UPRIGHT SCAFFOLDS PORTABLE TOWERS ERECTION AND MAINTENANCE

1. GENERAL

1.01 This section is reissued to revise the guying information so as to conform with the tower manufacturer's recommendations. In general this section describes the recommended procedures for erecting and maintaining the portable towers manufactured by the Upright Scaffolds Company. These towers are used for supporting microwave antennae associated with short period microwave channels established for video services or similar purposes. Usually the erection of the portable towers is the responsibility of the Division Construction Superintendent. Locations are designated by Transmission or Plant Engineering forces.

1.02 Each portable tower section is 4-1/2 ft. wide, 6 ft. long, 6 ft. high when opened, and weighs only 64 pounds. Heat treated aluminum, one-third the weight of structural steel, is used for the structural members. Each section of the tower when folded is a flat "package" only 6-1/2 inches thick. Five sections and a base may be transported easily in a pick-up truck.

1.03 Four men can erect the tower with Hand-operated Drum Winch; an eight-man crew is recommended for greater speed and for reducing the possibility of accidents or mistakes because of excessive fatigue.

1.04 Locate a four-man crew to work as follows: Station two men on the tower. Station two men on the ground: one man to operate Hand-operated Drum Winch and the other man to control the movements of the sections with the tag line. The winch and tag line men are to secure the guys to the anchors (Exhibit 1).

1.05 Locate an eight-man crew to work as follows: Station two men on the tower. Station six men on the ground: two men to set up sections, two men to install guy wires, one man to work the winch, and one man to work the tag line.

Note: Rotate assignments to prevent fatigue.

1.06 Siting: The choice of site for the tower depends on the desired height of the tower and on the requirements of the associated equipments (see note below). The site should be a level area, free of trees, buildings, and other obstructions. The soil must be firm enough to support the weight of the tower and additional forces exerted upon it. Provide drainage around the tower base to prevent soil erosion.

Note: Normally, the wide faces of the tower are in the direction of the towers of adjacent stations. Instructions covering the directions of the towers of adjacent stations, height of the tower, and guy attachment level must be given before the erection of the tower is begun.

2. ASSEMBLY AND INSTALLATION

2.01 Assembly of Tower Section: The following assembly procedure applies to all Tower Sections. All sections are assembled on the ground prior to installation.

Step 1 - Place the folded section flat on the ground with the top side of the platform facing upward (Exhibit 2).

Step 2 - Grasp the end of the frame at A, and rotate it 180°.

Step 3 - Raise the end frame and the platform frame at point B until they are at right angles to each other.

Step 4 - Secure the hook end of the ladder to the lower horizontal brace at point C. Register each snap hook on the brace between the two pins provided.

Step 5 - Lift the platform frame until the remaining end frame is standing upright.

Step 6 - Install the long diagonal snap brace on the side opposite the ladder (Exhibit 3). The long diagonal snap brace is secured to the frame in the same manner as the ladder. All other snap braces are secured by spring-loaded pins, but the procedure for installation is the same as for the ladder.

Step 7 - Install the two short diagonal snap braces. Note that all diagonal snap braces run counter to the ladder.

Step 8 - Install the horizontal braces with the hook on the inside of the vertical member of the frame. Now the sections are ready to be installed on the tower.

2.02 Installation of Base (Exhibit 4): Install the base in such a manner that the wide sides of the structure face in the direction of the tower of the preceding station and/or in the direction of the tower of the following station.

Note: Instructions covering the direction of adjacent stations, the height of the tower, and guy attachment levels must be given before the erection of the tower is begun.

Step 1 - The site of tower base previously chosen must be leveled to provide a solid,

secure mounting surface. Level and tamp an area of approximately 5 feet by 7 feet. Use timbers, if available, for the foundation for base plates. These timbers may be two pieces 12 inches wide by 4 inches deep by 5 feet long, or four pieces each 2 feet long. Thoroughly treat them with creosote or asphaltum to retard deterioration of wood. A rigid base which will withstand the vertical pressure of the tower legs without sinking is essential.

Step 2 - Assemble Base Section as described in Paragraph 2.01. Lift the assembled section onto the base plates. Adjust the plates so that the screw legs of the base section sit squarely over the stubs of the plates. Secure each base plate to the timbers with four lag screws; if the timbers are not available, secure the plates to the ground with the ground stakes if provided.

Step 3 - Place a level on the platform of the base section. Check the amount of deviation from the horizontal level of the wide and narrow sides (Exhibit 4). Adjust the length of the screw legs to correct the deviation.

Step 4 - To adjust the length of any of the four screw legs, insert a screw driver through the hole in the adjustment screw, and turn the screw slowly. Make a rough adjustment, and check with the level. If the rough adjustment brings the section near the level position, proceed to make the fine adjustment. To maintain uniform load distribution, keep Tower Section perfectly level. No personnel should be working on the base section during the leveling procedure.

Step 5 - The level (Step 3 above) of the base section must be checked again after the first set of guys has been installed and placed under correct tension to insure that the tower structure has not been distorted.

2.03 Installation of Tower Section: Set the Base Section in place. A hoist assembly is supplied to install Tower Sections. The hoist assembly (Exhibit 1) is mounted on the tower with the aid of tools supplied. The hoist assembly consists of Hand-operated Drum Winch (Exhibit 5), a snatch block, Davit (Exhibit 6), a hoist rope, and a tag line.

2.04 Hoist Assembly

Step 1 - Install the winch to the vertical member of Base Section (Exhibit 1). Locate the lower clamp of the winch casing just above the intermediate welded fitting when using the winch for light loads.

Step 2 - Install the snatch block to the tower base section by securing the snatch-block coupling to the lower horizontal brace, just inside the long diagonal brace (Exhibit 1).

Step 3 - Before the first Tower Section can be installed, Davit must be assembled as follows: Raise arm A until it is perpendicular to the vertical tube, and secure the cable to the top of the vertical tube at B (Exhibit 6).

Note: The maximum allowable load on the davit when assembled as shown in Exhibit 6 is one tower section or one guy assembly.

Step 4 - Pass the hook end of the hoist rope over the lower and inner davit sheaves then through the cable connector and over the outer sheave. Each sheave rope guide is formed to retain the rope. A sharp pull on the rope will spring the sides of the guide and allow the rope either to seat on the sheave or to be removed without uncoiling all the hoist rope from its spool. Pull the rope through until the hook is approximately 12 feet from the first sheave.

Step 5 - To install the davit on the tower section (Exhibit 6), place the two hooks between the two locating pins on the upper and center horizontal members of the section. The davit is free to swing when the handle is slightly raised. Slots index the davit for correct hoisting position.

Step 6 - Pass the rope through the snatch-block. Secure it to the winch by winding the rope approximately 4 turns around the drum and by rolling the rope between the drag rollers.

Step 7 - Installation time may be decreased if a hoist line crew is available. Sections may be installed by four to six men pulling directly on the hoist line after it leaves the snatch block. The number of men required to install the tower section increases with the height of the tower.

2.05 Tower Sections

Step 1 - Assemble Tower Section as described in Paragraph 2.01.

Step 2 - Attach the hook of the hoist line to the eyebolt in the center of the tower section. Form a loop with the tag line around the two legs on the broad side of the tower. Thoroughly clean the male joints of the tower section before hoisting it to the tower.

Step 3 - Control the movement of the davit from a position on the tower, and control the swinging motion of the rising tower section with a tag line from the ground.

Warning: Be extremely careful when erecting the first 18 feet (one tower base section and two tower sections) of tower to prevent this unguyed unit from tipping. Attach a temporary guy on the side opposite the davit. At the 18 foot level the first set of guys is installed. As the tower is further assembled, it must be guyed at the levels shown in Section 3.

Step 4 - Hoist the tower section until it is 6 inches above the installed section. Do not raise the tower section to the full height of the davit because the hoist hook will jam in the sheave. Raise the davit handle slightly and swing the section directly over the tower. Reverse the winch and manually aline the joints as the section is lowered into position. Keep the section level to prevent jamming at the joints.

Note: It is essential to have communication between the tower and the ground during assembly, disassembly, and repair of the tower.

Step 5 - When the new section is in place, remove the interlock clip from the storage hole located directly below the joints, insert the clip in the upper hole, and pass the pin through the tubes until it protrudes on the other side.

Step 6 - Remove the ground end of the hoist rope from the drum winch. Remove the hoist hook from the eyebolt on the newly installed tower section and pull 12 feet of rope through the davit to secure the hook end of the rope to the tower. This will prevent the davit from falling to the ground if it slips during transfer.

Step 7 - Two men are necessary to transfer the davit: One man sits astride the top section platform and locks his legs under it: the other man stands on the section platform below. They lift the davit into position. Make every effort to keep the davit in a vertical position during this operation.

Step 8 - Secure the tag line to the hoist hook, and lower it to the ground.

Step 9 - Use the upper portion of the davit only when raising loads of 150 to 500 pounds. To disassemble the davit, release the cam locks on the two clamps, and separate the two sections of the davit.

3. GUYS AND GUY LOCATIONS

3.01 Guys must be installed so as to brace the tower from all directions. This requires a minimum of four guy lines at each level. Guys should be attached at the levels tabulated in Exhibit 1 or Exhibit 2 of Section R49.001.1.

3.02 Maximum tower capacity results from a radial guy system. This system is indicated by dotted lines on the drawing of Exhibit 7.

3.03 Resistance to tower twist is achieved by the anti-twist guy system indicated by solid lines on the drawing of Exhibit 7. These anti-twist guys are generally only installed at the height where the antennas are installed, which is usually at the top of the tower.

3.04 For towers up to 80 feet in height, the first three levels of guys from the ground up should be installed on common anchors. Higher towers will require additional anchors for the guys above the third level. The locations of the anchors are shown on Exhibits 1 and 2 of Section R49.001.1.

3.05 The tension in each set of guys should be 600 lbs. in each guy wire. Tests have shown that this procedure provides the best combination of tower capacity and resistance to twist and sway under high wind conditions.

3.06 The attachment of the guy wires to the tower members through a guy strap and clevis is illustrated in Exhibit 8. This method of attachment should be used for both standard and anti-twist guy wires.

3.07 It is desirable that guy tensions be accurately measured with a tensiometer (dynamometer). The use of four tensiometers, one on each guy of a set will expedite the proper adjustment of guy tensions without the danger of tipping the tower during tensioning. Tension must be applied gradually to each pair of guys in increments of 25 pounds or less.

3.08 The tensiometer, supplied in its case, is used to check the tension of the guys. Use the tensiometer on guy cables as shown (Exhibit 9). Turn the knurled adjustment nut until the small calibrating hand moves in line with the mark scribed on the upper left of the tensiometer frame. Then read the tension directly from the large indicating hand on the dial at the lower center of the frame.

3.09 As each section of tower is placed it shall be anchored by temporary rope guys before anyone climbs on the added section. Sections which support permanent guys shall have the permanent guys placed in lieu of the temporary rope guys. These permanent guys shall be pulled up to a tension approximately 50 lbs. greater than the final value in order to seat the tower sections in the sockets and to allow for some slackening off when the next higher set of guys is placed. Guys at lower levels shall be rechecked after each new level of guys has been placed and shall be retensioned to the specified final tension if they measure less than that value.

3.10 When the tower is completed to the proper height with all permanent equipment mounted, each guy shall be checked for proper tension, starting with the top set and working in order down to the lowest set of guys. If necessary, each guy tension shall be readjusted to the value specified for the guy level.

4. PAINTING AND LIGHTING

4.01 Regulations and Standards for the Protection of Air Navigation require

that towers, poles, smokestacks and similar structures which present a hazard for day operations in air commerce should be painted throughout their height with alternate bands of aviation surface orange and white, terminating with orange bands at both top and bottom. The width of the aviation surface orange bands should be approximately one-seventh the height of the structure and the white bands should be approximately one-half the width of the aviation surface orange bands; Provided, the aviation surface orange bands shall not be more than 40 feet nor less than 1-1/2 feet in width. (It is recommended that on structures located within two miles of a landing area, the width of the aviation surface orange bands not exceed 20 feet).

4.02 To comply with the above regulations, portable towers are furnished with an equal number of sections painted white and international orange. These sections must be assembled in the proper sequence so that the completed tower will have alternate bands of white and orange which approximate the requirements of Federal Regulations. Exhibit 10 illustrates a recommended erection sequence for tower sections to provide properly painted towers of from 6 to 150 ft. height. The same principles should be extended to the assembly of sections to provide towers of greater height.

4.03 Under certain conditions outlined by the Civil Aeronautics Bureau, lights are required on towers during night-time operations. Current C.A.B. regulations should be checked by the Division Plant Engineer to ascertain whether lighting is required at each tower location. When lighting is required, at least two 100-watt lamps (A-21, clear, Traffic Signal type, or equal illuminates) inclosed in aviation red fresnel or prismatic (heat-resisting preferred) obstruction light globes should be installed at the top of the structure. The two lights should burn simultaneously and should be positioned to insure unobstructed visibility at least to one of the lights from an aircraft at any angle of approach.

5. MAINTENANCE INSTRUCTIONS

5.01 Tools and Materials: The following tools and materials must be on hand before performing preventive maintenance:

Brush, paint
Common hand tools
Grease, General Purpose No. 2 (WB)
Paint, white
Sandpaper #000

5.02 Lubricants: When adjusting turnbuckles, apply a small amount of grease as a corrosion preventive. The application of the grease also facilitates the adjustment of the tension of the back-up anchors.

5.03 Preventive maintenance means making systematic checks and adjustments at regular intervals to keep equipment at top efficiency. It is not the same as trouble shooting and repair. The purpose of preventive maintenance is to prevent breakdowns and, therefore, the need for repair. The purpose of trouble shooting and repair is to locate and to correct existing defects. The importance of preventive maintenance cannot be overemphasized. Failure of one piece of the equipment may cause the failure of the entire equipment. It is vitally important, therefore, that operator and repairmen maintain their equipment properly.

5.04 General Techniques: Tower requires routine preventive maintenance. The performance of preventive maintenance operations depends to a certain degree upon the climatic conditions encountered in the particular location where the antenna support is set up. Rapid changes in weather, such as heavy rain followed by blistering heat, excessive dampness, and snow and ice tend to cause damage to exposed surfaces. This damage is indicated by rust or corrosion of metal parts of the support and guy facilities. Rust or corrosion of threaded parts of turnbuckles may cause difficulty when readjustment becomes necessary. High winds and heavy ice coatings on the supported antennas may cause loosening of guy cables and anchors.

5.05 Detailed Instructions - General: The following preventive maintenance operations should be performed at monthly intervals or more frequently if desired.

5.06 Specific.

Step 1 - If the guy wire carries excessive ice, remove it, give the guy a sharp pull. A wave will travel along the guy and often will cause the ice to fall off the cable. Repeat this operation if necessary.

Step 2 - To remove the ice from the tower members, tap them lightly with a wooden mallet or stick. Be careful not to damage the tubular members of the tower.

Step 3 - Remove excessive ice from the stairway steps.

Step 4 - If the tower had been erected on frozen ground and a thaw occurred or a heavy rain fell, check the base to see whether or not the base plates have sunk. In case of heavy sinking, readjust the level of the base section with the screw legs. If the sinking is very pronounced, the tower should be dismantled and reinstalled on a firmer base.

Step 5 - Use the tensiometer to check the guy wires for proper tension.

5.07 Supporting Parts, Sections, and Accessory Equipment.

Step 1 - Inspect all parts for corrosion. Clean all corroded parts of the tower surfaces with sandpaper and touch up the surface with white or orange paint.

Step 2 - Inspect the mounting and assembly bolts of the insulator clevis. Tighten all loose connections. Never apply too much force; nuts or bolts can be damaged by stripping threads or by shearing off bolts heads.

Step 3 - Inspect grounding wires and terminals at the base and on the ground rod for tightness and for indication of corrosion. Clean the electrical contact surfaces with #000 sandpaper and retighten the contacts securely.

Step 4 - Visually inspect the entire antenna installation for indication of loose guys, loose guy anchors, guy strap distortion, and drainage of tower base area.

5.08 Guy Assembly.

Step 1 - Inspect the guys daily for a short time after the supports have been erected. The tension in the guys may slacken off because of elongation of the loops around the take-up winch and because of compression of the strands. The vibration rate of all guys should be recorded at the time of installation of the tower. Check the tension of the guy regularly with the tensiometer.

Step 2 - Determine whether it is necessary to apply a small amount of grease to the turnbuckles of the guy back-up assemblies.

5.09 Replacement of Parts - General. To replace minor defective components of a completely erected and installed tower, it is not necessary to dismantle the tower. Horizontal and diagonal snap braces, guys, winches, anchors, and back-up assemblies may be replaced easily. Damage to the erected tower is uncommon and ordinarily results from hurricane winds or from external objects which may cause partial or complete destruction.

5.10 Replacement Structural Members.

Step 1 - Remove antennas and antenna supports to the ground.

Step 2 - Remove defective braces, replace the uppermost ones first and work down.

> Warning: When repairing any damage on the tower, be sure that all safety rules are observed. If damage is too extensive, dismantle the tower, section by section, until it is possible to replace the defective section.

5.11 Replacement of Guy Assembly: To replace a guy assembly, proceed as follows:

Step 1 - Wrap and knot the supplied rope (1/2-inch diameter) around the supporting tube immediately above the guy attachment strap. Use this rope as a temporary guy.

Step 2 - Run the temporary guy to the anchor for the guy which is to be replaced. Place tension on the temporary guy.

Step 3 - Loosen the defective guy from the guy attachment strap and lower the guy to the ground with the davit.

Step 4 - Use the davit to hoist the new guy into place; attach it to the guy attachment strap.

Step 5 - Thread the take-up winch on the ground, and secure the winch to the anchor with the insulator clevis.

Step 6 - Apply tension with the take-up winch.

Step 7 - Check the tension with the tensiometer; correct it, if necessary, with the take-up winch.

Step 8 - Remove the rope used as a temporary guy.

5.12 Disassembly: To disassemble the tower, reverse the procedure given in paragraphs for installation.

Step 1 - To release a tower section, two men are required to lift opposite sides of the tower in unison. A slight jolt may be required for initial loosening; however, it must be simultaneous and equal on both sides or the joints will jam.

Step 2 - Use the davit and hoist the rope to the lower tower sections. Do not remove the snap braces from the tower section until it has been lowered to the ground.

Step 3 - It is not necessary to use the drum winch in the conventional manner when lowering loads of less than 500 pounds. Bring the hoist rope from the snatch block, one full turn around the drum of the winch, with one man holding the free end of the rope. The winch is used as a snubbing post and allows one man to control the rate of descent of the component being lowered.

Step 4 - Use a guy guide to trolley the guys to the ground.

> Note: Do not loosen the guys until the section to which they are attached is to be disconnected and lowered to the ground.

Step 5 - Inspect guys, clevises, winches, and anchors for signs of wear or failure before repacking in their respective containers.

5.13 Repacking for Shipment or Limited Storage: The exact procedure in repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored.

After the tower has been disassembled, collapse the tower sections and strap them securely, Place all loose parts, such as clevises, nuts, bolts, and clips in containers, note the item name and quantity. Rewind the guys on reels and secure the loose-ends.

Attached: Exhibits 1 to 10, Inclusive.

Exhibit 1

Hoist Components, Standard Operation

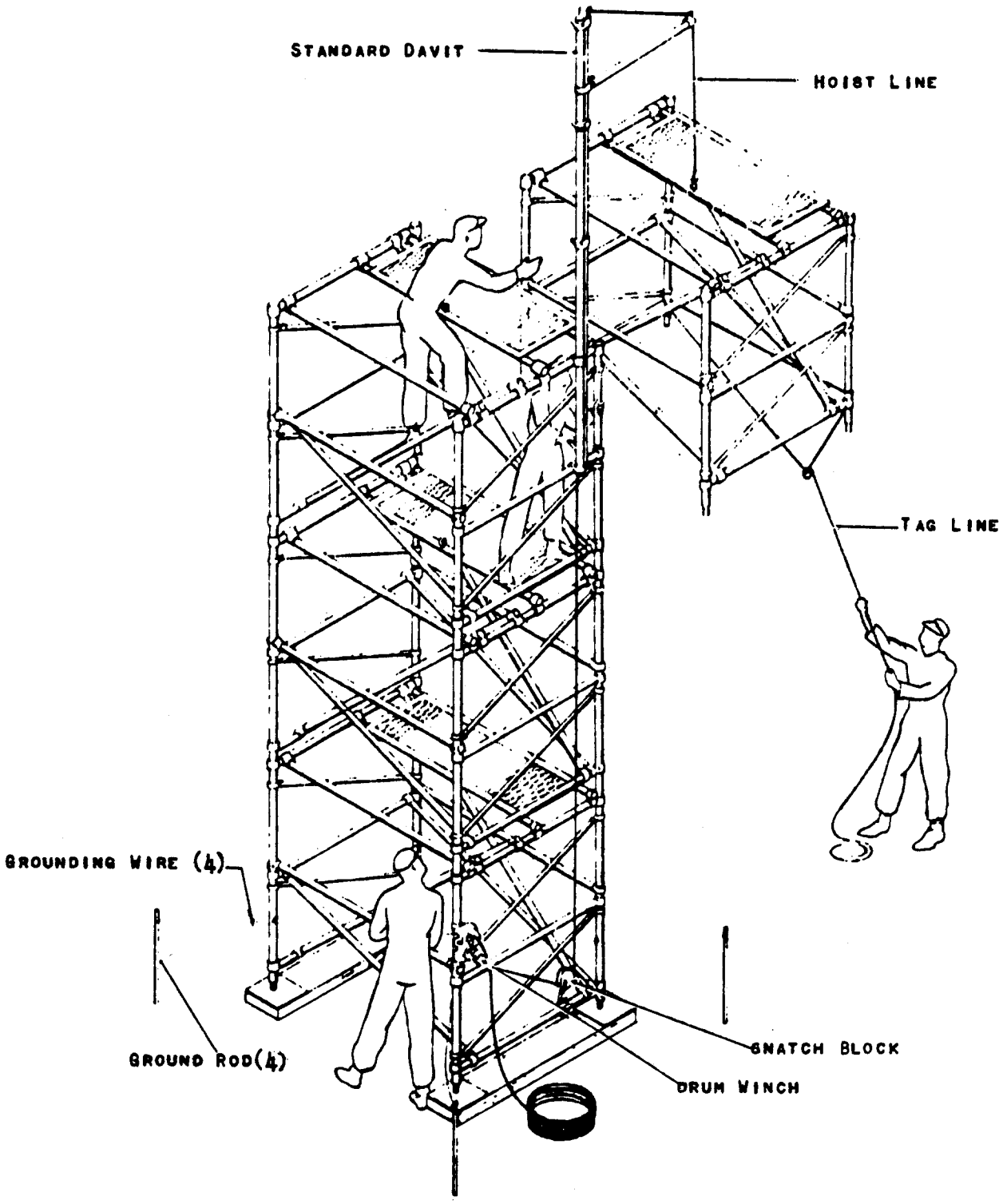


Exhibit 2

Assembly of Tower Section

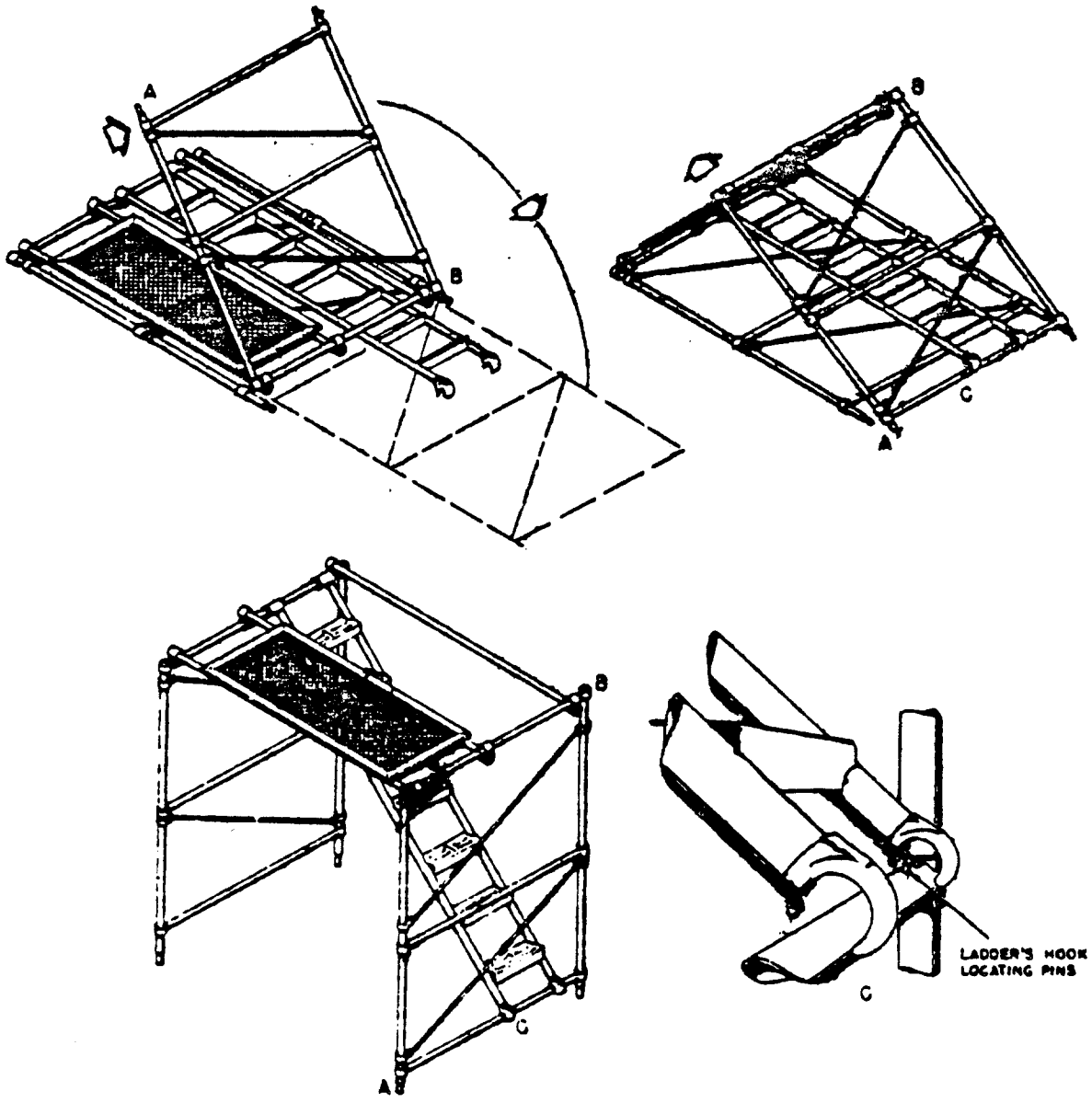


Exhibit 3

Tower Section

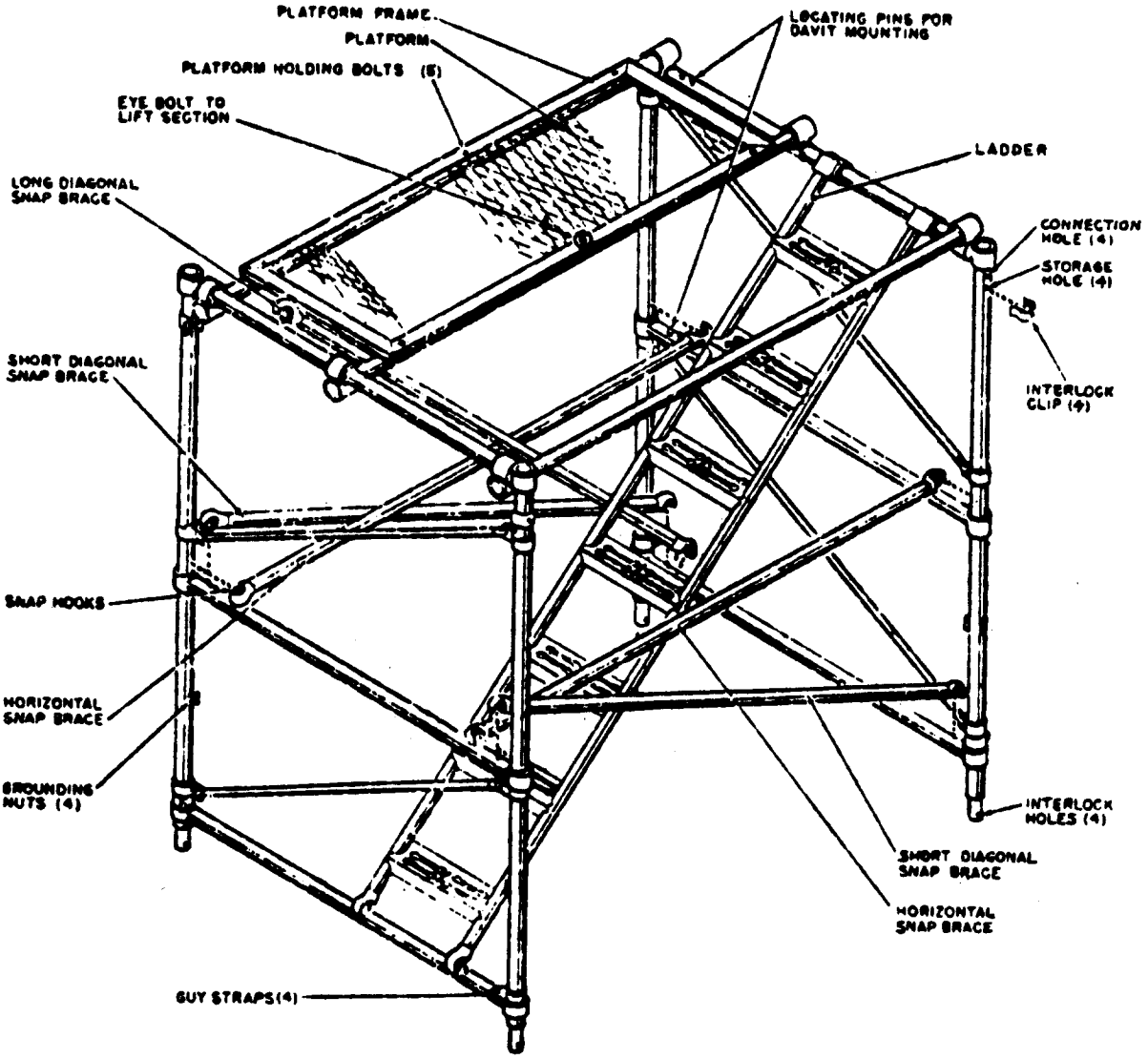
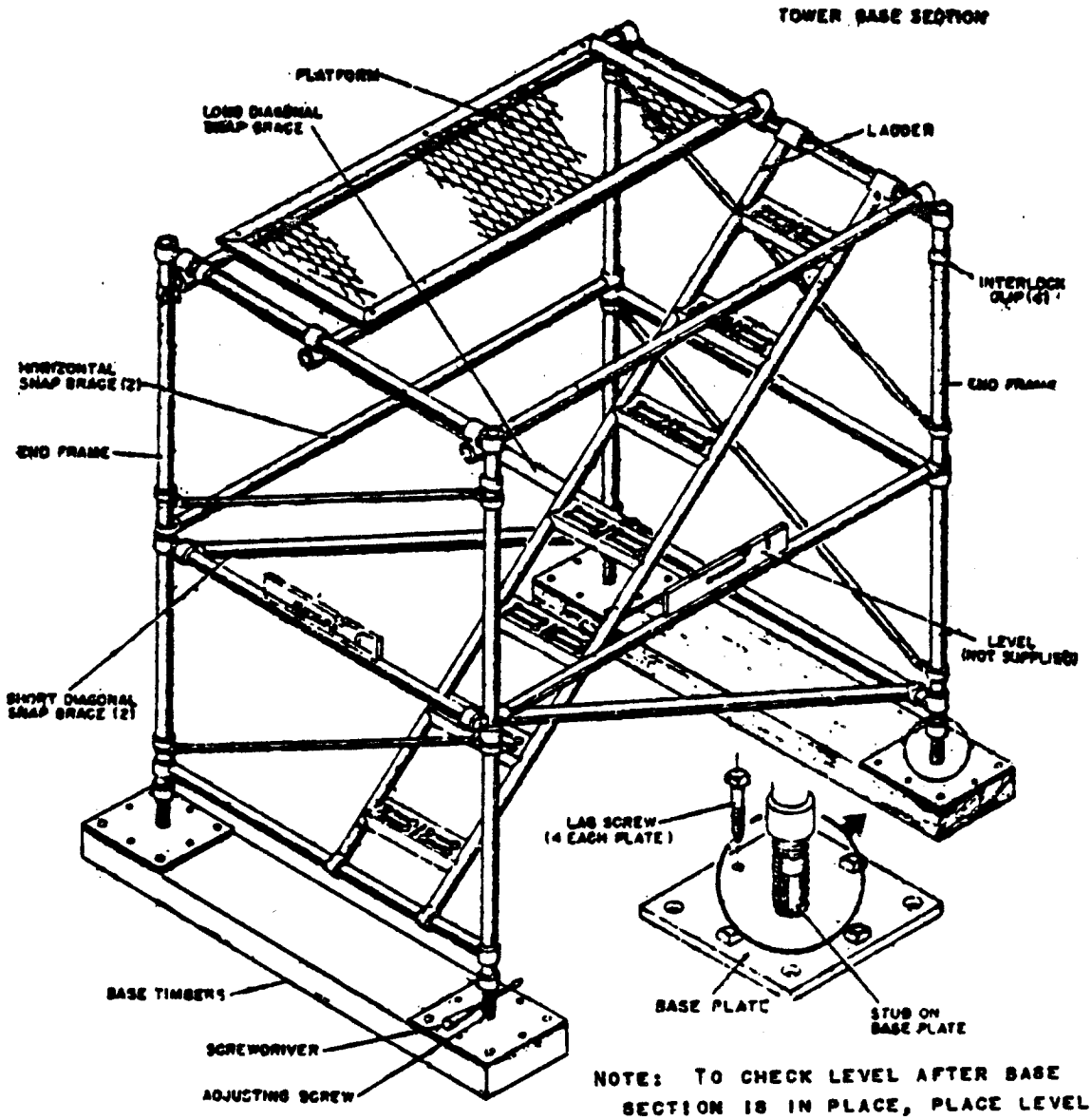


Exhibit 4

Base Leveling



NOTE: TO CHECK LEVEL AFTER BASE SECTION IS IN PLACE, PLACE LEVEL ON THE PLATFORM.

Exhibit 5

Hand-operated Drum Winch

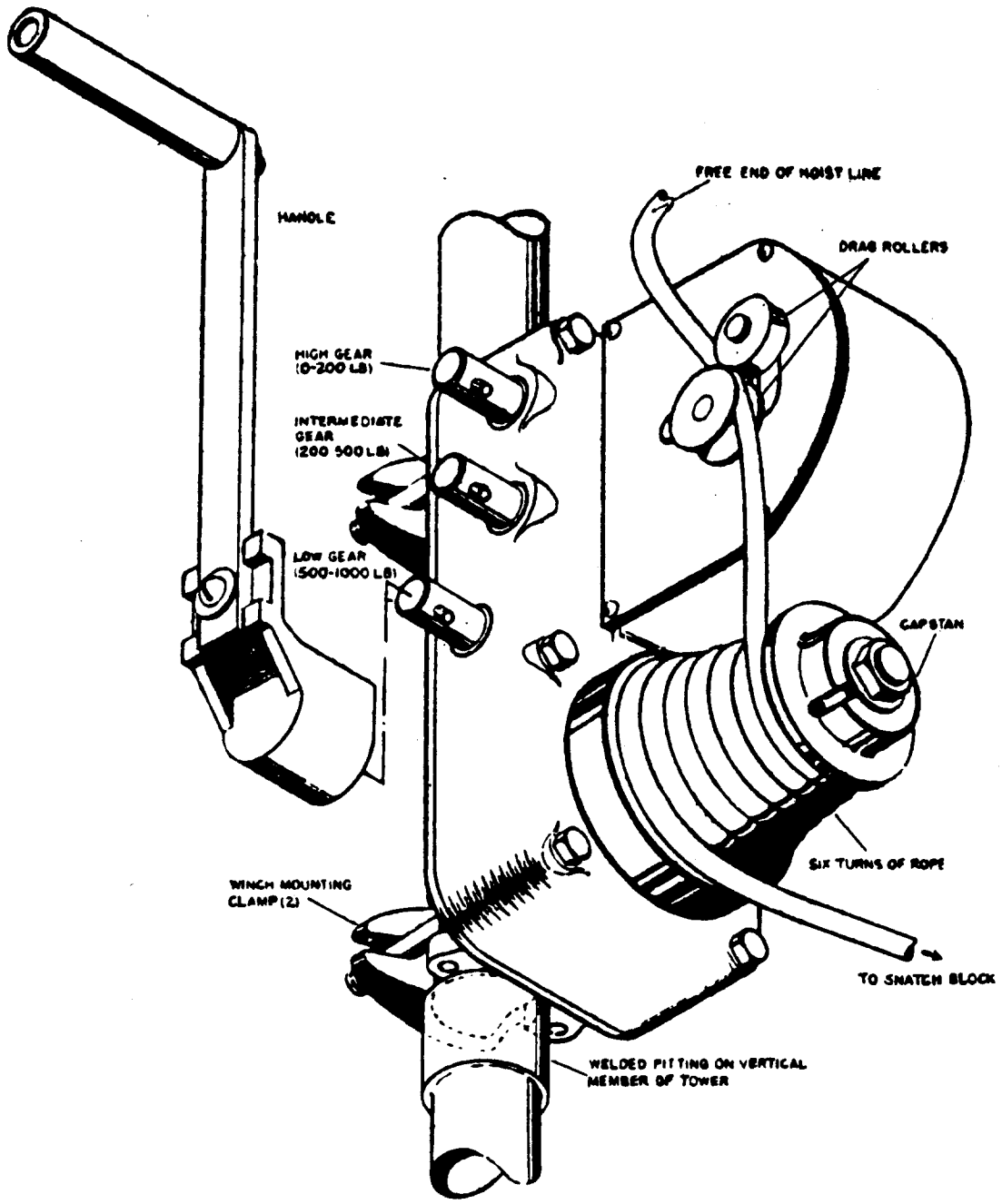


Exhibit 6

Davit

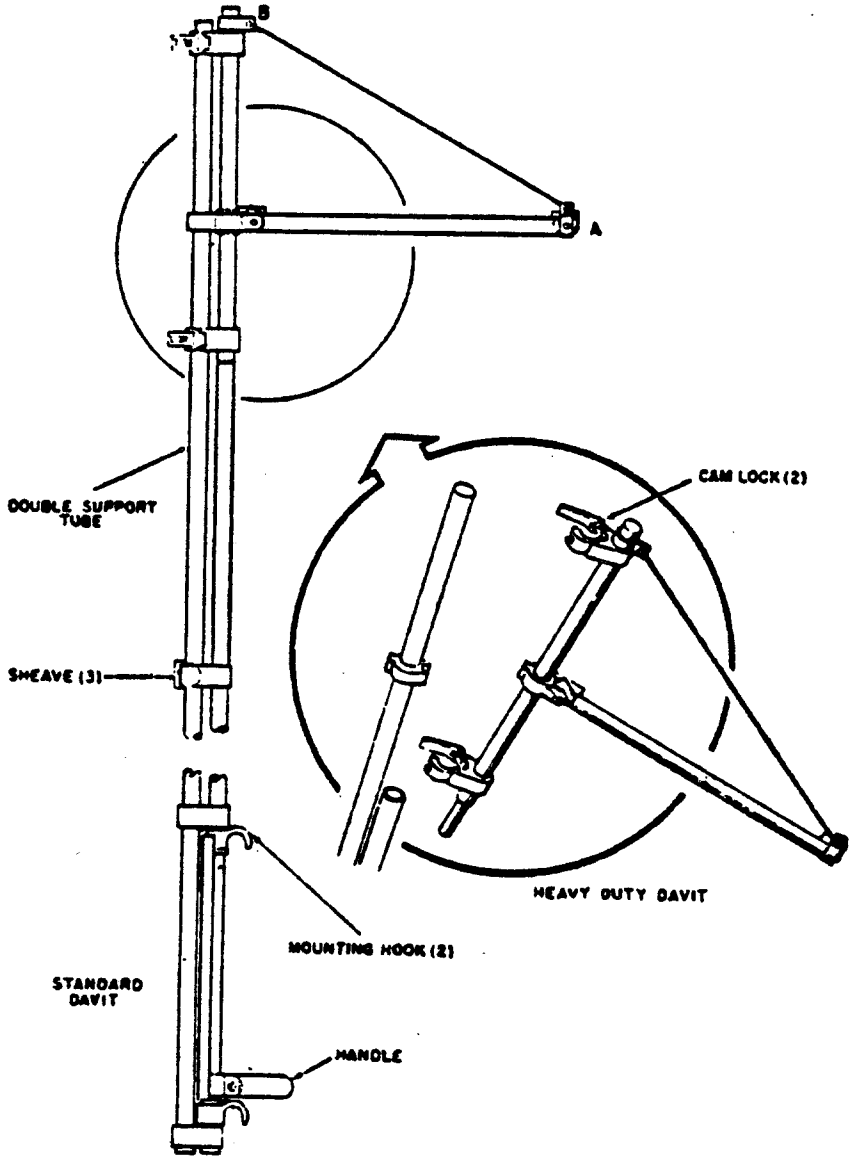
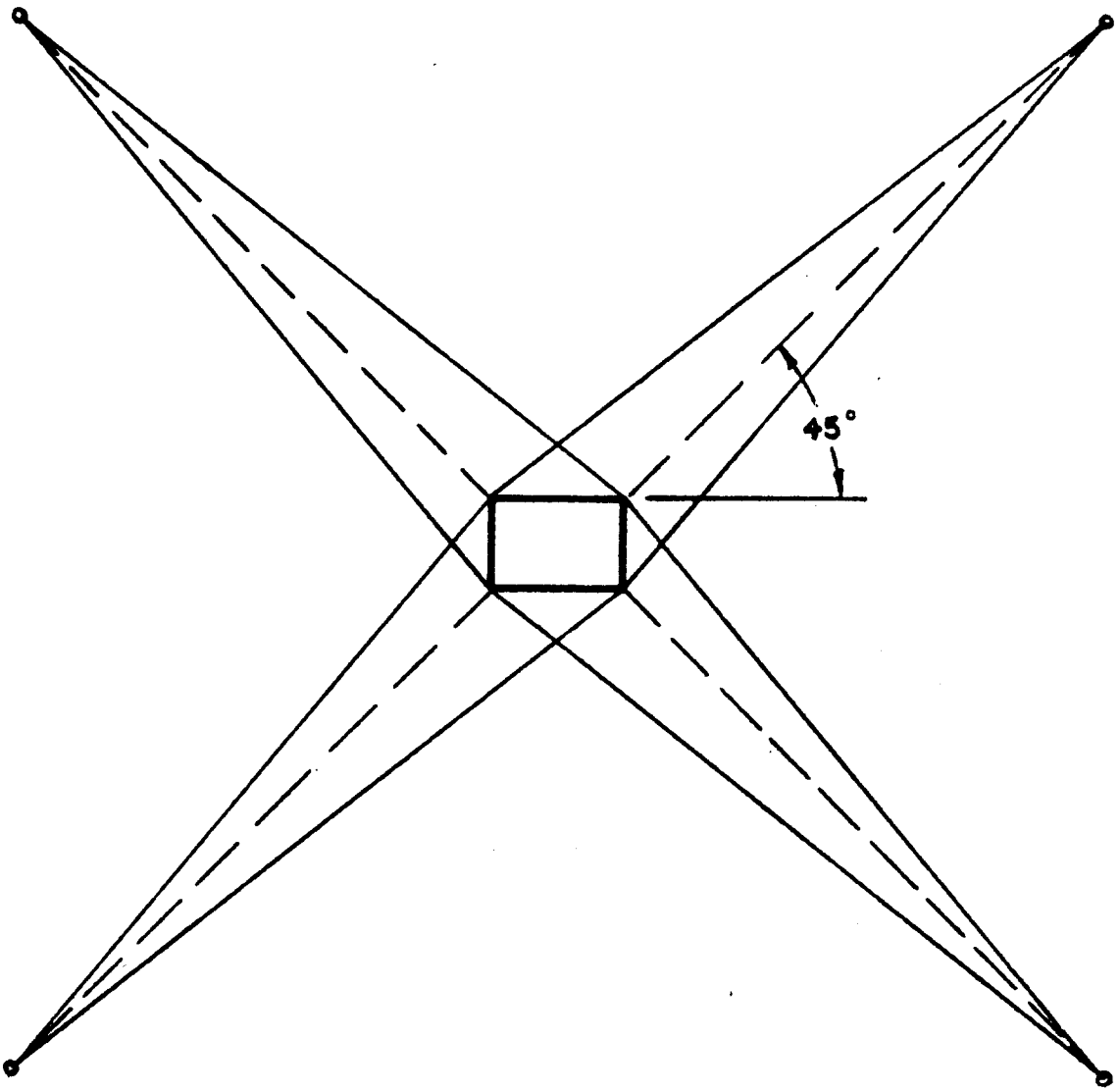


Exhibit 7



ANTI-TWIST GUY SYSTEM

THE ANTI-TWIST GUY SYSTEM IS REQUIRED AT EACH LEVEL JUST BELOW AN ANTENNA INSTALLATION. DOTTED LINES INDICATE STANDARD GUY SYSTEM AND SOLID LINES INDICATE ANTI-TWIST SYSTEM.

Exhibit 8

Installation of Guys on Tower

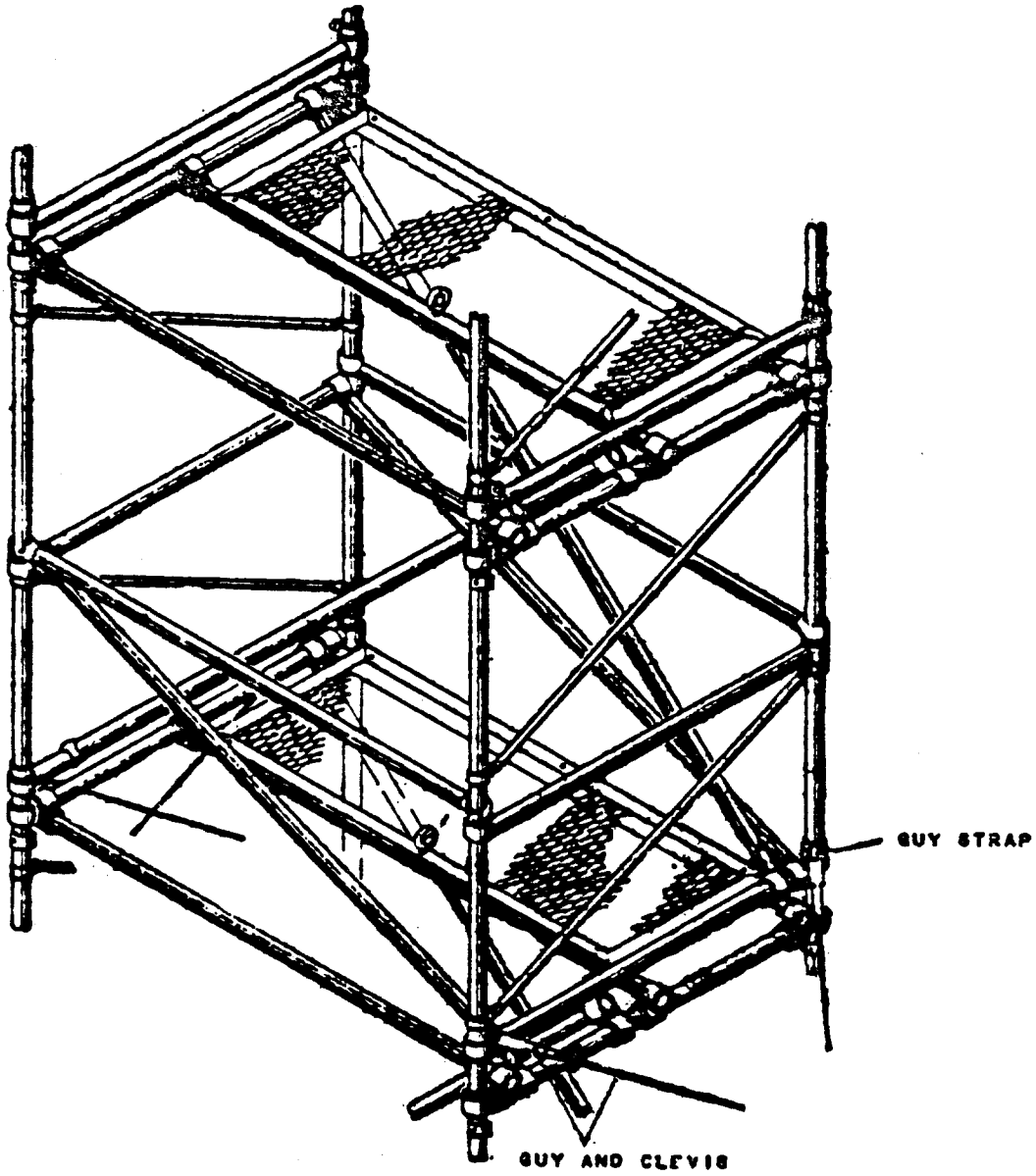
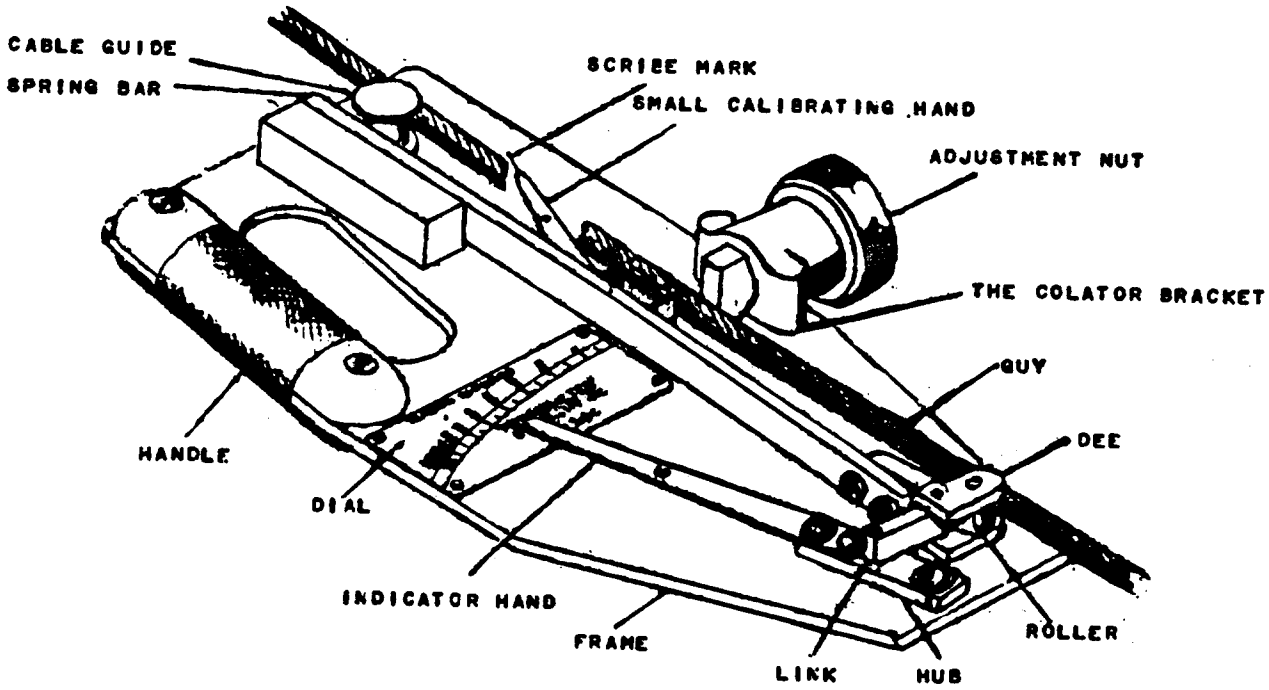


Exhibit 9

Tensiometer



APPENDIX 1, 770-280-603SW
Issue A, 7-1-65

Exhibit 10

ERECTION SEQUENCE OF PAINTED TOWER SECTIONS