BUILD A 35' FREE STANDING

TILT OVER ANTENNA TOWER

BY

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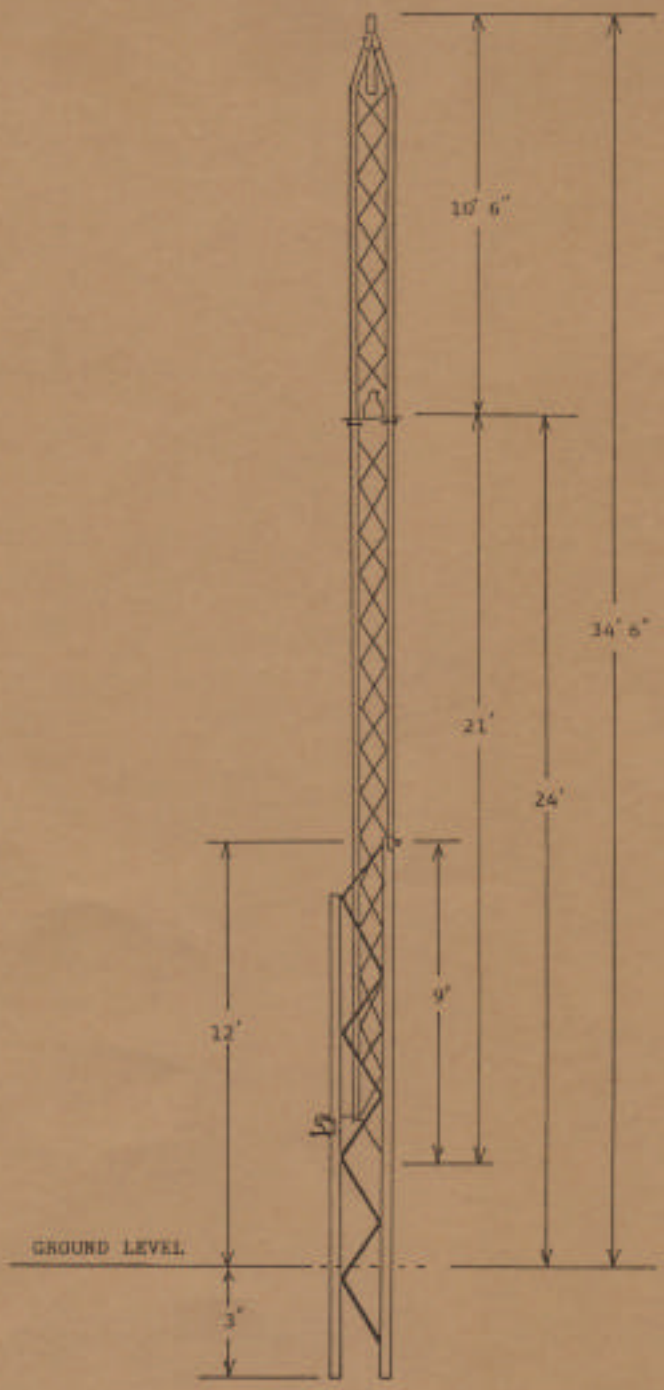


FIGURE 1

A slender metal tower with its efficient pattern of trusses rising majestically beside the ham radio shack is an impressive sight that might stir feelings of envy in those of us who think we can't afford to purchase such a luxury. For many of us it is unlikely that we could ever justify such an expenditure for something as unessential as a mere hobby. Most of the towers we see are commercially built and they are so neatly done that the specialized components suggest that some of what we need would not be readily available or difficult to produce. And the many welded joints and the symmetrical pattern of the trusses suggest that exotic equipment including complex jigs and fixtures might be required. Of course that is a tribute to those who have learned through long experience to do a superior job, and no fault could be found with purchasing any of the very excellent commercially built towers on the market if you can afford it. But if you, like myself, must stretch a limited number of dollars over a broad variety of needs and desires, then you might find the way to gratify your lust for a metal tower in these pages. You may be surprised to discover how easy and inexpensive it really is to build your own tower.

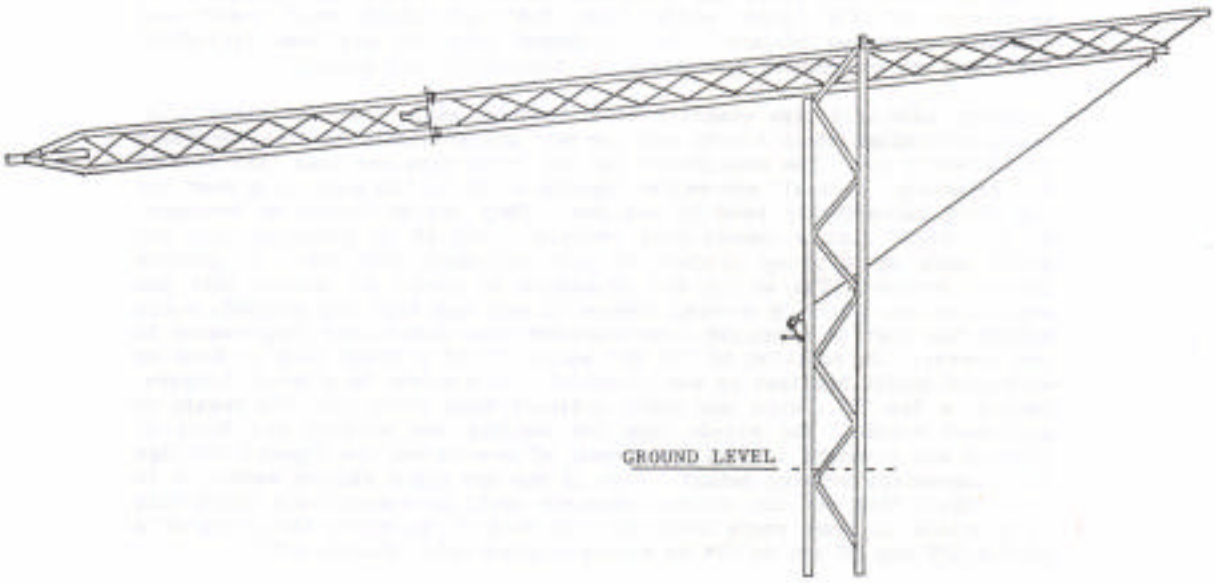


FIGURE 2

What is presented here is a construction plan for a free-standing tilt-over tower that can be used to support a beam antenna for 20, 15 or 10 meters or a light tri-band beam antenna. It could serve as well to support a wire sloper or an inverted "V", or of course it could also support a T.V. or F.M. antenna. And certainly a pair of towers could be erected to support a flat-top. The nominal height is about 35 feet for a beam or rotatable dipole. Its base section is set in a full cubic yard of concrete so that guying is not necessary for ordinary conditions and use. Certainly guying would make it even more durable but in its first season it has withstood very high winds without apparent harm.

Figure 1 will give you an overview of the project and you will see that the tower is built in three sections. The first section is welded up of three 15 foot lengths of standard weight 1" pipe with 3/8" re-bar trussing. The second section is of standard weight 1/2" pipe and 1/4" hot-rolled steel round stock, and the top section is of standard 3/4" E.M.T. electrical conduit with 1/4" trussing. The top section terminates with a length of 1 1/4" pipe that provides the radial bearing for the mast, which can be standard 1" pipe or standard antenna mast. The 3/4" conduit fits snugly over the 1/2" pipe and standard automotive hose clamps secure the joint. The rotator adapter is mounted at the joint of the second and top section and its clamps add to the strength of the joint. The base section is fitted with a 600 pound boat trailer winch wound with 1/8" stranded steel cable to lower and raise the tower as shown in figure 2. The pivot is fabricated of 3/4" pipe, angle iron, 3/4" hot-rolled steel round and standard set-screw collars. Only standard materials are used throughout and there are no complex operations for fabrication and assembly.

Ordinary materials like standard pipe, conduit, angle iron and strap iron, small hot-rolled steel rounds and 're-bar' are available nearly everywhere in the world now. The expenditure for the proto-type was less than $100.00 for materials. A small arc-welder capable of up to 100 amps is a must but you don't necessarily have to own one. They can be rented or borrowed, or you might find a second-hand bargain. And it is possible that you might work up a group project to pool equipment and labor to produce several towers. The set-up and procedure is really so simple that you might consider building several towers to sell and thus the proceeds would absorb the cost of acquiring some equipment you might have long wanted to own anyway. In addition to the arc welder it is a great help to have an acetylene outfit but that is not essential. An electric hand drill, hacksaw, hammer, a few "C" clamps and other ordinary hand tools fill the remaining equipment needs. The simple jigs for bending and welding are built of plywood and standard lumber, and a pair of saw-horses can support the jigs at a convenient working height. Even if you are not a skilled welder it is most likely that you can achieve adequate skill in a relatively short time of practice on some waste material. In fact it is worth the price of a simple 225 amp AC arc welder to merely acquire this valuable skill.

Among the first areas of concern in building the prototype were the forming of the trussing, fabricating the pivoting mechanism, mounting the rotator and terminating the top section. All else appeared to be routine labor and the initial problems all proved to be of very simple solution as well. There simply were no serious obstacles to forming and assembling the components. The proto-type was built single-handed, though admittedly a second pair of hands would have been welcome, especially while forming the trusses. The trusses were formed by cold bending but clearly it would be much better to heat the bar stock to a red heat before bending, thus getting a sharper bend with less effort. However some help was enlisted to dig the hole and mix the concrete to erect the base section. The concrete was allowed to cure for a week before the center and top sections were installed, which was managed quite easily single-handed, although another pair of hands would have made that job easier too. It was then a simple matter to install the adapter for the rotator, the mast and the antenna to complete the job. The finished product looks good and functions very well.

There certainly can be no claim to originality in this design or the application of materials for it is merely a composite of many towers seen. The author is not an engineer and no engineering has been applied to this project so no statement can be made to tell you how much wind it can withstand or what will happen to it in the event of earthquake or flood. The 21 foot long center section was considered to be the weak link but it supported the author's body weight bouncing in the center while supported at both ends. Certainly there is a limit to the size and weight of the antenna it can support but that limit is not known at this time. Any structure is liable to fail from causes such as flaws in materials, faulty welds, unusual winds, earthquake, flood or other forces, and there is a measure of liability if your structure causes injury or damage to persons or property. No doubt your tower might be judged "an attractive nuisance" if a child climbs it and is injured. No attempt has been made to discover and point out all of the hazards and liabilities in this project so you must use your own judgement or consult experts to determine whether it is safe, sound and legal in your application. As an amateur and confirmed "do-it-yourselfer" the author can only assure you that building your own tower is really quite easy and certainly fun and rewarding in many ways.

One of the greatest dangers in antenna work is coming in contact with high voltage electrical wires. So plan your installation so that the tower and the antenna will be a safe distance from any high voltage source even if it should topple from high winds or other forces. Of course you will plan the installation so that electrical service and phone wires won't interfere with lowering and raising the tower.

The tower may present an irresistible urge for some children to climb it and this design is probably not safe for anyone to climb. The lack of horizontal bars makes it difficult to climb but that may not deter some children. You might consider wrapping the lower portion with chicken-wire or other small mesh to make it impossible to get a toe-hold.

Of course there are hazards in building the tower too since you will be using welding equipment and other tools. Black pipe was used for the prototype in order to minimize exposure to zinc vapors from galvanized pipe. But the conduit is plated so a fan was used to blow away the vapors. A fire extinguisher was kept close at hand and all flammable liquids were moved a safe distance from the welding area. Sawdust, paper scraps and other flammable stuff was swept up and the area was cleared of anything that might pose a stumbling hazard while moving about with the welding helmet on. If you must work outside you should suspend a tarp to protect casual observers, especially children, from the glare of the arc and flying spatter. It is well worth while to deliberate over each operation and make sure that you do not pose a hazard to yourself or others as you work. Now if after careful consideration you still want to build a tower we can proceed.

Before you begin you should familiarize yourself with the sources for pipe and steel in your area. Prices were found to vary by 300% and more in a single area so the shopping time was well spent. The prototype was built with mostly brand new materials purchased for less than some dealers asked for used stuff. Be especially wary of cutting charges, which often far exceed the cost of full lengths. For example you might pay a $30.00 fee to cut a bar or pipe that costs only a few dollars in full length. Obviously it will be best to carry home full bars and save any excess for future jobs. Pipe normally comes in 21 foot lengths while the bar stock comes in 20 foot lengths. You need only a small amount of angle iron, strap iron and 3/4" round bar so you should buy "drops" to avoid cutting fees.

One of the initial problems was to get the materials home since no truck was available. The round bar stock and re-bar were simply bent into a broad "U" shape and tied with wire to be hauled on the car-top carriers. But 21 foot joints of pipe pose a formidable challenge and the usual light duty car-top carriers are really not adequate for such a chore. However, it is easy to suspend the pipe under the car with wire or chain at front and rear bumpers. Remember that such a load is a terrible hazard if it gets loose in transit so make absolutely certain that it is secure before you move.

MATERIAL LIST

Quantity	Item	Size	Use
3	1" std. pipe	15'	base section legs
2	3/8" re-bar	20'	base section trussing
1	2" X 1/4" angle iron	6"	winch mount
3	1/2" std. pipe	21'	center section legs
3	3/4" E.M.T. conduit	10'	top section legs
5	1/4" H.R. steel round	20'	center & top trussing
1	1 1/4" std. pipe	24"	top termination
1	hose clamp	2"	top termination
1	3/4" conduit scrap	9"	top termination

1	1" pipe or T.V. mast	12'	mast
1	boat trailer winch	600 lb.	tilt-over mechanism
1	1/8" cable	25'	tilt-over mechanism
2	cable clamps	1/8"	tilt-over mechanism
2	3/8" bolts	1"	tilt-over mechanism
2	3/8" bolts	2"	lock
4	lock washers	3/8"	winch mount & lock
4	nuts	3/8"	winch mount & lock
1	1" X 1/8" angle iron	5'	rotator adapter, pivot assembly and lock
1	1" X 1/8" strap iron	24"	rotator adapter
4	1/4" bolts	3/4"	rotator adapter
4	lock washers	1/4"	rotator adapter
4	nuts	1/4"	rotator adapter
3	1/4" U-bolts	7/8"	rotator adapter
3	hose clamps	1"	top section clamps
1	3/4" pipe	18"	pivot assembly
1	1 1/2" X 1/8" angle iron	6"	pivot assembly
1	3/4" H.R. steel shaft	20"	pivot assembly
2	set-screw collars	3/4"	pivot assembly
1	1/2" plywood	24" X 96"	jig
3	2" X 4"	8'	jig
2	1/4" carriage bolts	3"	jig
6	1/4" carriage bolts	2"	jig
2	1/4" carriage bolts	1"	jig
10	nuts	1/4"	jig
10	flat washers	1/4"	jig

misc. nails, screws, 1/4" plywood, primer, paint, etc..

BUILDING THE JIG

All that is required to bend the trusses is a series of studs over which the bar stock can be bent to a uniform pattern. A half sheet of 1/2" sheathing grade plywood will serve very well when braced with a pair of 2" X 4" ribs as seen in figure 4. The ribs and the gauge bar to be added later will be best installed with screws rather than nails for easy disassembly. Later the same surface is used for welding the trussing and finally for the assembly. This same jig is later altered for the center and top sections. A number of 6" "C" clamps or other clamping devices will prove useful throughout the project. A pair of saw-horses to support the jig at comfortable working height complete the set-up.

FABRICATING THE BASE SECTION

Referring to figure 3 you will see that the base section is fabricated of standard 1" pipe with 3/8" re-bar trussing. All sections are triangular in shape as shown above the side view in figure 3. The legs are spaced uniformly at 14" on both sides and the front. This dimension is between each pair of legs and NOT from center to center.

BASE SECTION DETAIL

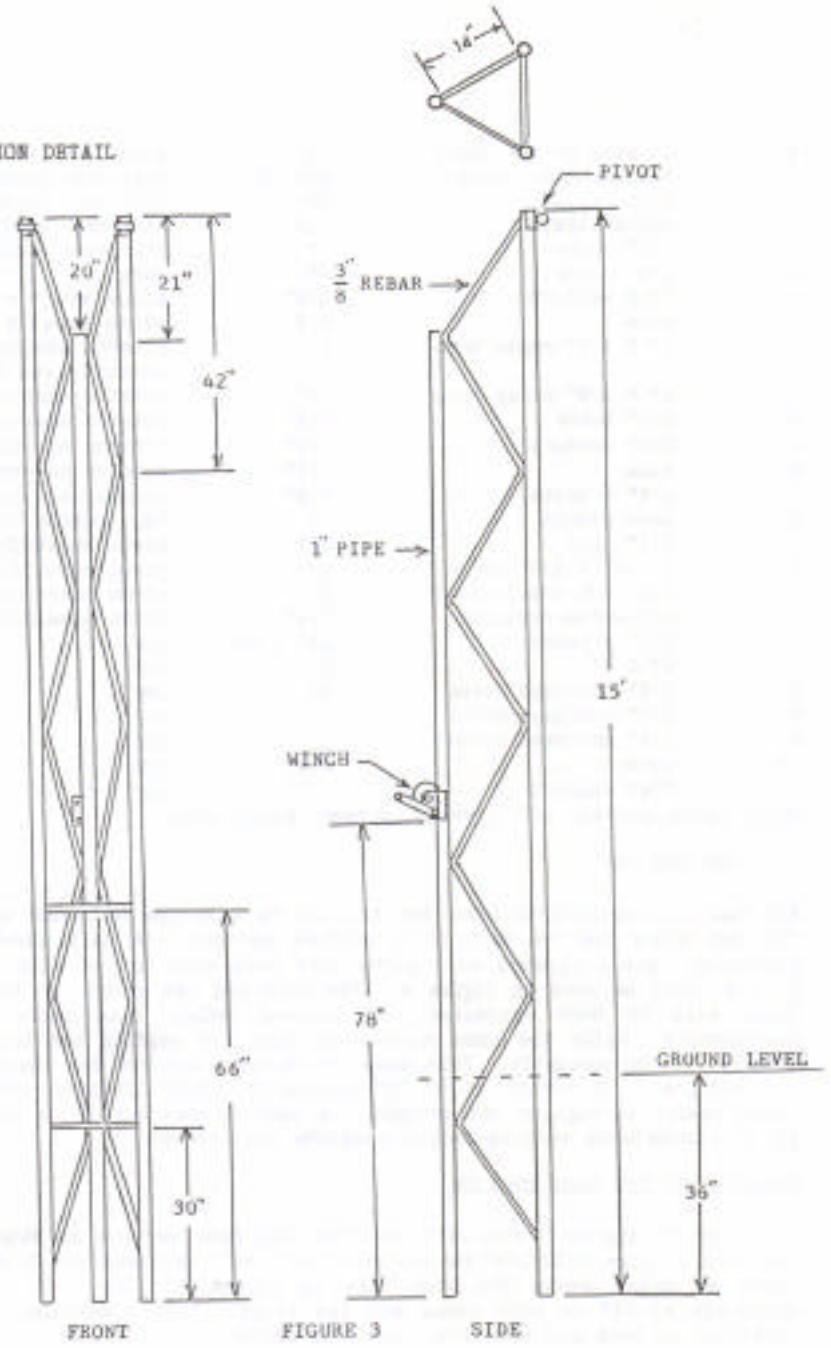


FIGURE 3

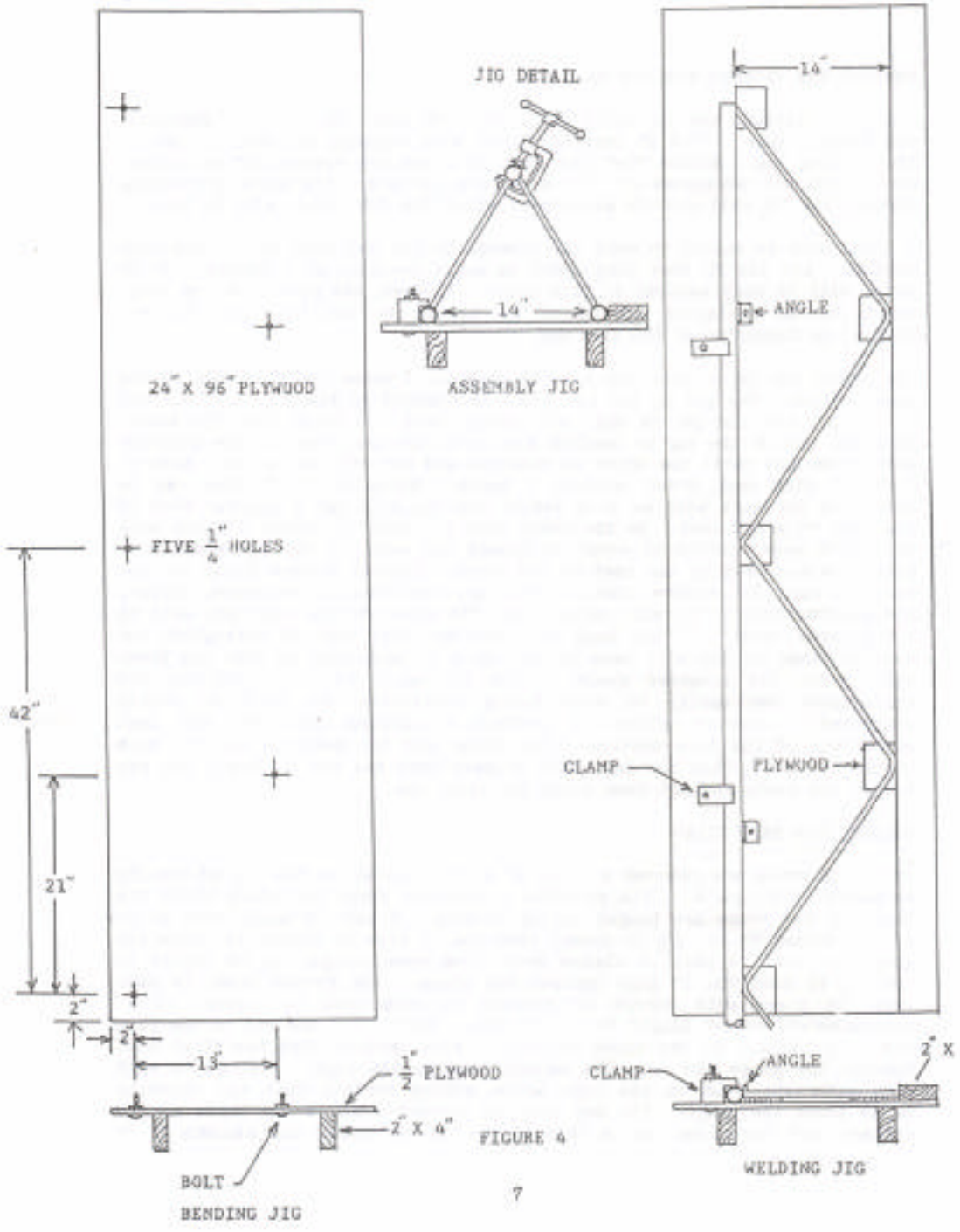

JIG DETAIL
14"
ASSEMBLY JIG
24" X 96" PLYWOOD
FIVE 1/4" HOLES
42"
21"
2"
2"
13"
1/2" PLYWOOD
2" X 4"
BOLT
BENDING JIG
14"
ANGLE
CLAMP
PLYWOOD
CLAMP
ANGLE
2" X
WELDING JIG

FIGURE 4

BENDING THE TRUSSES FOR THE BASE

Begin by drilling the jig table with five 1/4" holes as shown in figure 4, and install five 1/4" X 2" carriage bolts with washers and nuts to set up the bending jig. Notice that the rows of holes are spaced 13" on center, spaced 42" and staggered 21" for a uniform pattern. The bolts protruding through the jig will provide studs over which the 3/8" rebar will be bent.

A broad area is needed to bend the trusses so you may want to do this work outside. And the 20 foot long stock is quite unwieldy so a second pair of hands will be very welcome at this point. However, the prototype was built single handed by laying the jig on the ground so that the rebar did not have to be supported at the free end.

The object now is to bend two sets of diagonal trusses for the sides of the base section. One end of the bar stock is clamped to the jig at either end of the jig and the bar is bent alternately back and forth over the studs. When the end of the jig is reached just move the last bend to the starting point, continue until the truss is complete and cut off the excess. Note in figure 3 that each truss requires 7 bends. While the 3/8" rebar can be bent cold the work will be much easier and you will get a sharper bend if you heat to a red heat. In the event that you heat the bends a handy help will be a spray bottle of water to quench the wood of the jig, which will surely be scorched by the heat of the torch. Plastic trigger spray bottles such as used for window cleaners etc. are available in hardware, variety and supermarkets. You will surely want the spray bottle when you weld in the trusses later. If you bend cold the bar will tend to straighten out when released so you will have to over-bend at each stud so that the truss will retain its intended shape. This is really not very critical and corrections can easily be made during fabrication so don't be overly concerned. However strive to produce a uniform pair for the best appearance of the base section. The center and top sections will be much easier to bend. When you have both trusses bent and cut to length you can remove the studs and set them aside for later use.

WELDING THE BASE SIDES

After the studs are removed a third 2" X 4" is added to the top of the jig as shown in figure 4. This provides a straight guage bar along which the bends of the truss are gauged during welding. A pair of angle iron stops can be bolted to the jig to ensure that the 1" pipe is spaced 14" from the guage surface. A pair of clamps made from wood scraps can be bolted to the jig to hold the 1" pipe against the stops. The formed truss is then layed in place with scraps of plywood at each bend to support it at approximately center height on the 1" pipe. Begin near one end of the pipe and weld the end of the truss securely. Make certain that the first bend touches the guage and weld the second bend to the pipe. Proceed to weld each alternate bend to the pipe while making certain that the opposing bends touch the guage. You may have to correct some of the bends as you proceed, and the truss can be held to the jig by screws and washers if it

tends to lift. The scorched wood of the jig can be quenched with the spray bottle. When the end of the jig is reached simply slide the whole thing along to new starting point and proceed. Make a uniform pair that look like the side view in figure 3.

ASSEMBLING THE BASE SECTION

The angle iron stops can be removed from the jig and the wooden clamps are moved to set up the assembly jig as shown in figure 4. The two sides are set in the jig with the front legs spaced 14" and the back leg can be clamped to the trusses with "C" clamps as shown in the assembly jig insert of figure 4. Make certain that the upper ends of the front legs are both flush with the end of the jig before you weld. You can clamp the bends of the trusses to the back leg and tack weld them progressively. Then weld in the two front spreaders at the 30" and 66" height. Finally roll the assembly from side to side to position it conveniently to finish welding each bend securely to the pipes. Drill the 2" X 1/4" angle iron bracket to match the base of the winch and weld it to the back leg at the 78" height. The pivot assembly will be added later so you can prime paint the base section and set it aside for now.

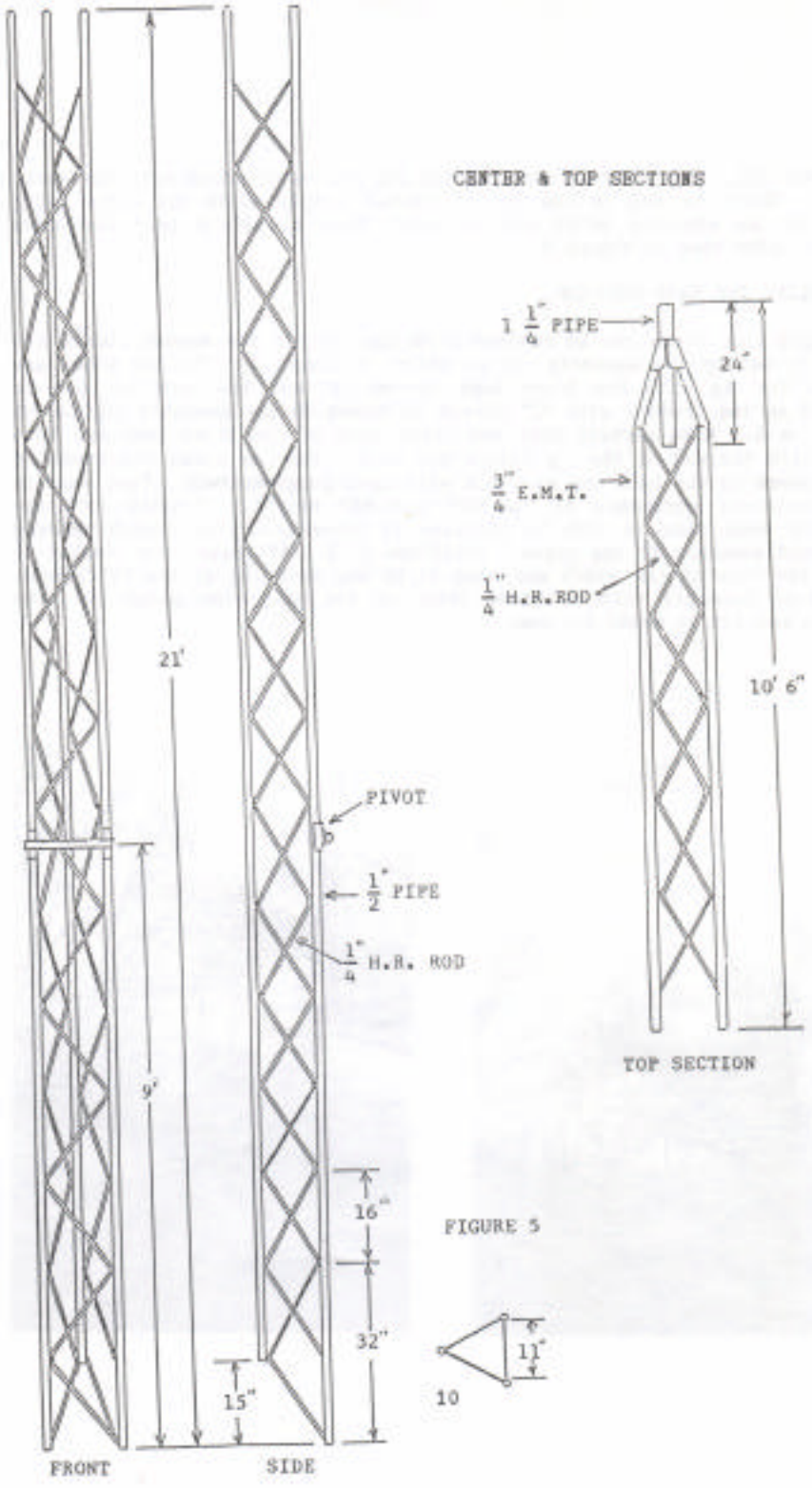

CENTER & TOP SECTIONS
1 1/4" PIPE
24"
3/4" E.M.T.
1/4" H.R.ROD
10' 6"
TOP SECTION
21'
PIVOT
1/2" PIPE
1/4" H.R. ROD
9'
16"
32"
15"
FRONT
SIDE
11"
10

FIGURE 5

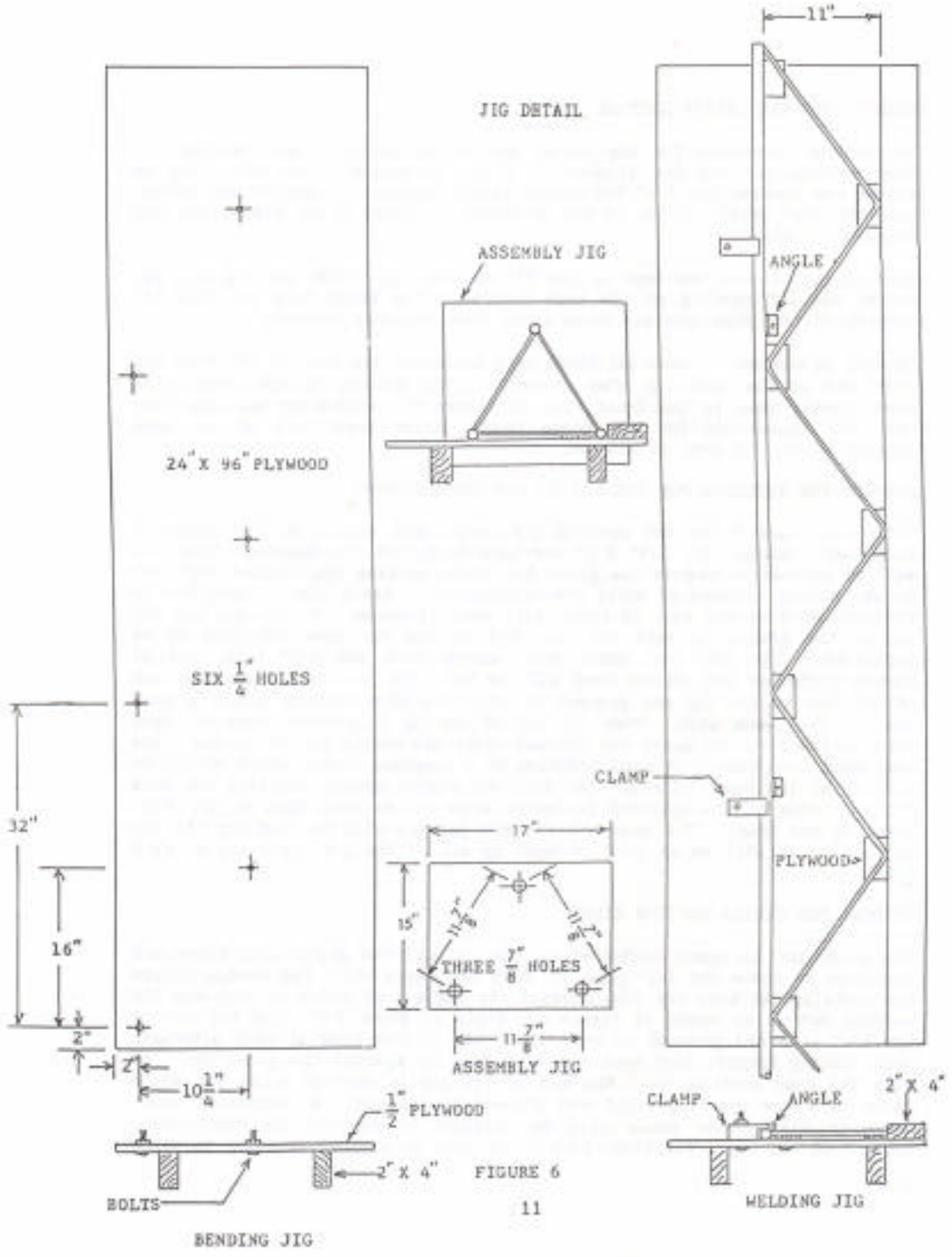

JIG DETAIL
11"
ASSEMBLY JIG
ANGLE
24" X 96" PLYWOOD
SIX 1/4" HOLES
32"
16"
2"
2"
10 1/4"
CLAMP
17"
15"
11 7/8"
11 7/8"
THREE 7/8" HOLES
11 7/8"
ASSEMBLY JIG
PLYWOOD
1/2" PLYWOOD
2" X 4"
BOLTS
BENDING JIG
CLAMP
ANGLE
2" X 4"
WELDING JIG

FIGURE 6

FABRICATING THE CENTER SECTION

The general procedure for the center section is exactly like that for the base section but the end product is a bit different. The work will be easier now because the 1/4" hot-rolled round trussing is lighter and softer than the 3/8" rebar. Refer to the drawings in figure 5 for dimensions and assembly details.

The spacing between the legs is now 11" so that the center section will fit inside the 14" spacing of the base section. The three legs are full 21' lengths of 1/2" pipe, and all three sides have diagonal trussing.

It will be easiest to make all three legs identical and cut off 15" from the lower end of the back leg after assembly. The pattern of the trussing is most clearly seen in the front view of figure 5. Notice in the side view that the dimensions for the truss bends differ from that of the base section so the jig must be altered.

BENDING THE TRUSSING FOR THE CENTER AND TOP SECTIONS

Refer to figure 6 for the bending jig layout and drill six 1/4" holes as indicated. Install six 1/4" X 2" carriage bolts for the bending studs. It will be easiest to remove the guage bar while bending the trusses and that is why screws instead of nails are recommended. Again the 20' long bar is unwieldy so a second pair of hands will make it easier. Or you can lay the jig on the ground so that the free end of the bar does not have to be supported. The 1/4" bar bends much easier than the 3/8" rebar but of course a sharper and easier bend will be had with heating. Clamp one end of the bar to the jig and proceed as with the base section truss to bend the bar over each stud. When the end of the jig is reached move the last bend to the starting point and proceed until the entire bar is formed. The last bend will result in some fraction of a diagonal truss, which should be cut off at the bend. The 20' bar will not render enough trussing for each 21' long side so the splicing is better done at the bend than at any mid-point in the truss. The same spacing and pattern will be used for the top section so it will be as well to bend up all of the 1/4" trussing at this time.

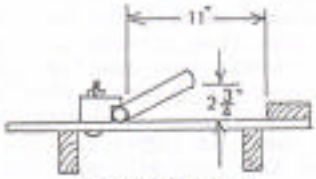
WELDING THE CENTER SECTION SIDES

The guage bar is again installed on the jig and the angle iron stops are installed to space the 1/2" pipe 11" from the guage bar. The wooden clamps are installed to hold the pipe against the angle iron stops to complete the welding set-up as shown in figure 6. Begin at about 1/2" from the end of the 1/2" pipe and proceed to weld the truss to the pipe at each alternate bend, making certain that each opposing bend is against the guage bar. As with the base section, when the end of the jig is reached slide the whole thing to a new starting point and proceed to the end. An additional saw-horse or some other means will be required to support the overhanging portion of the leg. The final foot or so will be without trussing to allow

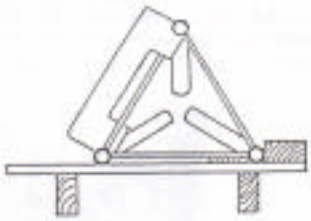
clearance for the joint with the upper section and the rotator. Make three sides like the front view in figure 5.

ASSEMBLING THE CENTER SECTION

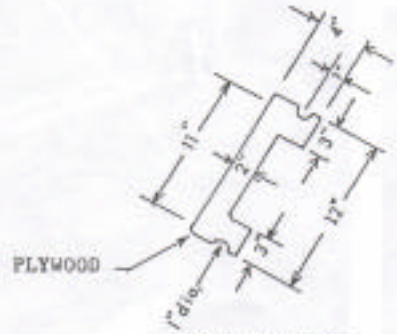
The long sides will be very flexible and unwieldy so some means is required to hold them in position for welding. Once it is welded in a few spots it becomes quite rigid and the ultimate strength of this assembly is amazing. Begin by making two assembly jigs from plywood or masonite as shown in figure 6. The three holes fit closely over the 1/2" pipe and support the three legs in approximate position for assembly when installed over each end. However the center will still require some extra support at first so make six assembly spacers as shown in figure 7. The half holes in the assembly spacers are made 1" so that they will work for the top section as well. These spacers will hold the center in position. Use extra support at each end and align the assembly to be reasonably straight before you begin. Once the assembly is aligned properly begin to tack weld at points where the trussing bends meet the pipe legs. Use "C" clamps where neccessary and use plywood spacers under those bends that rest on the jig so that the truss bends will meet the pipe legs at about center height. Once each joint is tack welded it is easy to rotate the assembly to securely weld on all sides. Cut off about 15" from the back leg and the free end of the truss and weld in the final short truss to complete the assembly. The pivot will be welded on later so the assembly can be prime painted and set aside for now.



WELDING SET-UP



ASSEMBLY SET-UP



ASSEMBLY SPACER

TOP ASSEMBLY

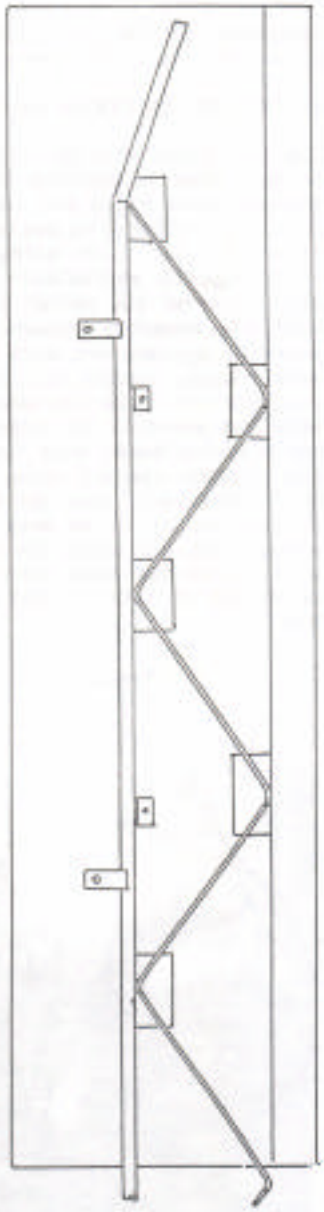


FIGURE 7

BENDING THE TOP SECTION LEGS

The top section terminates in a single 1 1/4" pipe so the upper ends must be bent. And the lower ends are slit 2" deep with a hacksaw so that they will fit more easily over the 1/2" pipe of the center section. The joint will be secured with automotive hose clamps and the "U" bolts of the rotator adapter as shown in figure 12. This work is most easily done beforehand and the base section provides a convenient bending jig because the 3/4" conduit slips easily into the 1" pipe of the base section. You can prop the base section up with a sawhorse at one end and fasten a scrap of board to the 1" pipe with a "C" clamp. Allow the board to protrude 16" past the end of the pipe as a guage. Slide the conduit inside the pipe allowing 16" to protrude. Using a shorter length of 1" pipe as a lever, bend the conduit 5 5/8" as shown in figure 7. This is not a critical operation for the conduit will buckle neatly at the bend and a correction can easily be made at final assembly.

WELDING THE TOP SECTION SIDES

The trussing has already been formed and welding the top section sides is similar to the center section except that the material is lighter and the legs must be properly positioned. The same welding jig set-up is used as for the center section with its 11" spacing. But the end of the bent top portion is propped up to 2 3/4" height as shown in the welding set-up insert in figure 7. Because the conduit is much lighter than the 1/2" pipe you will use smaller welding rod and lower heat to weld but the remainder of the procedure is exactly as for the center section. Make three sides as shown in the top section in figure 5.

ASSEMBLING THE TOP SECTION

Because the top of the legs are bent it is not possible to use the assembly jig that was used for the center section but it can be used at the lower end. The assembly spacers are used at the upper end and near the center, and plywood spacers are used to support those bends that lie on the jig. Once it is all aligned you can proceed to tack weld each joint and finally rotate the assembly to securely weld all joints.

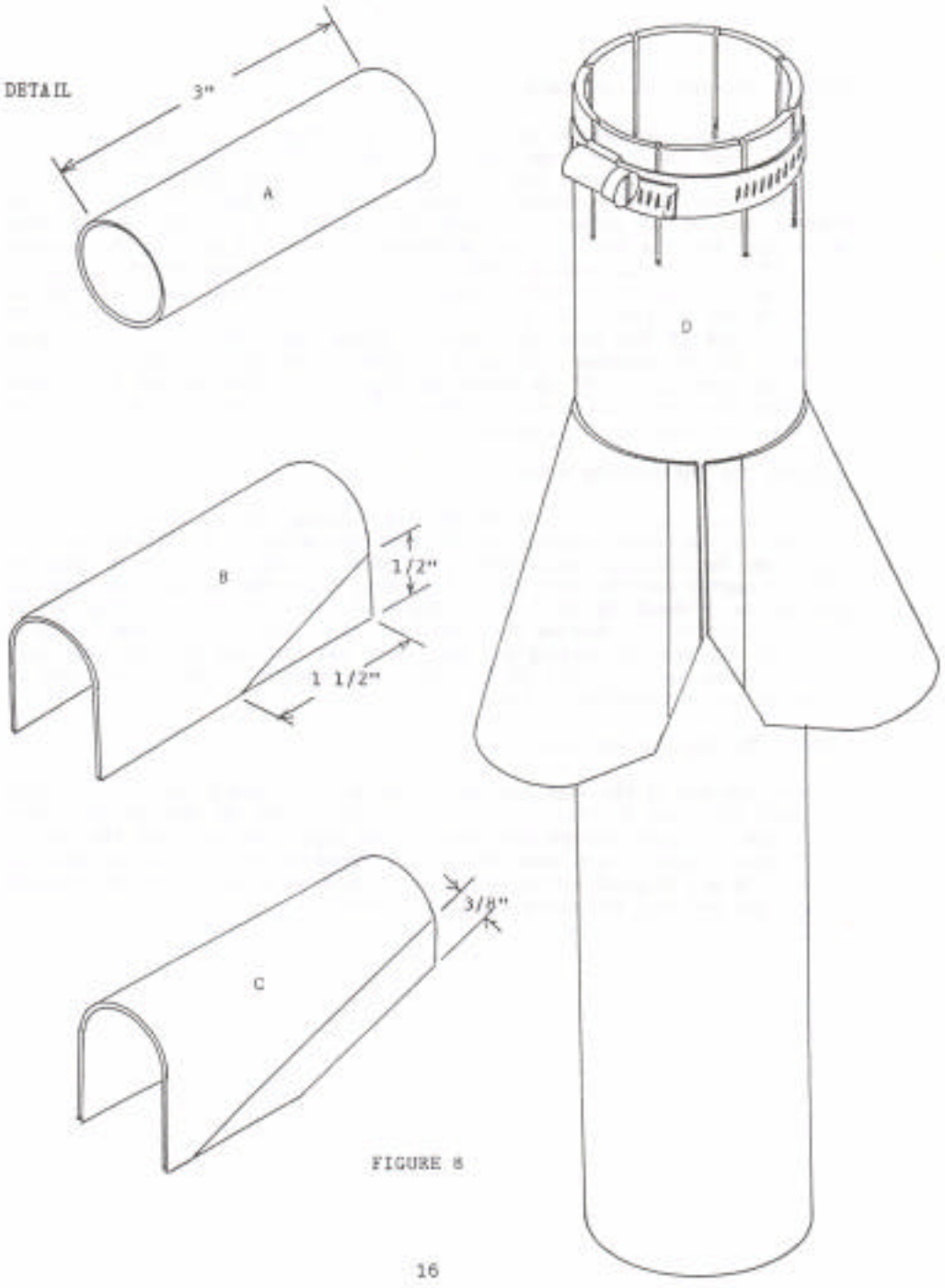


FIGURE 8

FORMING THE TERMINAL FITTINGS

To make the terminal joint neat and strong some fittings are employed. These are easily made from scraps of 3/4" conduit or from heavy sheet metal. The procedure using scraps of conduit is shown in figure 8. "A" represents a 3" length of conduit and it is split with a hacksaw to be bent in a "U" shape as at "B". A diagonal portion is cut off on each side as in "B" and a 3/8" wide flange is bent on each side as at "C". The three fittings are cold-forged to their final shape over a scrap of 1 1/4" pipe so that they will fit neatly as at "D". Some trimming of the flanges may be neccessary. There is some danger of bursing through the pipe when the fittings are welded on so extra care should be taken. If you have an acetylene torch you may elect to braze the fittings in place. In fact it may be as well to braze all the joints in the top section and terminal assembly. The fittings are welded or brazed at about 8" from the top of a 24" length of 1 1/4" pipe to complete the terminal assembly. The fittings provide sockets into which the ends of the top section are welded or brazed.

Because the 1" pipe or T.V. mast is notably smaller than the inside of the 1 1/4" pipe, the diameter of the terminal must be reduced by some means. If a lathe is available a bushing could be made but most of us don't have access to a lathe. It is a simple matter to cut 8 vertical slots 1 1/2" deep with a hacksaw, clean away the burrs inside and install an automotive type hose clamp to pull the segments together. Make sure that the mast will turn easily with a minimum of clearance. If wear occurs the slots can be widened later and the clamp tightened again. This work is best done before the terminal fitting is installed on the top section.

THE PIVOT MECHANISM

The center section is pivoted at a point 9' from its bottom and the boat trailer winch is used to lower and raise the tower to work on the antenna. A side view of the tilted tower is shown in figure 9. The combination of 3/4" shaft inside standard 3/4" pipe results in rather generous clearance but the arrangement works out nicely for this application. Remember that this pivot supports all of the weight of the center and top sections plus the mast and antenna, and it must endure the forces of high winds and possibly snow and ice loads as well. Make sure that your welds are very secure. These and all other parts of the tower should be checked frequently for indications of fatigue or wear.

FABRICATING THE PIVOT MECHANISM

Three fittings are welded up as illustrated in figure 10 and they are assembled with a 20" length of 3/4" H.R. steel shaft and two set-screw collars.

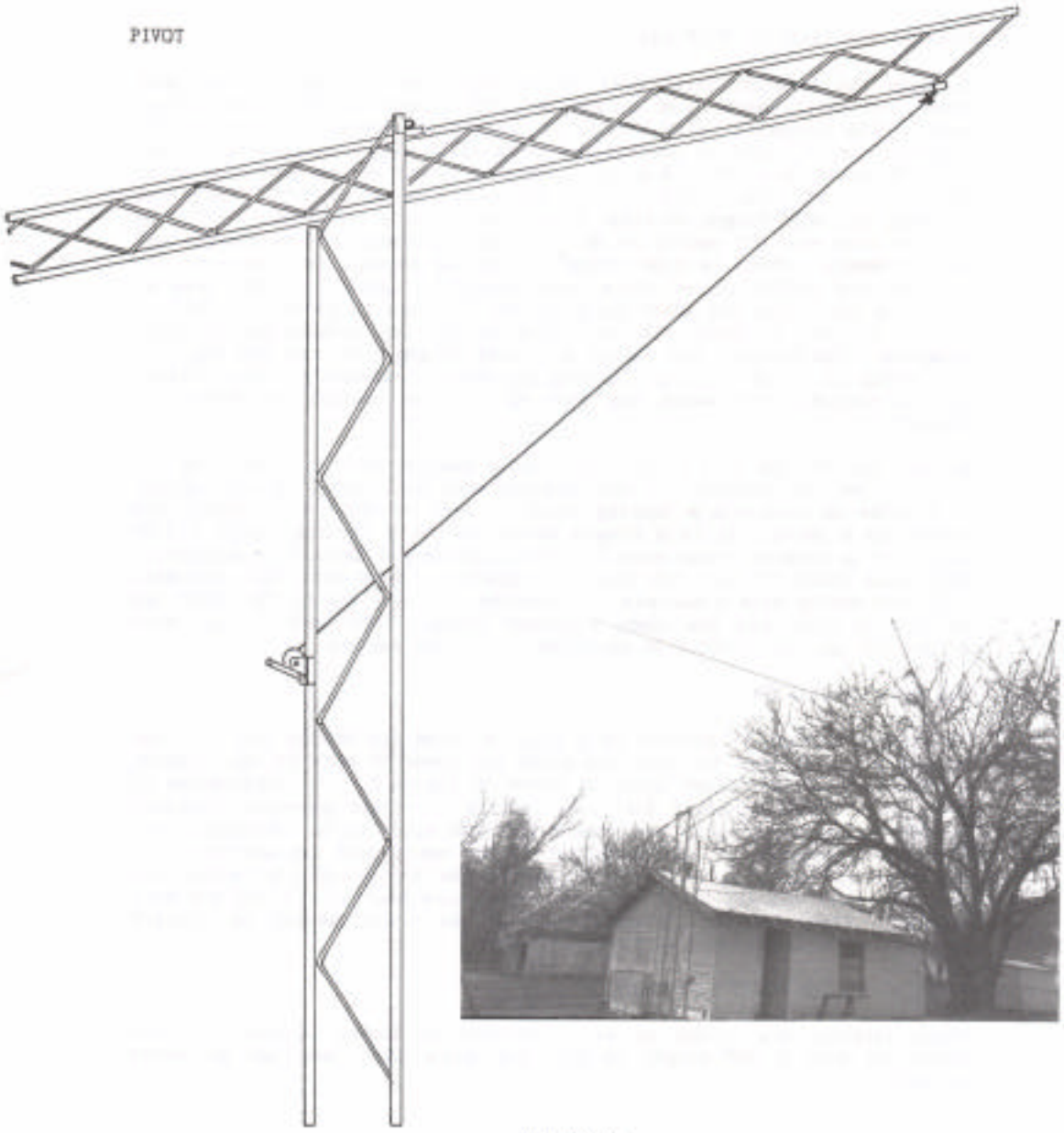
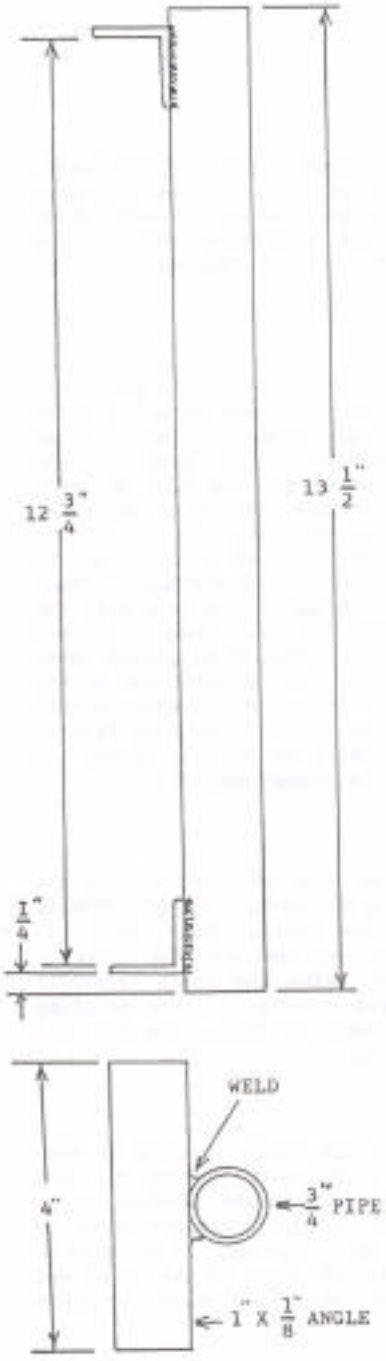
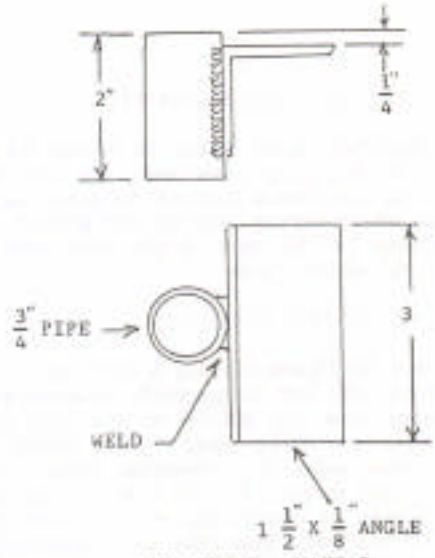


FIGURE 9



CENTER PIVOT



END PIVOT - MAKE 2

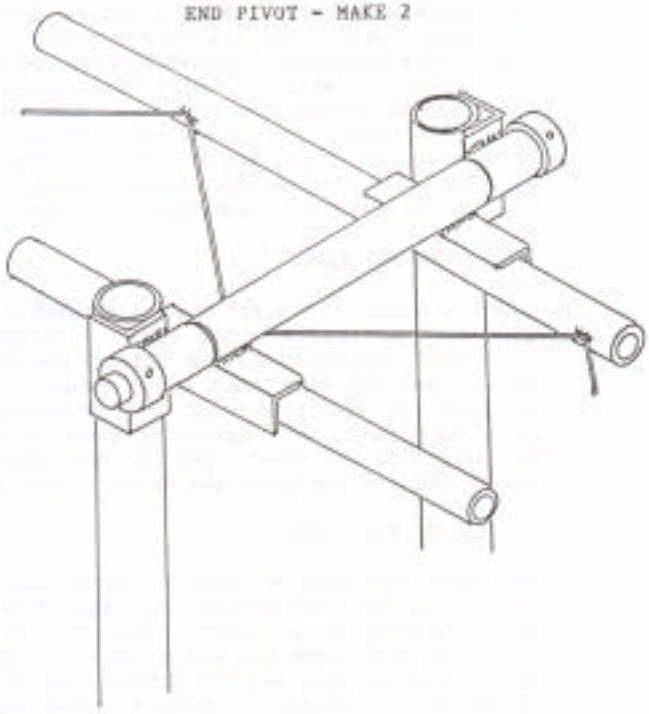


FIGURE 10

INSTALLING THE PIVOT MECHANISM

The completed center pivot is welded at exact right angles to the center section 9' from its lower end. To make certain that the sections will mate well when the center section is erect, assemble the base section and center section while laying flat on the ground. When all is aligned tack weld the end pivots to the legs of the base section and then disassemble the pivot to finish welding them.

ERECTING THE BASE SECTION

Referring to figure 11, dig a hole approximately three feet square and three feet deep, (Or try to persuade someone else to dig it!) and spread a layer of gravel over the bottom of the hole so that any water that might enter the legs can drain away. The sides and bottom of the hole must be undisturbed earth and remember that concrete must fill the hole so don't make it too large. A 5 to 1 mix is adequate for this purpose so that will mean 5 bags of cement and a cubic yard of gravel and sand mix, or a cubic yard of readymix from the local concrete company if they will deliver in that minimum quantity. Make a wooden form about 18" square and 3" deep from scrap lumber. Set the base section in the center of the hole with the wooden form suspended a distance above the ground for the present. Proceed to fill the hole with thoroughly mixed concrete to within 3" of ground level and drop the wooden form in place. Fill the form with concrete and strike it off at ground level. Check the base section with a level to make certain it is truly plumb and guy it with ropes or wires if necessary so that it will not shift before the concrete sets. It will be best to allow the concrete to cure for a week before you install the center section.

INSTALLING THE WINCH

Bolt the winch to the pre-drilled bracket on the base section. Follow the directions packaged with the winch for threading the cable. 25' of cable is more than adequate for this application but the excess amount helps to assure that the stub won't break loose. (When you see how the cable is threaded you will understand this precaution!) Wind the cable carefully onto the drum in even layers to avoid a tangle-up when you are handling the weight of the tower. Provide two cable clamps to fasten the free end of the cable to the lower end of the center section.

ASSEMBLING THE PIVOT

The winch was used to raise the pivot joint of the center section to near the top of the base section and then it was lifted over the top by hand while standing on a ladder. Then the center section was blocked up to align the pivot eyes and the shaft was slipped through. You are urged to enlist a helper and use two ladders for this job. Tighten the set screws of the collars securely. Fasten the free end of the cable to the lower end of the center section with the two cable clamps and raise it to its erect position.

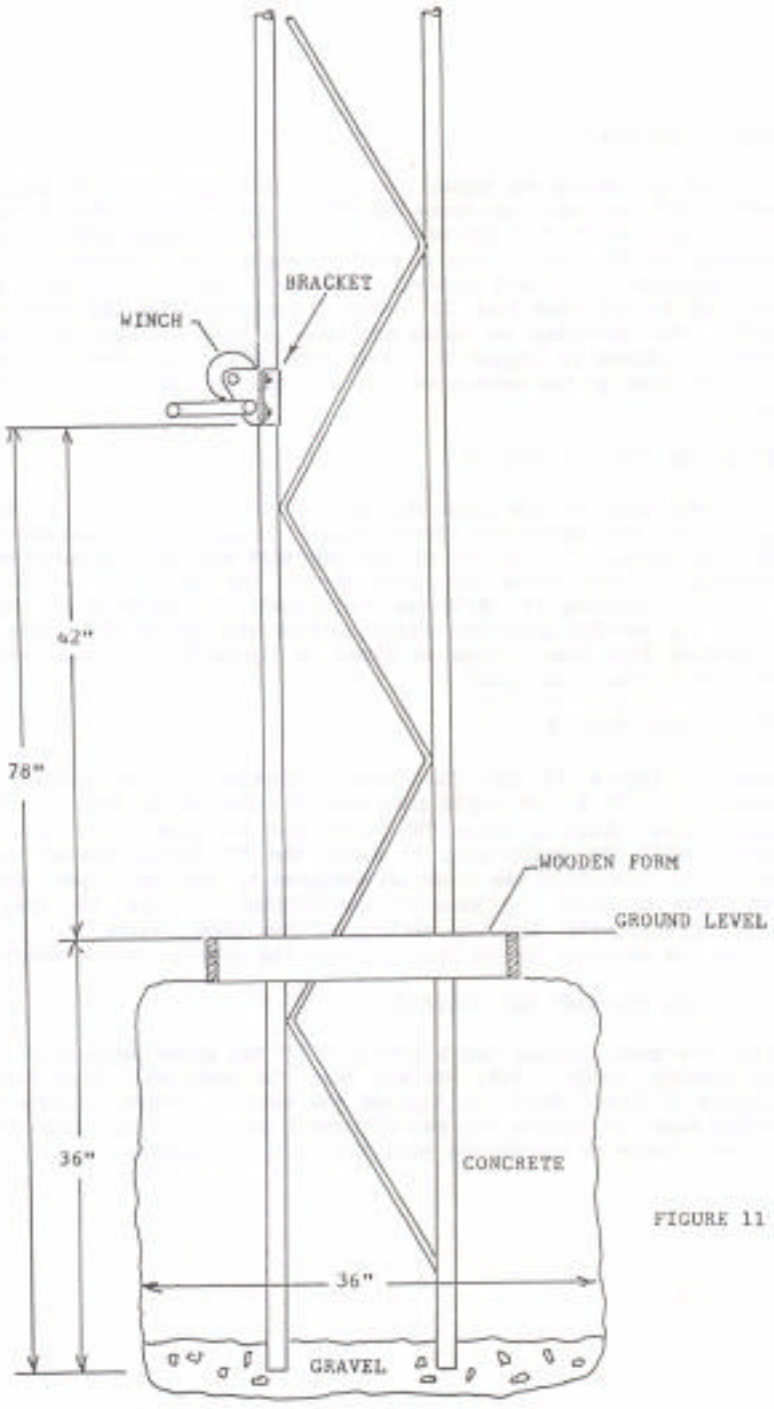

BRACKET
WINCH
42"
78"
WOODEN FORM
GROUND LEVEL
36"
CONCRETE
36"
GRAVEL

FIGURE 11

LOCKING THE TOWER

It would be unwise to depend entirely upon the cable to hold the tower erect. And besides that there is always the possibility of tampering or pranksters. A short chain with a padlock will ensure against unauthorized lowering of the tower. And a pair of angle irons bolted across the legs will eliminate play and prevent banging or rattling in high winds. It would be a good idea also to remove the handle from the winch to prevent anyone from releasing the cable and thus causing a tangle-up. The clamping device is shown in figure 13. Note that a wooden spacer is used because the 1/2" legs of the center section are smaller than the legs of the base section.

INSTALLING THE TOP SECTION

The lower ends of the legs of the top section are slit 2" deep with a hacksaw and the burrs are cleaned away. If you drive a scrap of 1/2" pipe into the conduit to the end of the saw slit you will be assured of easier assembly. Don't drive the pipe beyond the saw slit or you may have difficulty removing it. With the center section lowered slide the lower end of the top section onto the center section and secure the joints with three automotive type hose clamps as shown in figure 12. A step ladder will be required to reach the joint.

THE ROTATOR ADAPTER

Refer to figure 12 for the general details of the adapter, which is assembled of 1" X 1/8" angle iron and 1" X 1/8" strap iron. It is fastened to the tower joint by three "U" bolts that fit nicely over the top section legs. Drill the angle iron to match the "U" bolts, noting that one bar spans two legs while the other is centered on one leg. Space and drill the bar stock to match the base of the rotator. Install the adapter at the joint of the center and top section of the tower, where the "U" bolts will add to the strength of the joint. Mount the rotator on the adapter.

INSTALLING THE MAST AND ANTENNA

Slide the mast through the 1 1/4" pipe of the upper section and seat it in the rotator clamp. Make certain that the mast will turn freely with a minimum of play before you tighten the rotator clamps. Clamp the antenna to the mast and follow the manufacturer's directions to adjust the position of the antenna to correspond with the rotator indicator.

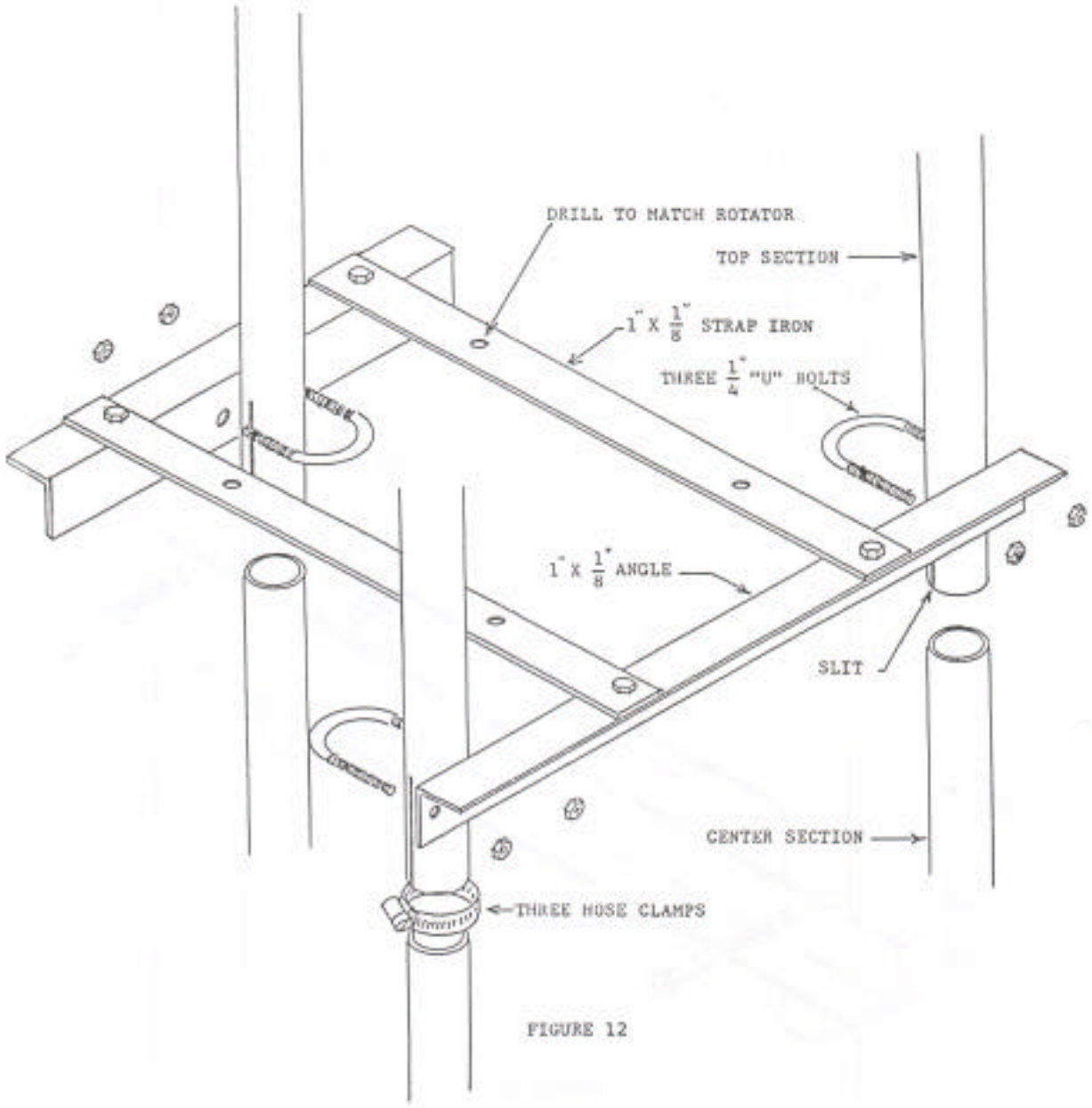

DRILL TO MATCH ROTATOR
TOP SECTION
1" X 1/8" STRAP IRON
THREE 1/4" "U" BOLTS
1" X 1/8" ANGLE
SLIT
CENTER SECTION
THREE HOSE CLAMPS

FIGURE 12

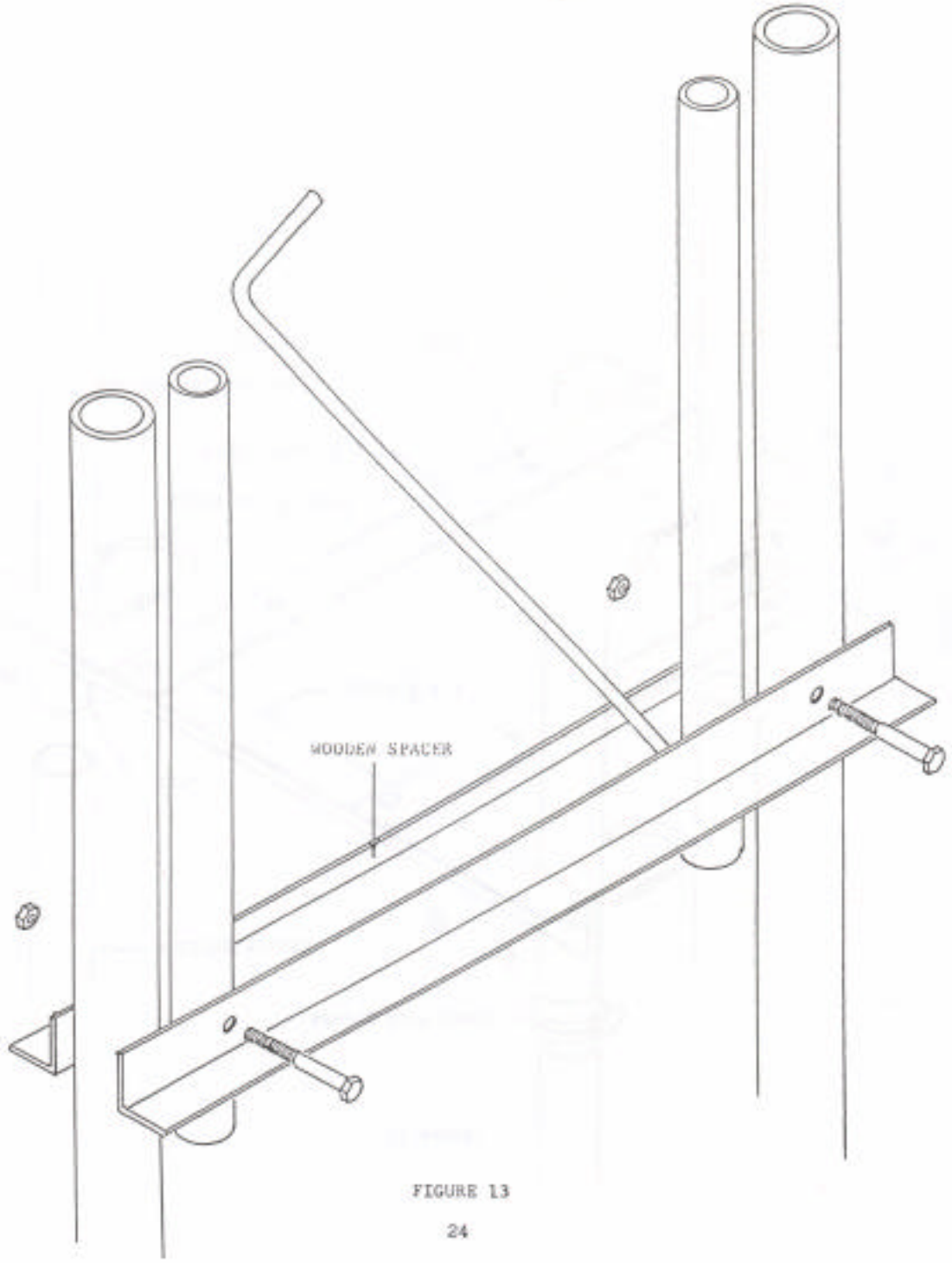


FIGURE 13

FINISHING TOUCHES

It won't take long before unprotected metal begins to rust so painting will be neccessary to avoid having an eyesore in your yard. Use oil base paint rather than latex for outdoor metal, and aluminum pigment is probably the best choice. If the metal is clean and dry the paint will adhere very well. Chip and wire-brush the welds thoroughly so that they don't peel after painting. Galvanized pipe may have an oily coating so it will need to be cleaned with solvent like paint thinner. Primer is a neccessity for painting metal and red oxide seems to be the most durable. Give the primer at least a day to dry before the finish coat. Once your antenna installation is complete and all adjustments are made you might want to tie a plastic bag over the winch to protect it and the cable from the elements.

Congratulations on building your own tower. It is likely that most of your visitors will think it is "Store-bought". Your poor relatives will want to borrow money from you because they will think you are rich. And you are!

AR SK TNX & 73 de KR4EBU

Dave Gingery