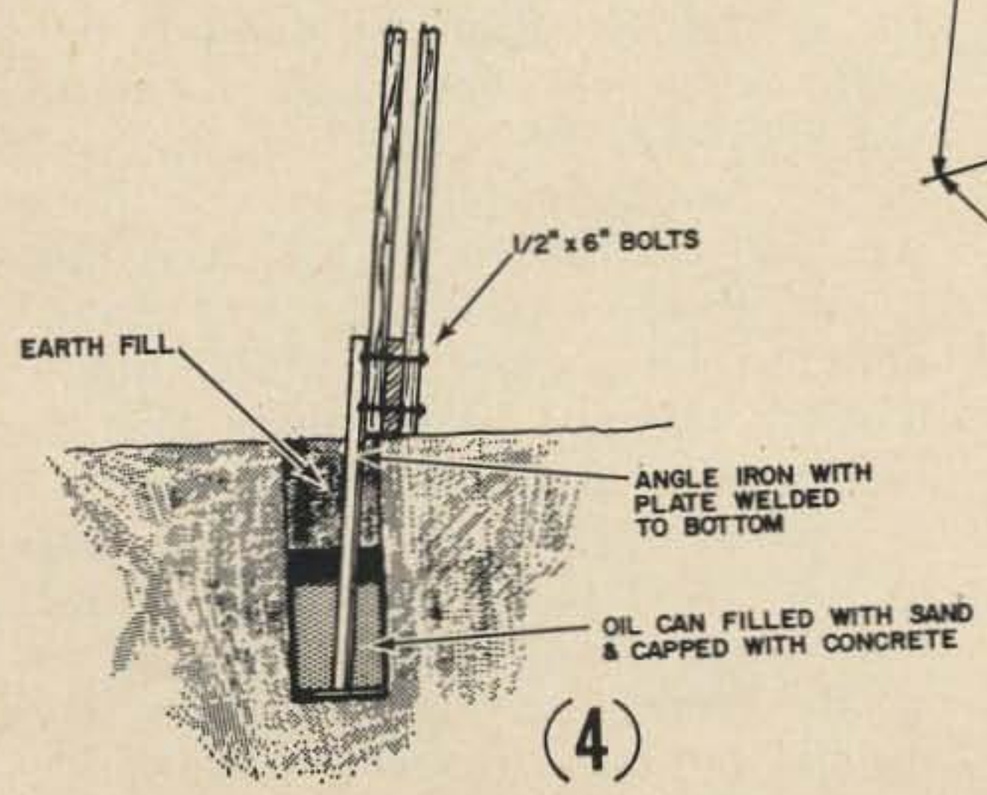
Before rushing off to buy materials, one should consider the type of lumber needed and this is pretty well dependent upon height and weight considerations. It's all very well to place a 20 meter beam at 70 feet in the air, but this is not practical unless you are going to get involved with much higher costs than are necessary. This tower of mine stood 33 feet from the ground to the top of the actual wooden frame. The rotator pipe extended two feet higher to the boom of the 20 meter beam. Therefore this beam was an approximate half-wave above ground, and its operation was perfectly satisfactory in both DX chasing and contests. Three feet over the 20 I mounted the 3-element 15, and four feet over that was the 4-element 10, making a total of 42 feet to the top of the mast. If your antenna is going to be a quad, this height will be quite satisfactory, even more so because of the quad's well known ability to perform beautifully at the lower elevations.

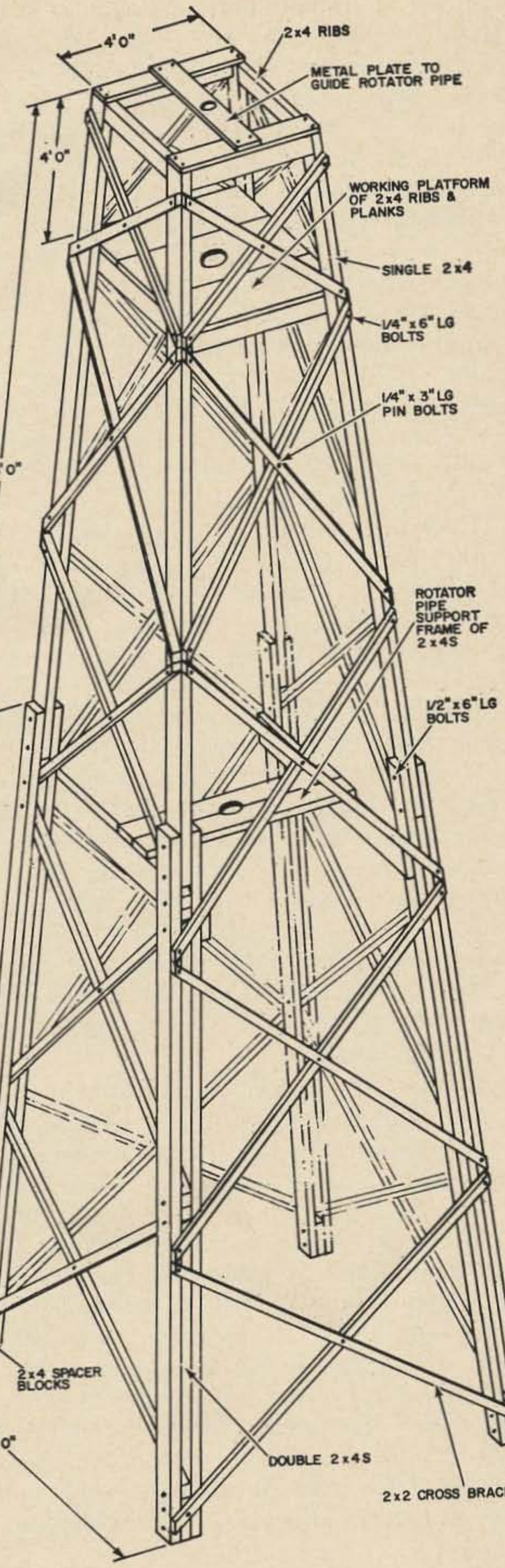
With due consideration for safety, the legs of the tower should be at least 2 x 4, and by referring to the overall diagram of the tower, you'll see that the lower part of each leg is actually made of two 2 x 4's with spacer blocks spiked between them. The upper leg is a single 2 x 4 which is inserted about 4 feet between the bottom two. This joint is rigidly fastened together with husky bolts. This is a good time to point out one construction feature of this tower; that is the use of bolts instead of nails. The cost is higher, and probably nails would be satisfactory if you use the newer spiral type, but I personally prefer bolts so the choice is yours. The wood sections should also be given a good coat of exterior primer and one or two coats of exterior house paint before they are assembled. Aluminum paint is also very good, and I would suggest buying it in the gallon size. It's much cheaper this way, and you'll certainly use it all!

In selecting the wood, the only proper way is to go to the lumber yard and keep









Composite details of VE1TG Tower. See Text

digging until you find just what you want. Have a chat with the yard boss and he'll certainly assist you to find the proper materials. Buy a good grade and make sure each piece is as knot-free as possible. If you don't know much about comparative strengths, ask for advice, and then buy the strongest type available. However, if you're in a real small yard and there's not much choice, don't give up. My tower was built from plain ordinary spruce and it's been standing for six years in some of the wildest gales you'll ever see, and it hasn't shown any signs of stress up to now. However, I did take care to give it lots of paint and I also made sure I had very few knots in any of the legs and braces.

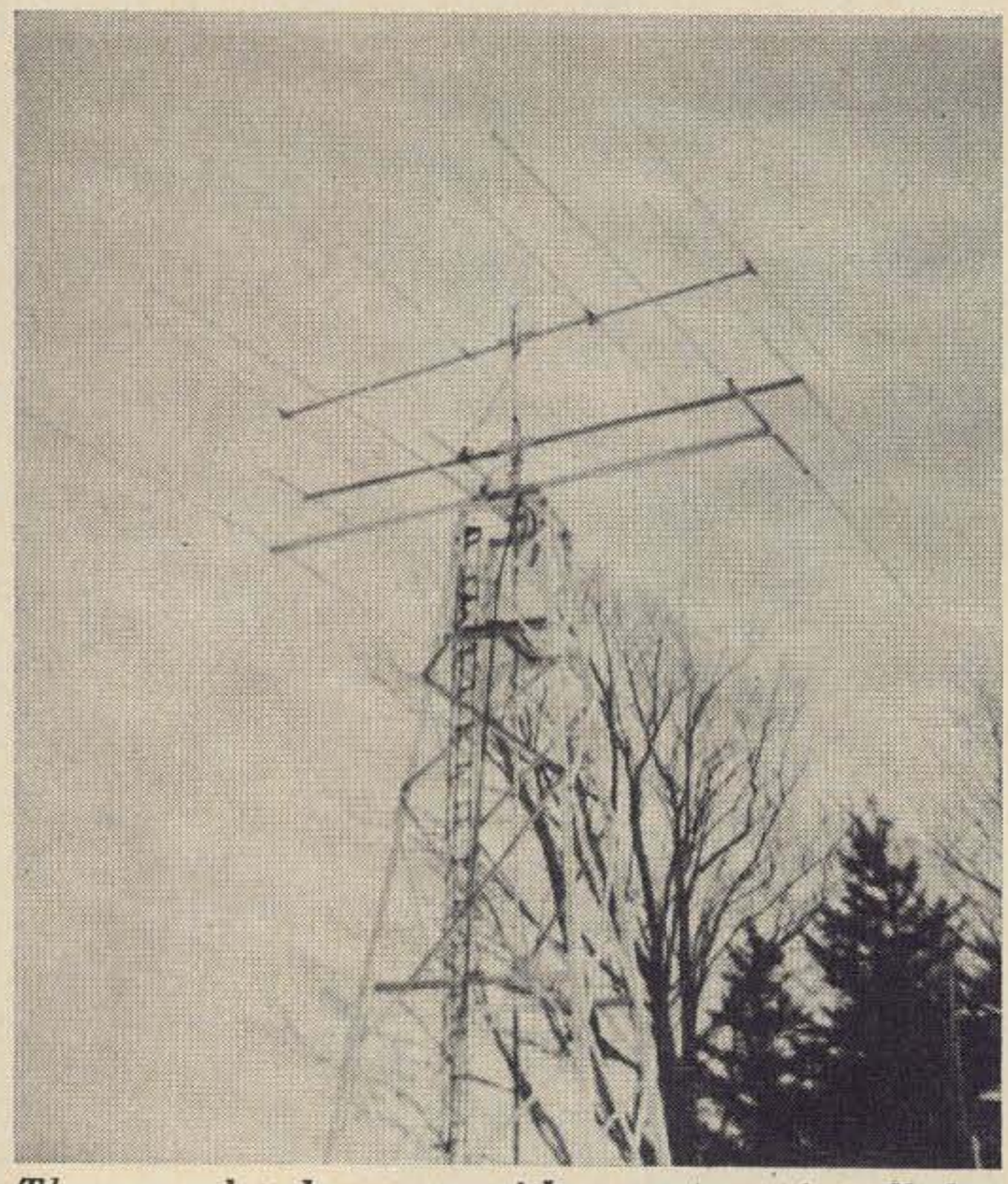
Everyone has ideas about constructing a thing like a tower, but I found it easiest to build two complete sides, each lying flat on the ground. For one thing, this makes it much easier to get the dimensions right and to end up with both sides being the same. The actual construction will be pretty clear from **Fig. 1,** with the cross braces all being made from 2 x 2 stock. You will find that this 2 x 2 will give an extremely rigid frame, but it is almost mandatory that bolts be used rather than nails. When the braces are crossed over themselves in the center, there is considerable strain placed upon the ends of each brace, and nails will almost certainly pull out of the legs. This is especially true of the shorter braces at the top of the tower.

I made the tower with a top width of 4 feet, and a base width of 10 feet, giving an approximate 3-to-1 ratio between height and base; or in other words, 16 square feet on top and 100 square feet on the bottom. This caused some of my friends to feel it would be rather "spraddle-legged" but the final appearance is very pleasing. The most important thing to remember is that this ratio makes the tower extremely stable and eliminates the need for guy wires. This one has taken hurricane winds of more than 100 m.p.h. on quite a number of occasions without any sign of damage, and without the slightest indication of becoming unsteady.

After the first two sides are finished, some thought should be given to erection before proceeding further. If yard space is very limited, it may be necessary to carry on and build the whole tower in one piece. If so, the same general methods can be used for the other sides, since all that will be required is to fit in the cross-braces. You must be careful that the dimensions are correct or the end result could be lop-sided, but by taking a little time and measuring carefully you should have no problem. The platform can be built into the tower, about 4 or 5 feet down from the top. This allows you to eventually stand safely *inside* the tower with a good solid frame all around you—quite an important feature if you're nervous about height or want to persuade some friend to come "topside" with you.

If you have built the whole tower in one piece, erection can be done quite easily. The only equipment needed is a block and tackle, a couple of pieces of 2 x 4 and a friend or two to give a helping hand. If you can get a car into position to pull straight on the tower, even the tackle can be eliminated. See **Fig. 2** for a suggested method of carrying this out. As the tower passes the "point of no return" there should be a man at the rear letting out the back rope carefully so the tower will not come down with a real bang. Probably no harm would be done, but why take chances?

The second method of completing the tower is shown in **Fig. 3.** The two completed sides are laid out end to end, and side braces of scrap wood are added to the top ends in such a way as to form a crude hinge. The braces must be fastened to the legs by means of bolts, and the bolt holes must be large enough for them to act as swivel pins. Now the center of the whole affair is raised by means of a step ladder or even just spare pieces of lumber acting as props. Now four men can grasp the legs and "walk" them inward—with the result that the tower rises smoothly until it is at the desired elevation. By marking the proper position for the four legs ahead of time, the legs can be walked in and set down in just the right place. This is the method we used for this tower and it is quite easy to do. Total erection time was about fifteen minutes. Of course when the tower is up it must be temporarily guyed as it has only two legs and is a little shaky. This condition is only of short duration if you make sure to have several pieces of the 2 x 2 cross brace material all ready at hand. As soon as the tower is vertical, go to work and install the cross braces, working from the ground up, and in the space of a few hours you can easily have at least half of the



The completed tower with antennas installed.

remaining braces securely in place. In fact if you can persuade the friends to stick around after the raising procedure you can probably get the whole thing finished by sundown. This is what I did, with the aid of four pals and supplemented by the XYL's sandwiches and a few gallons of good old Nova Scotia cider!

With all the bracing completed, all that remains is to build the working platform into the top. In the main diagram **Fig. 1,** you'll notice a hole is cut in this platform for the rotator pipe to pass through. About 16 feet up from the ground is another frame made from a couple of pieces of 2 x 4, also with a hole cut in it. This was necessary because I started out using a very large rotator made from a surplus D. F. antenna mount, and the thing was so big and heavy I had to leave it on the ground and run the pipe all the way up. Since the usual ham rotator won't be this big, it will normally be best to mount it up near the top and the platform can become an excellent mounting base for rotator and any extra control box which may be necessary. There is enough room to pull up a folding chair and work away in real comfort!

The metal plate shown at the very top is best made from a heavy piece of aluminum but iron will do if you give it a couple of good heavy coats of rust-proofing and paint. There should be either a sleeve or thrust bearing installed at this point but the exact type will depend upon your own rotator-pipe combination.

With your tower now completed, the footings should be considered. In my own case I found the thing so stable I used only old pieces of angle iron driven into the ground and bolted to the legs, but a better anchor can be easily made by digging the four holes and using old oil cans (from the local garage) filled with sand and capped with cement. Before filling them, make up a "T" from a couple of pieces of angle iron, bolt this to the mast leg, and let the angle iron act as a foot at the bottom of the can. Using sand is cheap and the top few inches of the can is easily capped with a bag of ready-mix concrete. Then tamp down the earth firmly over the whole affair. If this sounds pretty confusing, refer to **Fig. 4.**

One thing is still missing—an easy way to climb the thing. Well of course the easiest way is to construct a ladder and mount it on one side of the tower. Four lengths of 2 x 4 will be required and the rungs can be made from the left-over scraps of 2 x 2, or you can use short lengths of scrap pipe. My own method was to use two fifteen foot lengths of TV tower of the type that has horizontal cross braces on one side. This was mounted inside the tower and proved to be ideal for the purpose. Of course this is really a waste of money unless you happen to have the stuff already laying around so in the interests of economy I'd suggest the wooden ladder.

As a last "selling point" on the strength of this tower, after it was in use for about two years, it was taken down in one piece, loaded onto a trailer, pulled down the highway to a new QTH and put back up where it is still standing as solidly as ever. Total cost of the tower was approximately $55.00 including the paint and considering all its features of convenience, safety and load-bearing ability I think you'll find it hard to beat.

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