W9JWC and his mast take a rest at the 20-foot level.

# A Self-Supporting Antenna Tower

## *A 70-Foot Antenna Mast for Fifteen Dollars*

BY J. D. BOATRIGHT,* W9JWC

**Here is a description of an antenna tower that may help to solve some of your construction problems. After reading the story, you may not be interested in going up to the full 70 feet, but you can't go wrong with a 50-footer.**

ALONG with most other amateurs, I have always wanted to own a tower from which to hang any type of antenna that I might want. My funds being limited, I knew that it was out of the question to purchase a ready-made structure of steel.

Early last summer I visited one of the local lumber companies and inquired if they had any designs or plans for the construction of a high tower of wood. They had none, and so I was forced to draw up my own plans and to design the tower myself. Not being an engineer and knowing nothing about the stresses and strains in a structure of this kind, I just had to trust to luck that the tower would stand after it was built. Of course I intended to guy it, but even so I was plenty uncertain about it.

The plans were first drawn to scale on paper, using a 7-foot triangle for the base and making the height of the tower 70 feet. This looked to be in about the right proportions (see Fig. 1-A). The cross braces were then drawn in, relatively close together near the bottom of the structure where the sides are far apart and then a little farther apart where the sides get closer together. Since 2 by 2's are fairly cheap, I decided to build the whole tower, cross braces and all, out of them, and several hundred feet of them were ordered from the lumber yard.

### *Construction*

A triangle measuring 7 feet on a side was laid out on the ground about 2 feet from the back of the house, and a stake was placed at each corner. At the points marked by the stakes, 3-foot deep holes were dug for sinking the base supports. The supports were made from three old bed rails that were picked up at a local junk yard, although any pieces of steel angle bar could be used. Three holes were drilled about a foot apart at one end of each of the rails, and the other ends of the rails were placed in the holes in the ground. The tops of the rails were leveled and the rails made vertical in the holes, and then the holes were filled with concrete. When the concrete had set, holes were drilled in three of the 16-foot lengths of 2 by 2 to correspond to the holes in the bed rails,

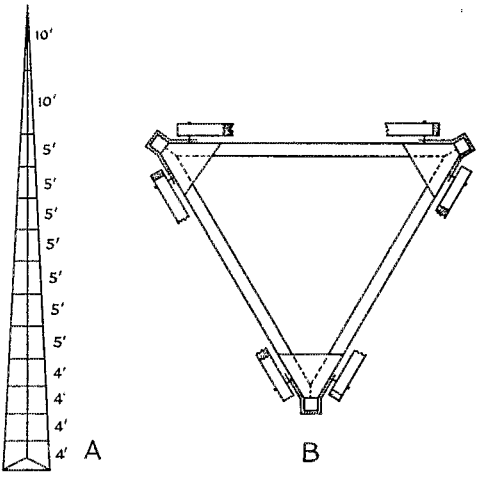


*Fig. 1* — The spacing of the various sections of the mast (A) and a plan view of one section (B), showing how the horizontal members butt into the vertical members.

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and the three 2 by 2's were bolted to the supports.

The cross braces, I decided, should be constructed on the ground and then carried up and bolted in place. I cut three pieces of 2 by 2 seven feet long and laid them on the ground in the shape of an equilateral triangle. Using a triangle, the ends were cut to match each other with a 30 degree cut. A local tinsmith made up a lot of iron triangles for me, and I bolted them to each corner, putting two bolts through each end of each 2 by 2. The result was a strong and rigid triangle of the correct length on each side to mount in between the three uprights, just above the point where the bed rails joined the uprights. With a shaped piece of strap iron (which conformed to the shape of the 2 by 2 and wrapped around it, and then extended far enough to bolt to the sides of the triangle), I bolted the first triangle in place.

Taking the top triangle as 0 feet on a side and

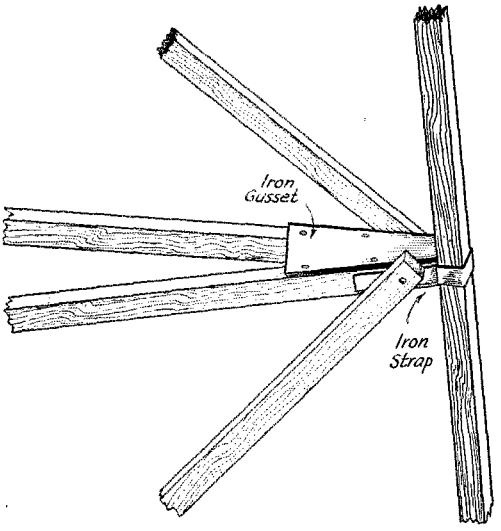
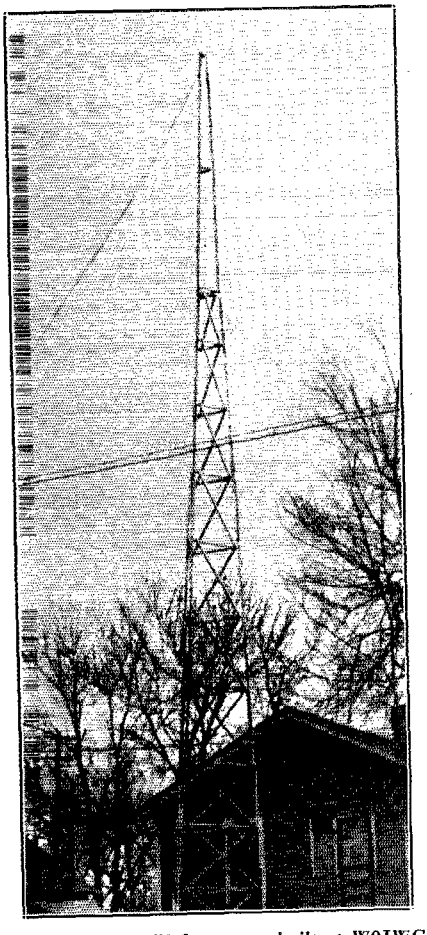



*Fig. 2* — Corner detail of the mast, showing the iron strap used to hold the horizontal members to the side piece and the gusset plate that gives additional strength to the horizontal members. The diagonal braces are fastened to the corner by bolts running through the horizontal members.



A self-supporting 70-foot mast, built at W9JWC for less than $15.

the bottom triangle as 7 feet on a side, I figured the middle triangle as 3½ feet on a side and so on, and thus I computed the length of the side of each triangle. I then constructed the second triangle and bolted it in place. I put them 4 feet apart and used the previously placed one to stand on while putting the next one in place. After putting four in place, the structure was beginning to get wobbly. It was at that point that I decided to put on cross angle braces instead of guying the tower.

I started at the bottom again and, taking the bolts out of the shaped iron braces one by one and replacing them with longer bolts so that they would accommodate two thicknesses of 2 by 2 instead of one, I placed 2 by 2 angle braces all around the bottom and then climbed up on that and did the same all the way up. After this extra bracing was accomplished, I found the 16-foot section just about as solid at the top as at the bottom.

About 2½ feet above the fourth triangle was the end of the 16-foot uprights. A 2 by 2 five feet long was bolted in place on each upright, half protruding above the top of the uprights, and then the next 16-foot long 2 by 2's were hoisted hand under hand and balanced in place on top of the lower pieces and then bolted to the splicing 2 by 2's. Then, on up to the top of this structure, I slowly made my way (placing a triangle in place, then down after another 2 by 2 and the saw, brace and bit, and the bolts and nuts, and back up again,

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## Self-Supporting Tower

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sawing the angle brace to fit, drilling it and bolting it in place), and so on up to the height of 50 feet. Each time I gained new height, I wondered at my sanity, climbing up that high with nothing but a 2 by 2 structure under me. However, as I went higher and higher, I gradually got used to the height.

At 50 feet I decided to stop. I had a platform triangle on top that measured 1½ feet on a side[1] that would make a swell mounting for a rotatable beam, and I didn't know how I was ever going to get the remaining 20 feet on top of what I already had. It was impossible to go any higher by the same method I had been using, since there wasn't enough room to work in, any way I looked at it.

At this point I decided that the remaining 20 feet would have to be constructed on the ground and then carried up and put in place. This was easier said than done, as I found out later.

I built the last section on the ground and painted it and put the halyard in place while the putting was good. It was 20 feet long, a triangle for one end that matched the one at the top of the tower, and for the peak I put in a small triangle 4 inches on a side to hang the pulley from. Halfway along another triangle was used to brace it, and it was ready to be put in place.

Twenty feet long, weighing a hundred pounds, ungainly as you can imagine, the problem of setting it in place just about floored me. It lay in the back yard for two weeks before I hit on a plan for raising it.

I first fastened a 15-foot 2 by 2 to one leg at the top of the tower, sticking up in the air 10 feet above the top. I put a rope through a pulley at the top of this pole and fastened one end to the midsection of the structure to be raised. However, the 2 by 2 would not take the weight of the structure, so I used it to steady the structure while I hoisted it with a separate block and tackle fastened to a rung on a false structure protruding 5 feet below the bottom of the last section which I was raising. The pulley for this block and tackle was fastened to the top of the 50-foot tower and we were all ready to go. The reason for the false structure at the bottom of the piece to be raised was to give enough clearance for the double pulley tackle and so that the piece could be actually raised up and set down on the top of the tower.

I took my position at the top of the tower and tied myself to the side of it. A friend kept the middle section as nearly straight as he could from below. Another slowly pulled on the main hoisting block and tackle, and slowly the tip came up even with me. I had previously prepared three pieces of heavy strap iron with which to bolt this last section in place. They were up there with me with the bolts, ready to be put in place.

As the tip came up even with me, I took hold of it and guided it on up as the two friends kept

[1] According to our calculations, the platform 50 feet up would be 2 feet on a side. Perhaps it looked smaller to W9JWC at the time. — Ed.