A Lattice Boom for 14 mc Antennas

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When a top-notch aircraft stress engineer and a hot shot DX man team up on an antenna design, you can look for something super. The strength of this lightweight boom has been demonstrated by supporting the ends on sawhorses and having three husky W6's sit in the center and bounce up and down!

The trend is towards bigger and better 14 mc beam antennas. Many beams have been constructed along the lines recommended by W6SAI[1]. This antenna is very satisfactory for the average installation. However, additional problems of ice and wind loading arise in severe climates. It was felt that a stronger structure could be devised that would be self-supporting, on the order of a trussed bridge. With careful choice of materials, this new design would not weigh any more than the present design, nor have appreciably greater wind resistance. It should be guyless, eliminating these ice-collectors, and it would be able to support many times the weight of the elements. A boom of this type would be a distinct advantage in windy, wintry climates. It would provide the ultimate in strength and safety.

A preliminary design was established and two experimental booms were constructed. The object of this paper is to describe the engineering and construction of this type of structure, so it may easily be duplicated by others.

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General Design

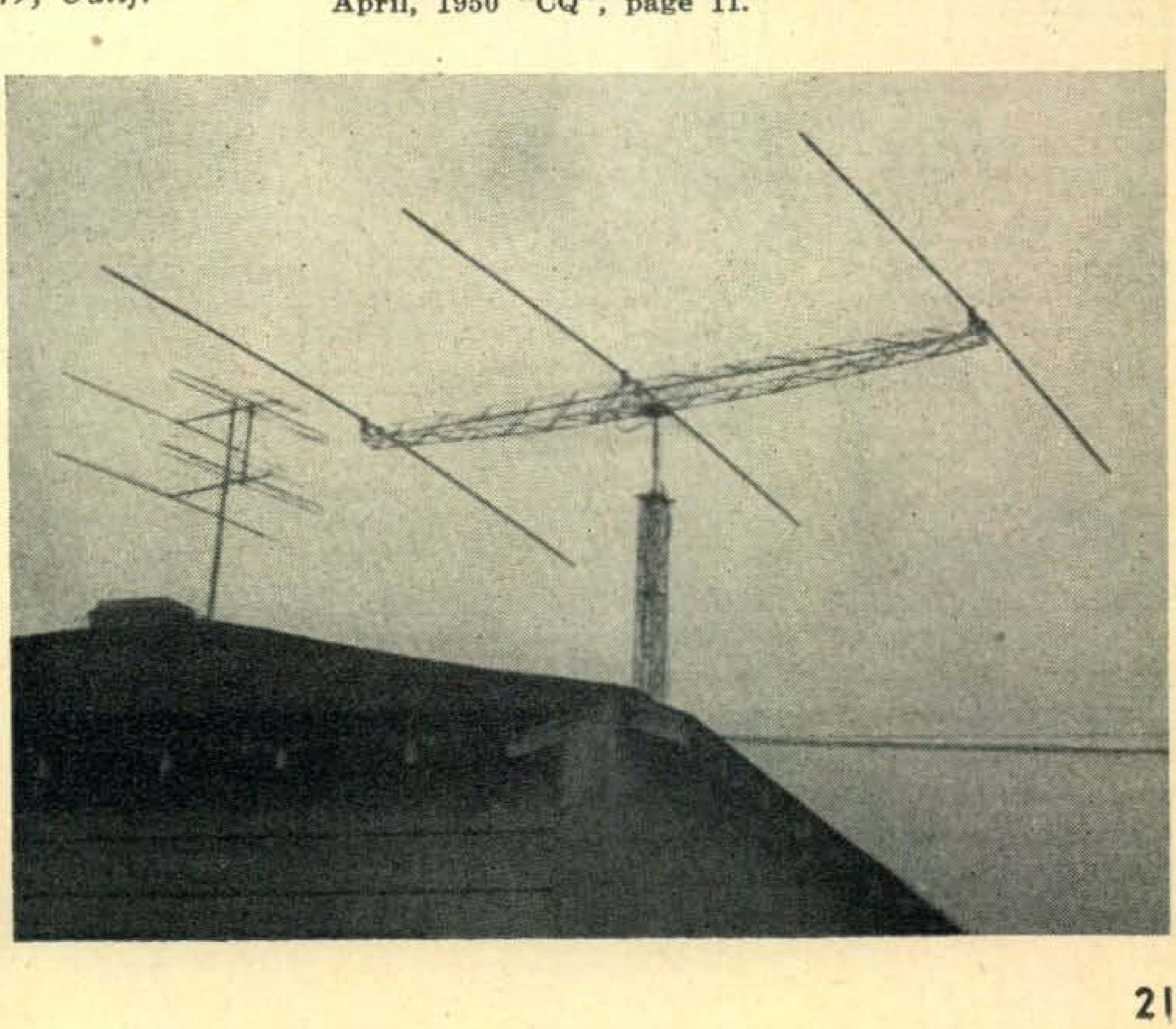
The trussed boom is twenty-four feet long. This allows fourteen feet director-to-antenna spacing and ten feet reflector-to-antenna spacing. This spacing provides the maximum gain for the overall length of the boom. The overall weight of the boom is 44 pounds, compared to 37 pounds for the "plumber's delight" type of boom, including cross-arms and guys. The element cross arm supports, as well as the guys which are needed on the "plumber's delight" are eliminated. This means the two types of construction are comparable in weight.

The longerons are made of four twenty-four-foot sections of 1" x 1" x .125" 61ST dural angle stock. An additional 160 feet of ½" x ¾" x .040" stock is needed for lacing material.

This angle stock may be clear or primed material. It should not be anodized, as this finish has a very high surface resistance. The elements are clamped to the boom by means of special micarta clamps. (Fig. 1) The cost of new material for the boom is approximately $25.00. Surplus material should cut this cost figure appreciably.

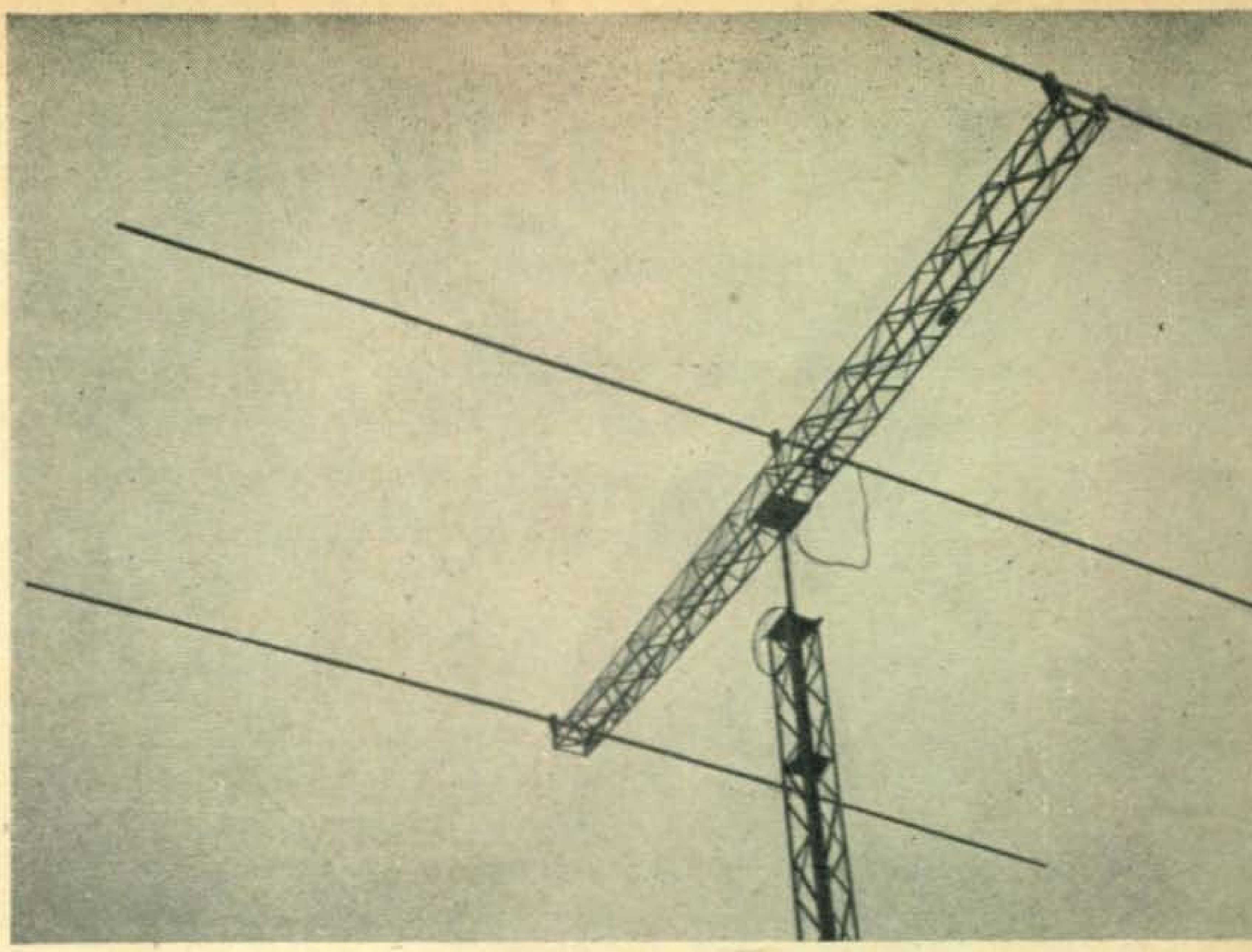
The 61ST material for the boom and elements was selected for two reasons:

1 "Building A Wide Spaced Twenty Meter Rotary Beam." April, 1950 "CQ", page 11.



Big Brother and Little Brother at W6FHR.

A close-up of the lattice boom at W6FHR.



1. It is cheaper than 24ST.
2. It is more corrosion resistant than 24ST.

Along this line, if one purchases surplus material, one should not accept any material in the soft or "O" condition. At this temper the material is highly susceptible to corrosion and should be avoided even if it has sufficient strength. The 61ST material has good corrosion properties and though about 15% lower in strength than 24ST, the element deflection will be the same. Contrary to general belief, equal sizes of tubing or stock angle will deflect the same amount regardless whether it is made of soft or hard stock. Deflection is purely a function of the size and load on the part, and of the modulus of elasticity of the material. These factors are practically the same for a given type of material regardless of its strength.

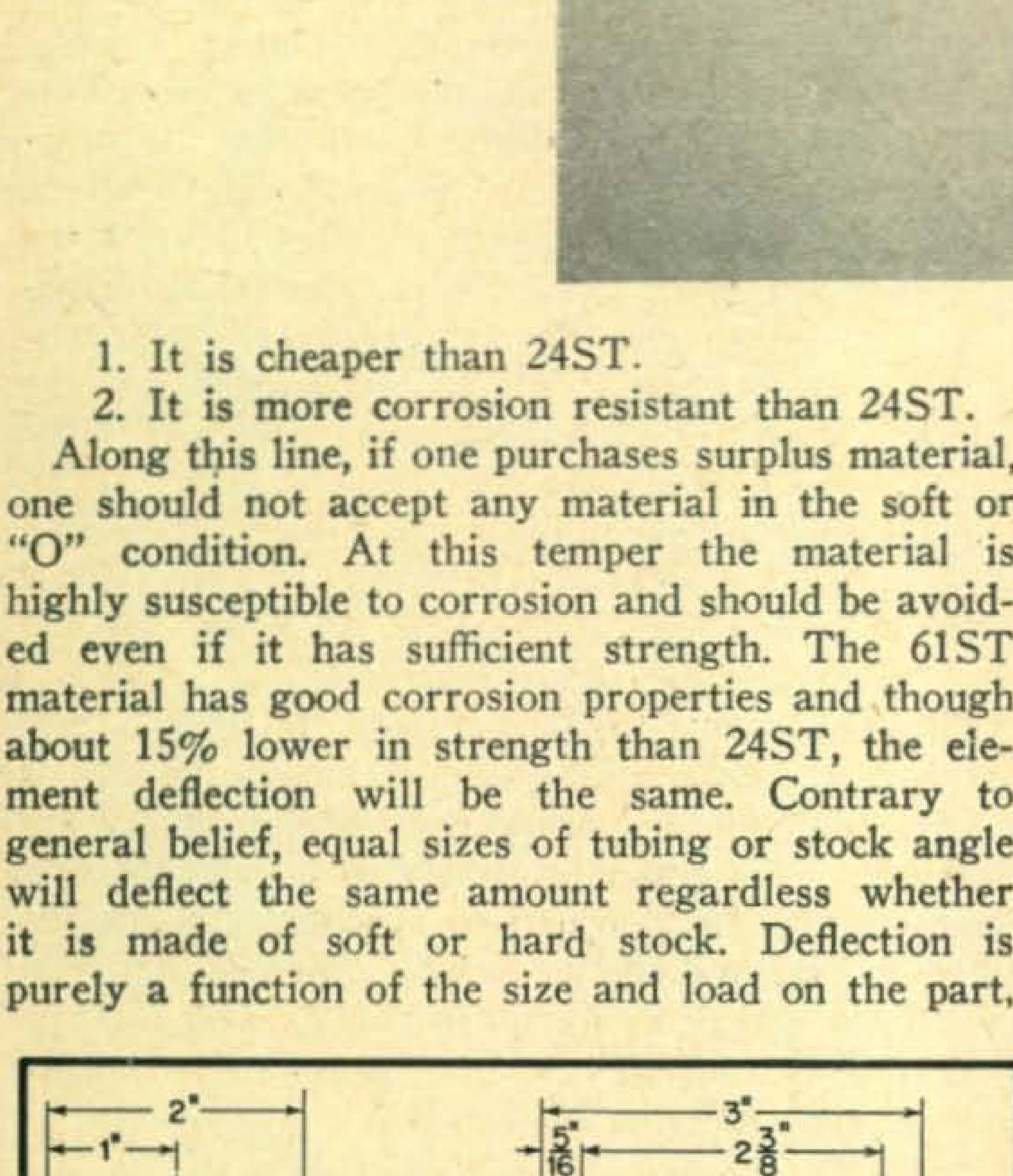


Fig. 1. Mechanical details of the micarta clamps used to hold the beam elements.

The boom has a cross-sectional area of 12" x 12" at the center, tapering to 12" x 6" at each end. (Fig. 2)

The boom may be fabricated with either 1/8" aluminum aircraft type rivets or 3/16" A-N type bolts. If an airgun is not available for driving the rivets, a hammer and a rivet set will work satisfactorily providing care is taken not to damage the surrounding structure. If bolts are used, even greater care must be exercised in maintaining proper edge distance than if rivets are employed.

Construction

The two sides of the boom are constructed first. The material should be laid out in a flat driveway or on a sidewalk. A top longeron is clamped to a 2" x 4" piece of wood 24' long to stiffen it and keep it straight. The two blocks of wood 11¾" long are then spaced between the longeron and a bottom longeron. These blocks are spaced one foot on each side of the physical center of the longeron.

The ends of the bottom longeron are now brought up to within 6 inches of the top longeron. Two pieces of stock 5½" long are cut and clamped to hold the ends in place. If both ends of the bottom longeron are brought up to the top longern simultaneously, the natural bend of the material will be the same on both sides of the center. (A goodly supply of "C" clamps on hand will do much to speed production work.)

It is best to start at the center of the boom and work towards the ends, since in this way any build-up in tolerances will be cut in half, and a more symmetrical structure will result.

The first pair of laces is started at the center of the top longeron. The lacing is cut square on the ends so as to be at right angles at each top joint.

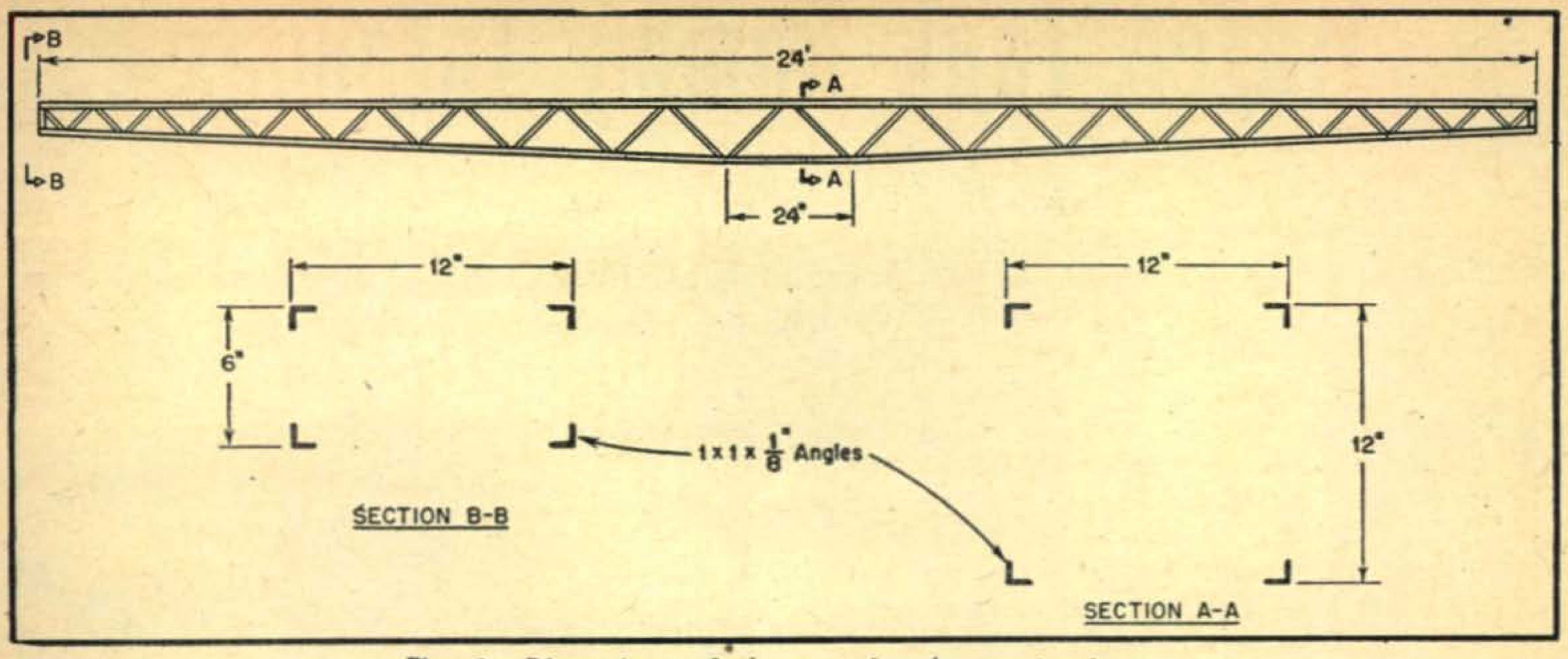


Fig. 2. Dimensions of the tapering boom structure.

(Fig. 3) It is best to cut the lacing as one progresses along the tapered sides, although four of each length may be cut at once so as to make up the opposite side. The work should progress towards each end simultaneously, and the tolerance build-up can be compensated for as the ends are approached. Care should be exercised in drilling the joint holes for the rivets or bolts to make sure that adequate material is left at the edge of the hole.

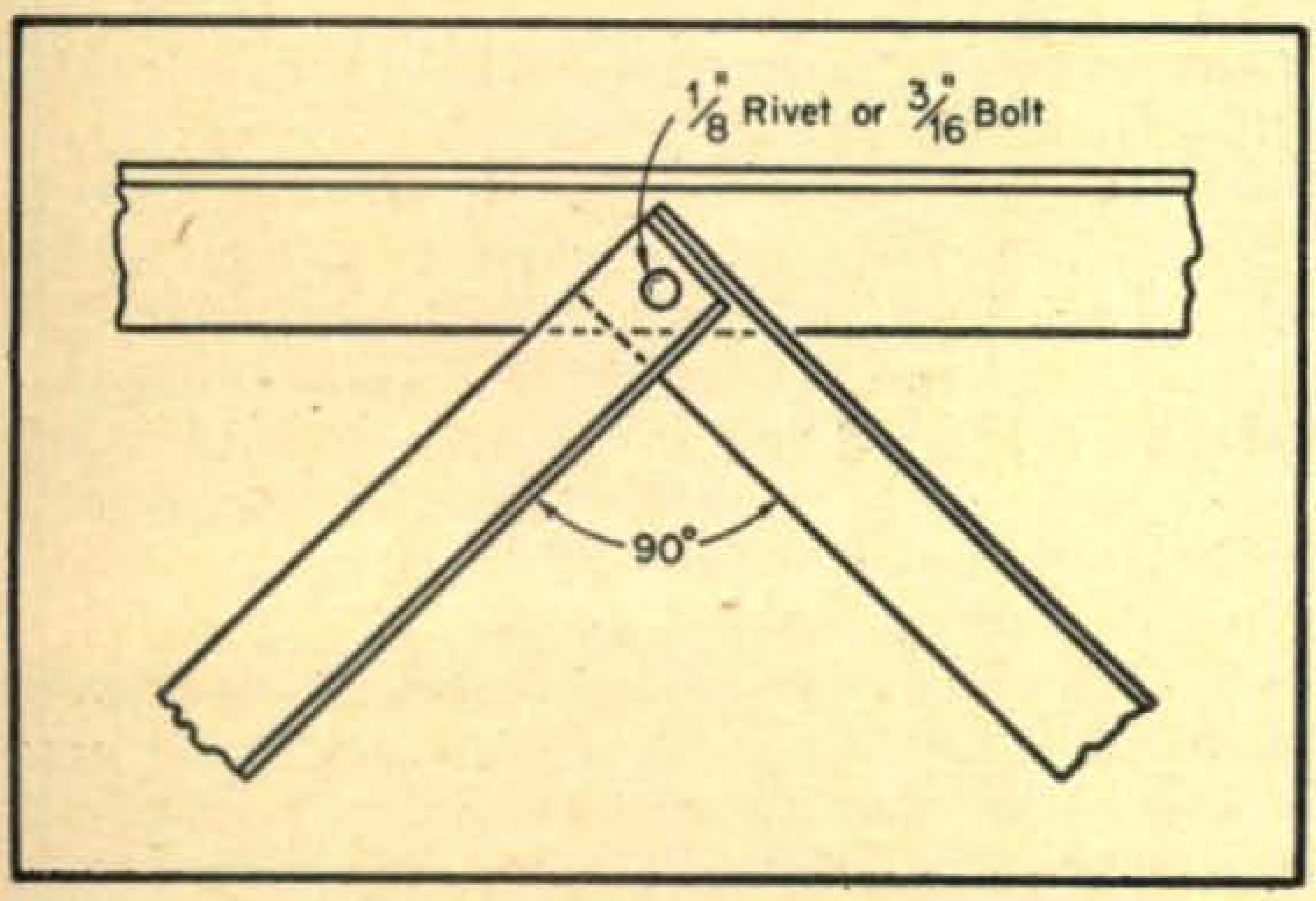


Fig. 3. Details of a typical lacing joint.

After the two side members are made, they are stood on edge with the top side down to provide a flat edge and are spaced 12" apart by means of wood blocks and "C" clamps. They are clamped into position and squared up with a carpenter's square. The top and bottom lacing is cut and installed. In the case of this lacing, it may all be cut at once. Again, it is recommended that work progress from the center of the boom towards the ends. If the 90° lacing angle is maintained, little or no interference with the previously made side joints will result. Slight irregularities or warps in the boom will easily be compensated for by the element mounts; so if these problems occur, just ignore them!

Painting

Now the boom is completed, and is sitting on two sawhorses in all its glory! The next step is to paint it. The best protective coat consists of a first coat of zinc-chromate primer and a second coat of flat gray enamel.

A simpler paint job consists of one coat of aluminum paint. In moderate climates, this will last for a year or so. Under no circumstances should the boom be used without a protective coating of paint.

We sincerely recommend that a spray gun be used for this job, as there are many nooks and crevices that must be reached which cannot be touched with a brush.

Mounting

A suitable mounting attachment must be devised to connect the boom to the vertical rotating pipe and thrust bearing. The boom should be attached so as to permit it to be tilted to a vertical position. In this way the boom may be raised into position and the elements attached to it at a later date,

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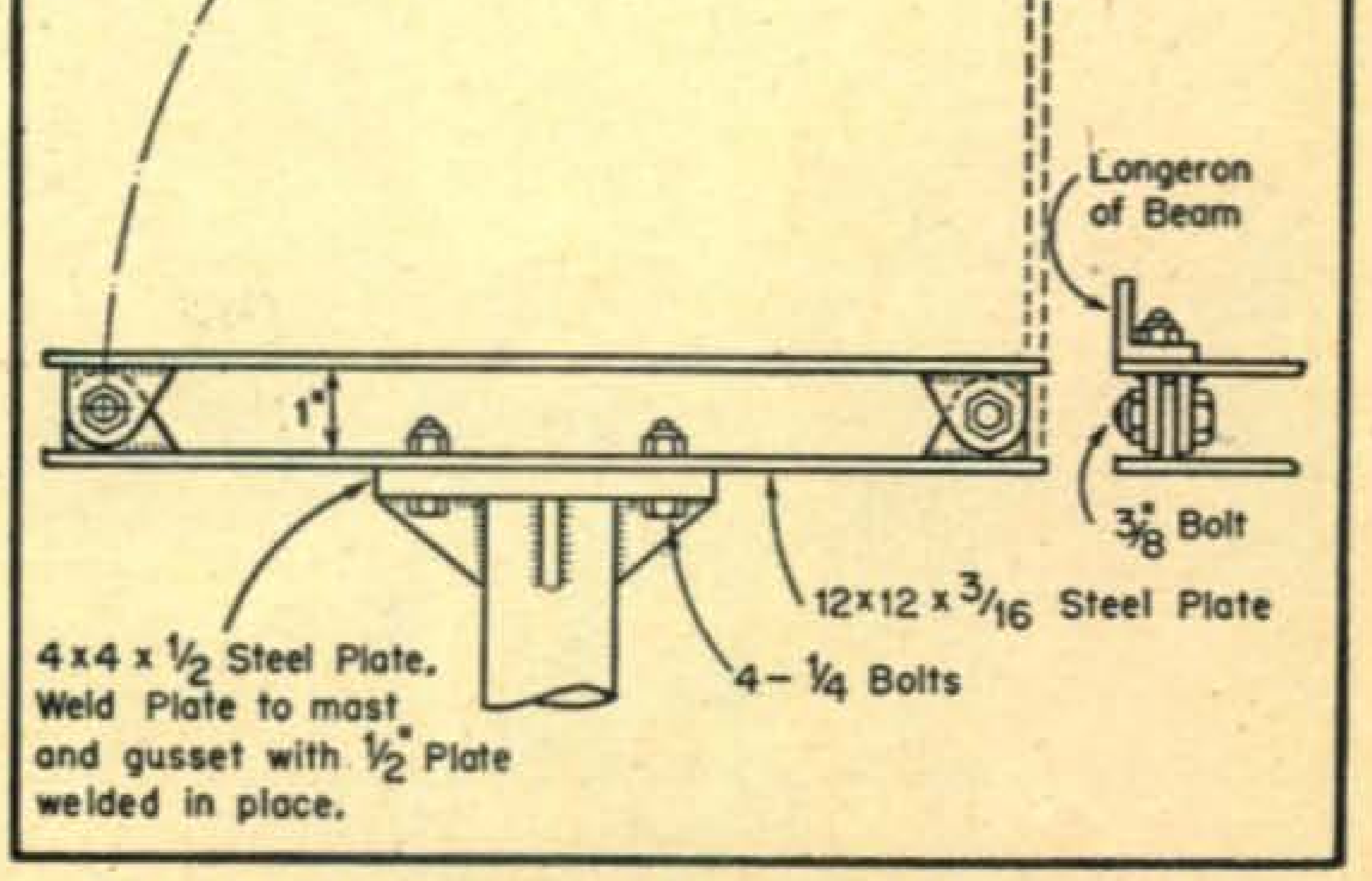

Fig. 4. The tilting method used by the writers.

minutes will increase 36°F, assuming no heat losses. The conductance increases in a linear fashion with temperature the rate being about 1½%of the initial value for each degree F. This means that if you adjust the resistance to 300 ohms it can go up about 70 degrees F before you get a 2 to 1 mismatch with the resulting 150 ohm tank. Since this will take an hour with 200 watts, or 15 minutes with 800 watts (output), it would seem that the 9½ lb tank should serve most amateur purposes.

The writer's conclusion is that with the aid of modern plastics and some water, the amateur can construct a cheap and satisfactory dummy load for any amateur power rig. While not very portable, the device apparently does not have any other serious limitations and you are hereby invited to give it a try.

LATTICE BOOM

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simply by tilting it to a vertical position and putting the elements in place while standing on the tower. A tilting mount that has worked satisfactorily for this beam is shown in Figure 4.

Insulators

In order to eliminate the cross arms usually present on beams of this size, a high strength insulator was devised as shown in Figure 1. Since the locations of the insulators are at low voltage points along the elements, a material such as paper or cloth base micarta was found to be suitable and to be amply strong.

After the insulators are made, they should be given several heavy coats of spar varnish to prevent moisture absorption.

To date this beam has weathered several 50 mph winds with hardly a whistle out of it, much to the relief of several neighbors who dwell in its shadow. No vibration or whipping actions are noticeable. It seems to be well worth the extra effort needed to construct the trussed boom. Try it and see!

RED ALERT

(from page 20)

atically up and down all streets in the area it is proposed to cover, the mapping process should not be too difficult. Of course, a different map would be required for each NCS location.

One of these maps, placed in each car during emergency operation, would eliminate the time-consuming process of driving around in search of a likely spot from which to contact the net-control station. It would also be useful in selecting sites for the permanent antennas mentioned above.

No such map would be needed for 10 meters. Only one 10-meter "dead spot" has been found in the entire city—an area blanketed by a local broadcast station. The erection of permanent antennas for this band is still considered a good idea, how-