Jan. 22, 1963 W. A. DAVIS ET AL 3,074,564

MAST EXTENSION JIB

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Fig. 1.

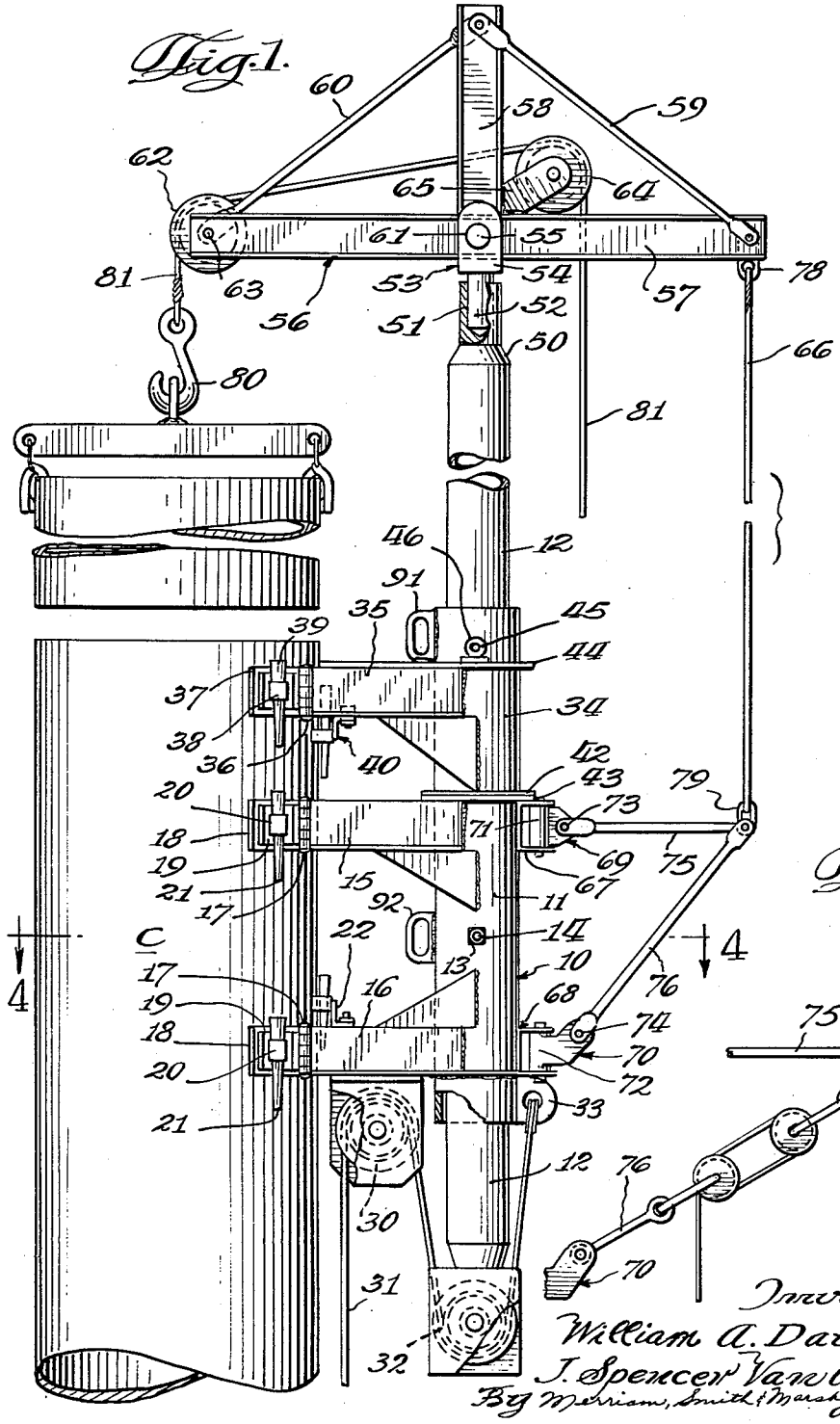

Fig. 7.

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Fig. 2.

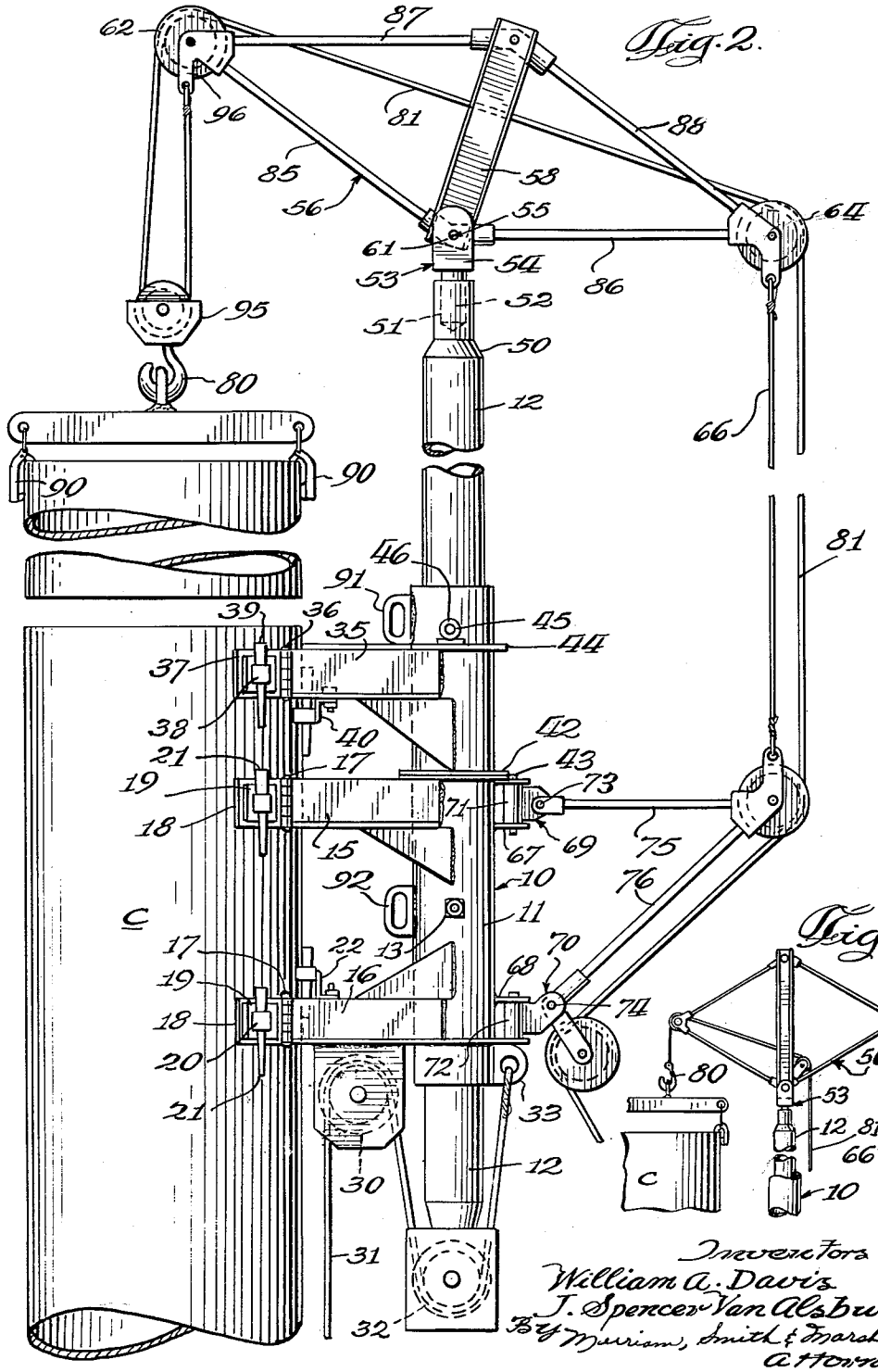

Fig. 3.

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Fig. 4.

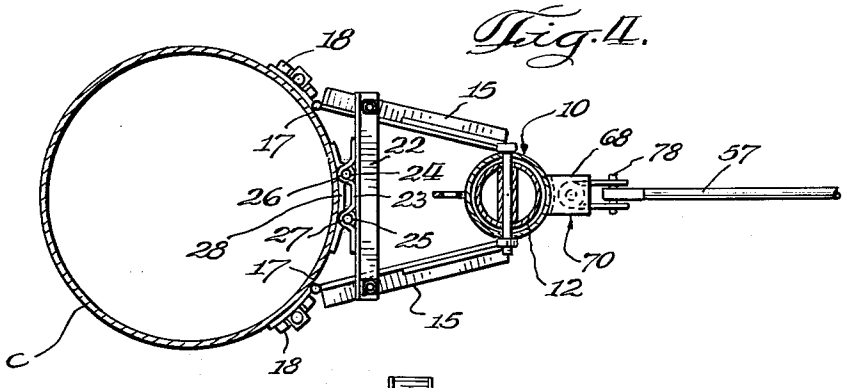
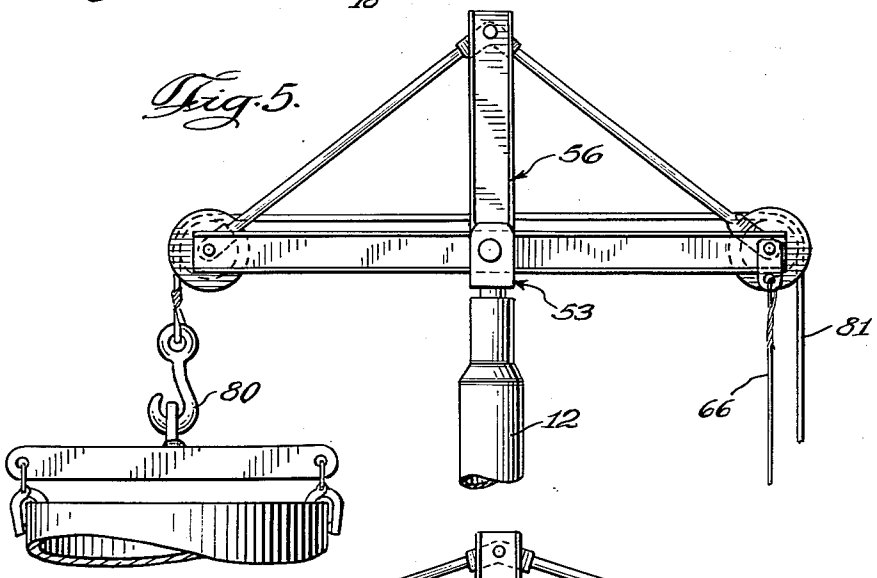


Fig. 5.



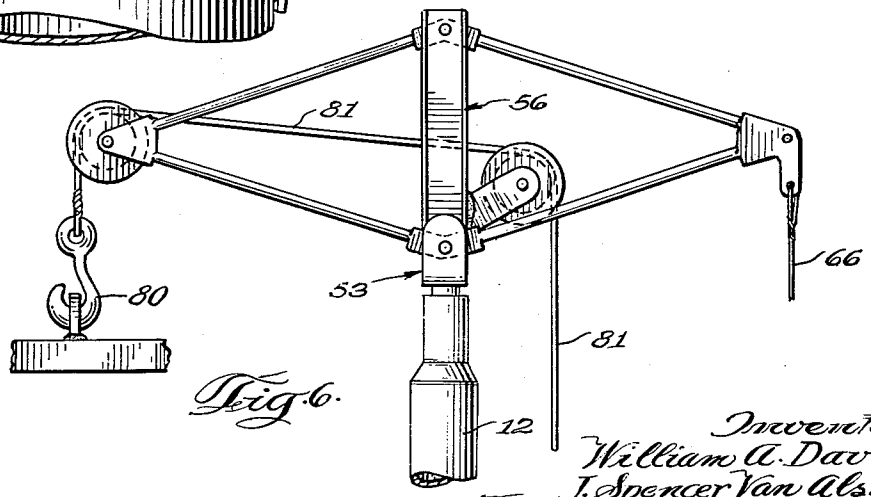


Fig. 6.

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MAST EXTENSION JIB

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6 Claims. (Cl. 212—64)

This invention relates to an apparatus for facilitating the erection of elevated structures. It more particularly relates to an extension jib derrick mounted atop the mast of the erection apparatus.

There has been developed a method of erecting elevated structures supported on one or more columns employing a gin pole or mast atop which is mounted a derrick device for lifting the structural elements for placement, wherein the gin pole is "jumped" upward to succeeding elevations as the work progresses until a predetermined height is reached and the central column is then used to support a derrick with a rotatable boom to finish hanging the steel in the upper portion of the tank. A mast and mast support system employed in this construction facility is described and claimed in U.S. Patent 2,754,012.

It is known in the art that a load on the boom portion of the mast-mounted derrick shown in the aforementioned patent induces a stress due to bending in the mast-mounting portion of the derrick which is proportional to the radius of the boom. According to the instant invention there is provided a mast extension jib derrick which places only vertical loading on the mast and greatly increases the lifting capacity of the derrick as well as the size and type of structures on which the aforementioned gin pole type of construction facility can be used.

In the drawings:

FIGURE 1 is a diagrammatic illustration of one embodiment of the extension jib derrick of this invention mounted on an illustrative gin pole;

FIGURE 2 is another embodiment of the extension jib derrick;

FIGURE 3 is a schematic showing of one embodiment of the derrick device wherein the lower anchor system for the jib stay is replaced by a counterweight;

FIGURE 4 is a cross-sectional view of the mast portion illustrating the means for preventing vertical sway of the mast assembly and showing the attachment of the back stay to a mast jumper;

FIGURE 5 shows an alternative rigging arrangement for use on the jib derrick shown in FIGURE 1;

FIGURE 6 shows an alternative rigging arrangement for use on the extension jib derrick illustrated in FIGURE 2;

FIGURE 7 illustrates an adjustable structural member connection between the "jumper" support and jib stay connection point.

Referring to FIGURE 1, the preferred embodiment of the invention is shown in elevation. The illustrative construction facility comprises the removable support 10 which is adapted to be temporarily secured to the central column C of an elevated structure being erected. The bottom "jumper" mast support 10 for the mast comprises a tubular member 11 through which extends a mast 12. The tubular member 11 is provided with holes 13 matching corresponding holes in the mast 12 through which bolts 14 are passed to secure the mast to the support. A pair of straps 15 extend outwardly from the tubular member 11 near one end thereof and a similar pair of straps 16 extend outwardly from the other end of the member 11. Secured to the outer ends of each of the straps by means of hinges 17 are apertured plates 18, each of the plates being provided with an opening 19 therein to receive an apertured lug 20 welded to the column C.

Tapered pins 21 are passed through the holes in the lugs 20 to secure the member 11 to the column. To prevent side sway in the bottom mast support 10, angle irons 22, as shown in FIGURE 4, are bolted or otherwise secured between each pair of legs 15 and 16 and to each angle iron 22 a coupling device 23 being so formed as to provide in cooperation with the angle iron 22 flange a pair of openings 24 and 25 is fastened to angle iron 22 by welding, bolting or the like. The openings 24 and 25 are adapted to register with similar openings 26 and 27 formed by cooperation with the wall of column C and a corresponding coupling device 28 welded to the column C. The coupling devices are joined together by pin 29.

Secured to the side of the member 11 adjacent its lower end is a sheave 30 adapted to receive a cable 31 passing thereover and thence downwardly around another sheave 32 secured to the bottom of the mast 12. The cable then passes upwardly and is secured to an anchor fitting 33 mounted, for example, on the lower end of the member 11.

Also a part of the mast support system is the upper jumper mast support 34 adapted to receive the mast 12 therethrough and provided with straps 35 similar to the straps 15 and 16, each strap being provided with a hinge 36 at its outer end and secured to an apertured plate 37. The aperture in the plates 37 are adapted to receive apertured lugs 38 therethrough, the lugs being welded to the column C. A pin 39 may be inserted through the lug 38 to secure the plate and hence the member 34 to the column. A coupling device 40, as previously described, is provided on the member 34 to hold that member against side sway. The lower end of the tubular member 34 is provided with a flange 42 adapted to rest against the corresponding flange 43 provided on the upper end of the member 11. The member 34 is also provided with a second flange 44 adjacent its upper end against which a pin or bolt 45 extending through an opening 46 in the mast can rest to secure the mast against vertical movement when supported solely by the member 34 as hereinafter described.

To carry out the instant invention, the upper portion of mast 12 is provided with a derrick mounting section 50 consisting of a cored cylindrical socket 51 into which fits the pin 52 of the jib derrick yoke to provide a swivel mount to permit horizontal rotation for the jib derrick. Yoke 53 is a clevis-like arrangement having spaced upwardly extending arms 54 which straddle the connection point 55 of the jib derrick which is shown generally at 56. The truss framework of the jib derrick consists of a chord member 57 rigidly braced by spacer strut 58 and brace rods 59 and 60 which respectively connect the spacer strut 58 with the load end and anchor end of chord member 57. An axle 61 passes through the arms 54 of bracket base 53 and the intermediate connection point 55 on chord member 57 in order that the jib derrick 56 can be pivoted in its vertical plane. Rotatable sheave 62 is mounted at the load end of the chord member 57 of the jib derrick by means of pin 63. A direction-changing sheave 64 is mounted on chord member 57 adjacent the connection point 55 by means of bracket 65. At the anchor end of jib derrick 56 there is pivotally connected one end of jib stay 66. "Jumper" support 10 is provided with spaced mounting brackets 67 and 68 into which are fitted joint connections 69 and 70 formed by cylindrical hinge pins 71 and 72 which allow free horizontal rotation of the jib derrick and connector pins 73 and 74 which allow freedom from binding due to misfabrication, and vertical adjustment of the anchor system. One end of structural member 75 is connected to joint connector 69 while the corresponding end of structural member 76 is connected to joint connector 70. The other end of the structural members 75 and 76 converge to a common

point where they are interconnected. A jib stay **66** is pivotally connected by link connectors **78** and **79** between the anchor end of the jib derrick **56** and the connecting point of the structural members **75** and **76** to restrict vertical rotation of the jib derrick **56**.

Lifting hook **80**, located directly over the centroid of the central column C transfers the load via cable **81** over sheaves **62** and **64** to a lifting winch, not shown, located on the ground.

By employing the jib derrick of this invention, all the loading on the mast **12** is vertical and there is no eccentricity developed with this configuration from which bending stresses in the mast will result. For example, the conventional boom and mast arrangement as shown in U.S. Patent 2,754,012 can lift, as a maximum, a piece 6 feet in diameter and 16 feet long, and weighing about 4,700 lbs. The mast extension herein described is not limited dimensionally to any size or weight lift but for a corresponding sized jib derrick, constructed in accordance with this invention, a lift of 10,000 lbs. can be made.

Although the preferred embodiment of jib derrick is shown in FIGURE 1, there are a variety of modifications of this structure which can be made. For simplicity, the same numbers as used above will be employed in describing equivalent members in the following variations. For example, the direction-changing sheave **64**, as shown in FIGURE 5, can be placed at the anchor end of the jib derrick **56**, or structural members **77** or **78** in the lower anchor system, as shown in FIGURE 7, or anchor cable **66** can be made to be adjustable so that the radius of the load side of the jib derrick can be readily altered. Usually, only one radius is needed for each column C installation in order that each new section of column C hangs directly over the section previously placed.

Another modification which can be made involves the configuration of the jib derrick framework as shown in FIGURES 2 and 6. In this assembly the chord member **56** of the framework truss is replaced by dihedral strut rods **85** and **86**. Suitable rod connectors **87** and **88** are used to connect the inner ends of the rods **85** and **86** to the spacer strut **58** and base bracket **53** and the outer ends of the rods **85** and **86** with brace rods **59** and **60**, as well as provide a sheave journal at the load end and anchor end of the framework depending upon the selected design. Any arrangement of structural members which will support the applied load is satisfactory. In still another embodiment, a counterweight such as shown schematically in FIGURE 3 replaces the lower anchor system.

In operation, lifting hook **80** coupled with a suitable lifting device, such as conventional lifting clamps **90**, is attached to the column piece to be lifted. The load falls, although shown as a single fall, can be multiple parts to form a load block having a substantial mechanical advantage. While the lift is being made, tag lines are used to swing the new column section into place. As the load portion of the jib mast extension is being swung into place, the anchor portion being so mounted also rotates horizontally through the same arc. Therefore, the load on the jib mast section of the derrick is always vertical.

The "jumping" operation of the erection derrick employing the instant invention which is the subject of U.S. Patent 2,754,012 is carried out as follows:

With the mast support **11** and **34** secured to the column C by the mast support attachment means described above, the jib derrick **56** can be employed to lift a second column section. The initial column installation is generally made using a truck-mounted crane or the like. The derrick can then be rotated on the mast **12** to swing the second section into position over the installed column section C in which position it may be secured thereto. When it becomes necessary to "jump" the mast, the cable of the mast extension is secured to the fitting **91** attached to the mast support **34** and the fastening devices which secure the mast support to the column C are removed. The upper mast support **34** is then lifted upwardly by means of the jib derrick to the new position where it is secured to the upper portion of the column section by attachment means previously provided on the upper part of the new column extension. The mast may be then secured to the upper mast support **34** by means of the pin and aperture device **45** and **46** previously described. The cable on the derrick is then released from the fitting **91** and secured to a fitting **92** attached to the member **11**. Bolt **14** is then withdrawn and the various pins which secure the member **11** to the column C are removed and the jib derrick **56** employed to lift the mast support **11** to the new position wherein it is secured to the attachment means previously attached to the top of the new column sections. By removing the pin **45** which secures the mast to the upper mast support **34** and by pulling on the cable **31**, the mast is then slid upwardly through the mast supports **11** and **34** until it reaches the position relative thereto which it had previously occupied, whereupon the bolt **14** and the pin **45** are reinserted and the mast and derrick are then ready for use to hoist another column section into position. Succeeding column sections may be elevated in position by moving the supports, mast and derrick upwardly as just described. It is apparent, therefore, that other mast structures and "jumper" mast support systems can be used in conjunction with the jib derrick of this invention.

The jib derrick can be constructed from conventional materials of construction. In selecting the derrick design, a truss framework should be employed which will provide a load arm having substantially the same extent as the anchor arm; however, variations in length can be used for different erection problems such as large diameter column installations. In the event that the jib derrick **56** is arranged such that the load arm has a different radius than the anchor arm, provisions must be made, as shown in FIGURE 2, for arranging the load falls so as to permit the jib derrick to exert a force on the mast structure substantially coaxial with the longitudinal axis of the mast. It will be noted that the jib derrick **56** shown in FIGURE 2 has been pivoted in a vertical plane so that the load arm and anchor arm do not have the same extent. In the jib derrick arrangement shown in FIGURE 2, hook **80** is secured to a sheave block **95**. The load fall **81** is reeved through the sheave block **95** and its terminal end secured to lug **96** of the sheave journal at the load end of the framework. By securing the load fall **81** in this manner, a proper balancing of the forces can obtain to effect the objectives of this invevntion which provides a jib derrick which will eliminate stresses due to bending in the mast structure of a construction facility.

While we have shown and described certain embodiments of our invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the method, construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

What is claimed is:

1. In a masted apparatus for facilitating the erection of an elevated column, a mast-mounted jib derrick comprising a unitary truss framework having a load portion and an anchor portion oppositely extending from an intermediate mounting pivot, said mounting pivot adapted to permit the rotation of said truss framework in a substantially horizontal plane, a rotatable sheave journalled in the free end of said load portion, a direction-changing sheave mounted on said framework adjacent said anchor portion, and means vertically depending from the terminal end of said anchor portion for anchoring said anchor portion to resist the upward displacement thereof.

2. In a masted apparatus for facilitating the erection of an elevated column, a mast-mounted jib derrick comprising a unitary truss framework having a load portion and an anchor portion oppositely extending from an intermediate mounting pivot, said mounting pivot adapted

to permit the rotation of said truss framework in a substantially horizontal plane and including a yoke portion to which said framework is pivotally attached to permit the angular displacement thereof in a vertical plane, a rotatable sheave journalled in the free end, a direction-changing sheave mounted on said framework adjacent said anchor portion, and means vertically depending from the terminal end of said anchor portion for anchoring said anchor portion to resist the upward displacement thereof.

3. In a masted apparatus for facilitating the erection of an elevated column, a mast-mounted jib derrick comprising a unitary truss framework having a load portion and an anchor portion oppositely extending from an intermediate mounting pivot, said mounting pivot adapted to permit the rotation of said truss framework in a substantially horizontal plane and including a yoke portion to which said framework is pivotally attached to permit the angular displacement thereof in a vertical plane, a rotatable sheave journalled in the free end, a direction-changing sheave mounted on said framework adjacent said anchor portion, and means vertically depending from the terminal end of said anchor portion for anchoring said anchor portion to resist the upward displacement thereof including a downwardly extending jib stay.

4. In a masted apparatus for facilitating the erection of an elevated column, a mast-mounted jib derrick comprising a unitary truss framework having a load portion and an anchor portion oppositely extending from an intermediate mounting pivot, said mounting pivot adapted to permit the rotation of said truss framework in a substantially horizontal plane and including a yoke portion to which said framework is pivotally attached to permit the angular displacement thereof in a vertical plane, a rotatable sheave journalled in the free end, a direction-changing sheave mounted on said framework adjacent said anchor portion, and means vertically depending from the terminal end of said anchor portion for anchoring said anchor portion to resist the upward displacement thereof including a downwardly extending jib stay adapted to be rotatably attached to said masted apparatus and substantially remain in the vertical plane of said jib derrick.

5. In a masted apparatus in accordance with claim 4 in which said jib stay is adjustable.

6. In a masted apparatus for facilitating the erection of an elevated column, a mast-mounted jib derrick comprising a unitary truss framework having a load portion and an anchor portion oppositely extending from an intermediate mounting pivot, said framework comprising a parallelogram truss having a dihedral strut assembly and an opposed dihedral brace assembly, said mounting pivot adapted to permit the rotation of said truss framework in a substantially horizontal plane and including a yoke portion to which said framework is pivotally attached to permit the angular rotation thereof in a vertical plane, a rotatable sheave journalled in the free end, a direction-changing sheave mounted on said framework adjacent said anchor portion, and means vertically depending from the terminal end of said anchor portion for anchoring said anchor portion to resist the upward displacement thereof including a downwardly depending jib stay adapted for attachment to said masted apparatus.

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