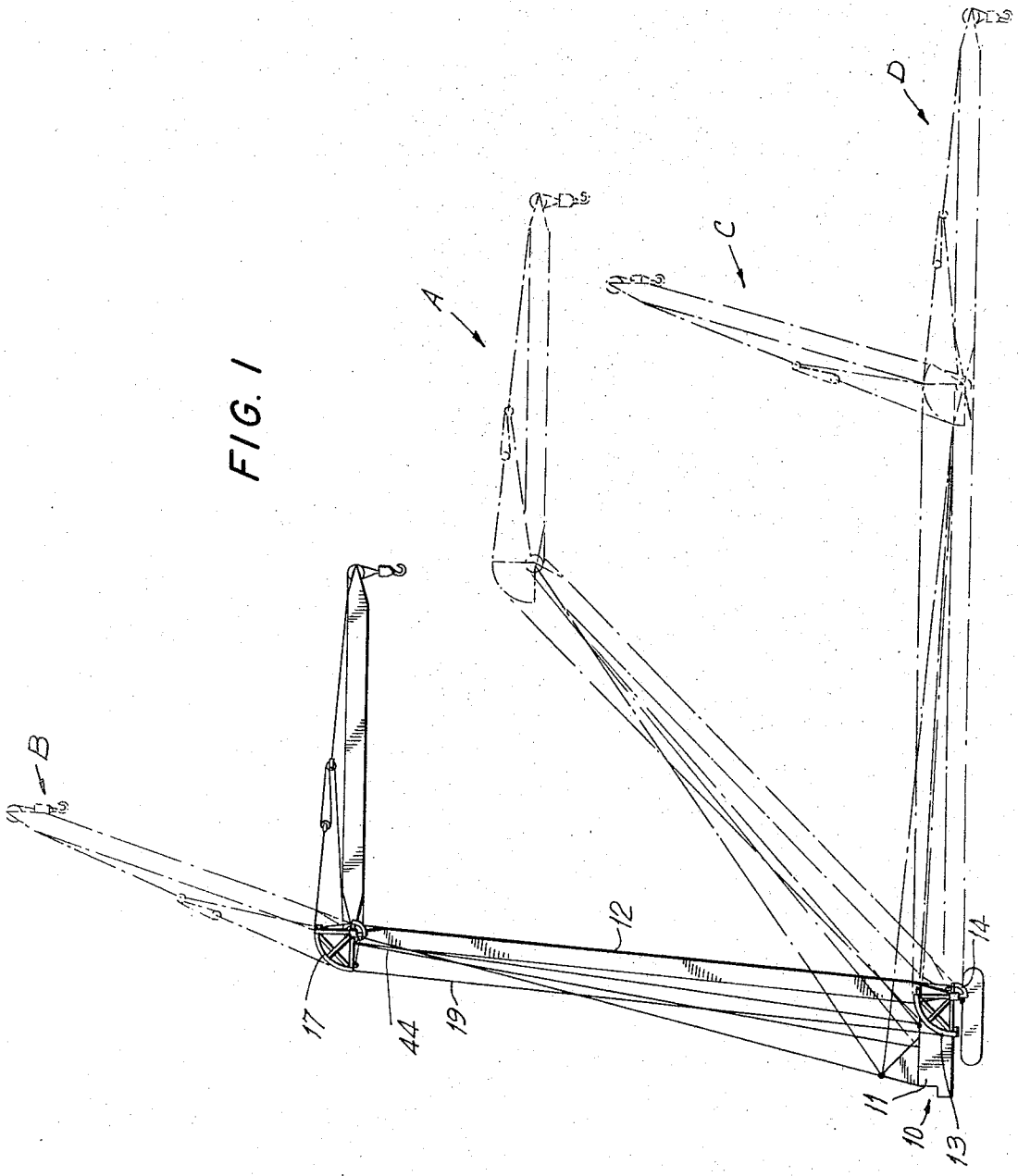
Feb. 28, 1967 S. POLLACK 3,306,468

BOOM AND PIVOTAL JIB STRUCTURE

Filed Oct. 15, 1965

3 Sheets-Sheet 1

FIG. 1

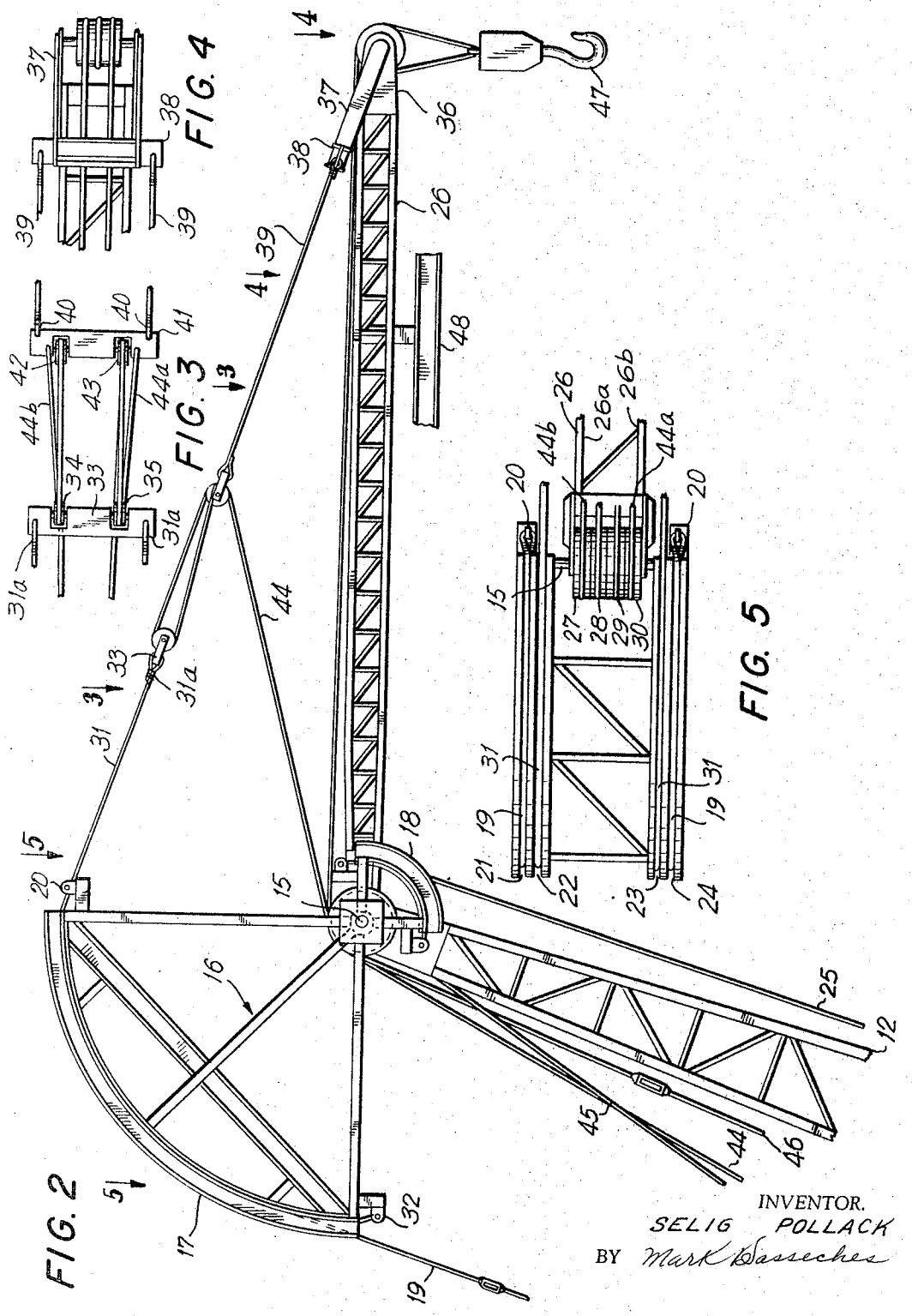


INVENTOR.
SELIG POLLACK
BY Mark Basseches
ATTORNEY

Feb. 28, 1967 S. POLLACK 3,306,468

BOOM AND PIVOTAL JIB STRUCTURE

Filed Oct. 15, 1965 3 Sheets-Sheet 2



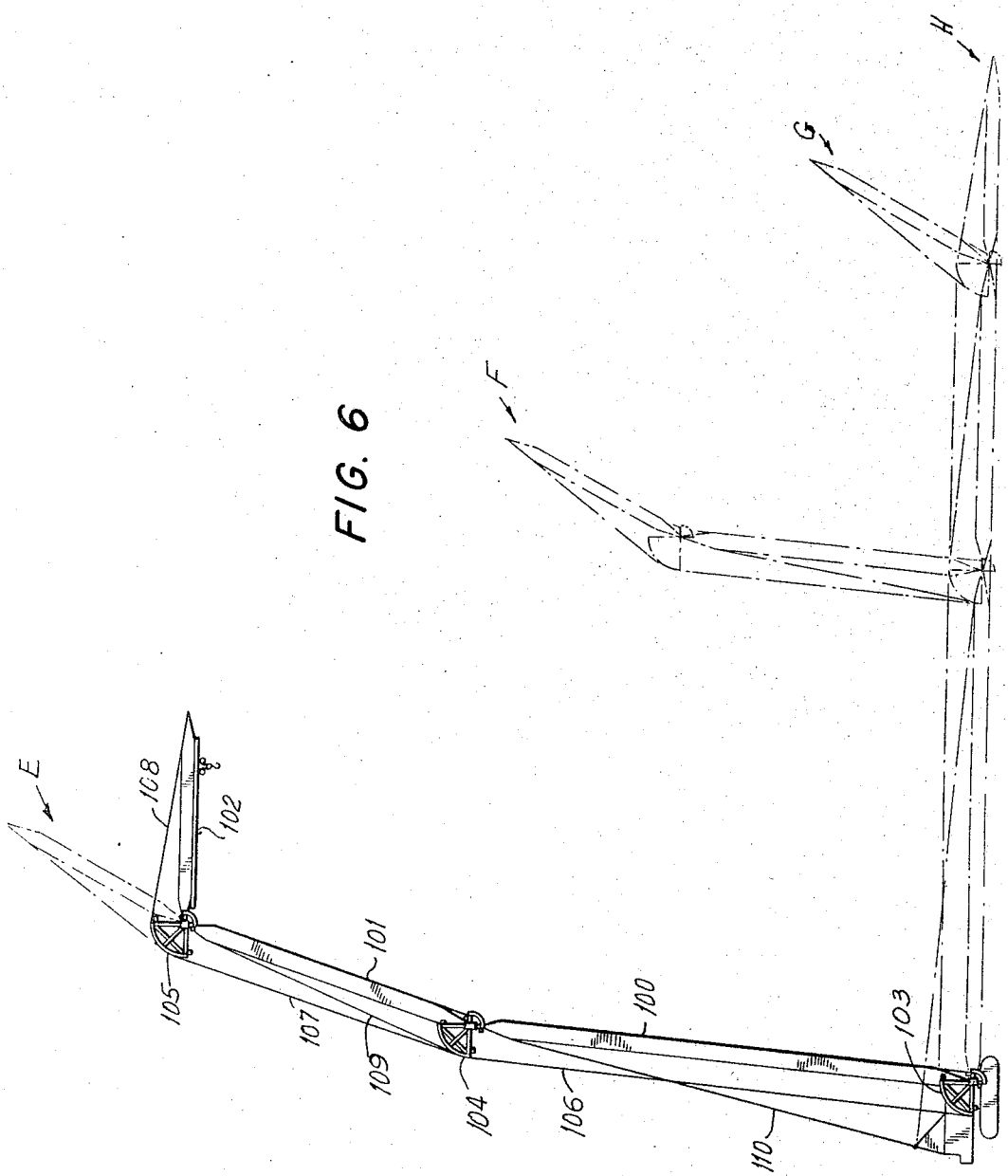
INVENTOR.
SELIG POLLACK
BY Mark Wasserches
ATTORNEY

Feb. 28, 1967 S. POLLACK 3,306,468

BOOM AND PIVOTAL JIB STRUCTURE

Filed Oct. 15, 1965 3 Sheets-Sheet 3

FIG. 6



INVENTOR.
SELIG POLLACK
BY Mark Bassechez
ATTORNEY

United States Patent Office 3,306,468
Patented Feb. 28, 1967

3,306,468

BOOM AND PIVOTAL JIB STRUCTURE

Selig Pollack, 11 W. 42nd St., New York, N.Y. 10036

Filed Oct. 15, 1965, Ser. No. 496,496
2 Claims. (Cl. 212—59)

This invention relates to improvements in cranes of the type shown in United States Patents Nos. 3,034,661 of May 15, 1962, and No. 3,062,384 of November 6, 1962.

More particularly, this invention relates to a crane assembly having an adjustable beam jib. Still more particularly, this invention relates to an articulatable crane assembly which may include one or more booms, to which is pivotally connected an adjustably mounted jib, the assembly being characterized by the ability to set the jib at any predetermined angle with respect to the ground and to articulate the main boom, the jib maintaining said predetermined angle throughout all relative adjusted positions of the main boom.

More particularly, this invention relates to a rigging structure for a crane having a jib adjustably mounted thereto, the angle between the jib and the ground being adjustable by actuation of powerized means on the crane chassis, the jib being enabled by the rigging structure employed to maintain the identical angular relationship to the ground throughout all articulated positions of the boom.

This invention relates further to a device of the class described wherein the jib is rigged to provide a constant moment arm, whereby the moment of mechanical forces lifted by the jib may be readily computed, the length of the moment arm resisting the lifting force exerted on the jib being constant throughout all articulated positions of the jib with respect to the ground.

Accordingly, it is an object of this invention to provide an improved crane structure.

It is a further object of the invention to provide an improved crane structure embodying one or more relatively movable booms and a pivotally adjustably mounted jib.

A further object of the invention is the provision of a crane device which may incorporate two or more main links which are relatively adjustable and wherein the angular relationship of the upper link or links will remain constant with respect to the horizontal, notwithstanding pivotal movement of the lowermost chassis supported link or boom.

A further object of the invention is to provide a boom and pivotal jib structure wherein pivotal movement of the jib about the boom will not affect the moment arm of the jib.

To attain these objects and such further objects as may appear herein or be hereinafter pointed out, I make reference to the accompanying drawing, forming a part hereof, in which:

FIGURE 1 is a schematic side elevational view of a crane device in accordance with the invention in various positions capable of being actuated by the parts;

FIGURE 2 is a detail view of the junction between the jib and boom, indicating specifics of the rigging;

FIGURE 3 is a fragmentary plan view of the section of the rigging of the jib indicated by the arrows 3—3 of FIGURE 2;

FIGURE 4 is a fragmentary plan view of the section of the rigging of the jib indicated by the arrows 4—4 of FIGURE 2;

FIGURE 5 is a fragmentary plan view of the section of the rigging of the jib and the jib quadrant indicated by the arrows 5—5 of FIGURE 2;

FIGURE 6 is a schematic view of an embodiment of the invention employing, in this instance, a main and an auxiliary boom in addition to the articulatable jib.

In accordance with the invention, there is provided a powerized crane **10** including a chassis **11** and a main boom **12**, pivotally mounted to the chassis. There is rigidly secured to the chassis, a main quadrant **13** and an oppositely disposed prestressor quadrant **14**, for purposes which will appear hereafter. The radii of the quadrants **13**, **14** are disposed concentrically with respect to the pivot point of the boom **12**.

A horizontally disposed trunnion **15** (see FIGURE 2) is supported at the upper end of the main boom **12**, the trunnion **15** pivotally supporting a second or auxiliary quadrant structure **16** comprising an upper quadrant member **17** disposed in parallelism with the quadrant **13**, and a lower or prestressor quadrant **18**.

The auxiliary quadrant structure **16** is maintained in parallelism with the lower quadrant by a quadrant tie **19** wrapped over and lying tangent to the lower quadrant, the lower end of said tie being made fast to the chassis and, in addition, wrapped over the upper surface of the quadrant **17**, the upper end of the tie **19** being made fast to anchor bracket **20** supported by the quadrant. While it is altogether possible to employ a single tie or fall **19**, it is preferred, as best seen from FIGURE 5, that the tie or fall **19** comprise a pair of identical guy members.

As will be seen from said FIGURE 5, the quadrant **17** includes four side-by-side disposed grooves **21**, **22**, **23**, **24**. in the illustrated embodiment the ties **19** lying in the outermost grooves **21**, **24**.

For the purposes set forth particularly in United States Patent No. 3,062,384, a prestressor guy **25** is rigged under the upper and lower prestressor quadrants **18** and **14**, respectively, thus to prevent possible damage due to shock loading and possible reverse or counter-rotative movement of said jib, as fully set forth in said Patent No. 3,062,384. As the operation of the prestressor components is in no wise germane to the present invention, further description thereof is not deemed necessary.

Pivotally mounted about the trunnion **15**, there is disposed an extended, articulatable jib member **26**. The jib member **26** preferably incorporates lateral, spaced-apart brace portions **26***a*, **26***b*, linked together by suitable reinforcing struts. Similarly, mounted about the trunnion **15** are four independent sheaves **27**, **28**, **29** and **30**.

From the description of the rigging of the upper quadrant **17**, and in the manner set out in United States Patent No. 3,034,661, it will be appreciated that when the boom **12** is pivoted about its connection to the chassis, the upper quadrant structure **16** will "float" or remain in the same angular relationship to the ground, i.e. it will rotate about the trunnion **15** in a manner to maintain it in parallelism with the lower quadrant **13** by reason of the wrapping and unwrapping action of the quadrant tie or ties **19**.

The jib structure **26** which is mounted on the trunnion **15** may be independently articulated through the use of the jib control rigging next to be described.

The control rigging includes a pair of ties **31**, which ties are wrapped over the inner grooves **22**, **23** of the upper quadrant **17**, the rearward ends of the ties being fixed to depending bracket members **32** formed on the undersurface of the quadrant **17**. The forward end **31***a* of the ties or guys **31**, as best seen in FIGURE 3, are made fast to a harness **33**. The harness **33** rotatably carries a spaced pair of sheaves **34**, **35**. To the end **36** of the jib **26** there is pivotally mounted a U brace **37**, terminating in a laterally disposed strut or spreader **38**. A pair of jib tie members **39**, **39** have their ends fixedly supported to the spreader **38**, the rearward ends **40**, **40** of the tie members **39** being fixed to a harness **41** which is spaced from and disposed in opposition to the harness **33**.

A pair of sheaves **42**, **43** are rotatably mounted in the

harness **41** in a spacing corresponding to the spacing of the sheaves **34**, **35** of harness **33**. A jib control cable **44** is rigged between the sheaves **34**, **35** and **42**, **43** and thence downwardly to the cab and lift engine maintained on the chassis, in a manner to cause the harnesses **33** and **41** to be shifted closer together or further apart, thereby to vary the angular relationship of the jib about the trunnion **15**, respectively in an upward or downward direction.

This rigging is accomplished by the spaced legs **44***a*, **44***b* of the control cable **44**, said legs being made fast to the harness **41** and then being led, respectively, under and then over the sheaves **35**, **34**, and then over and then under the sheaves **43**, **42**. The falls or cables **44***a*, **44***b* are thereafter led over the outer sheaves **30** and **27**, respectively, which are mounted on trunnion **15**, to a laterally extending equalizer (not shown) which functions, in the usual manner, to equalize the stress in the two lines. The equalizer is, in turn, connected to the crane lift engine through a further cable, it being readily understood that when the cable is slacked off, a clockwise rotation of the jib will be effected, since a greater spacing of the harnesses **33** and **41** will be permitted, whereas taking up on the cable connected to the lift engine will have a counter effect, namely, will result in the harness members **33** and **41** moving together and a counterclockwise or lifting rotation of the jib **26**.

A main boom topping lift **45**, which may be of single or double fall construction, is suitably rigged between the chassis **11** and an upper portion of the main boom **12** for controlling, in the usual manner, the angular position of the boom with respect to the chassis. Similarly connected to the engine by fall **46** is a lift hook **47**, it being understood that, if desired, a track **48** may be secured to the under-surface of the jib so as to permit the use of a longitudinally movable trolley carriage in lieu of, or in addition to, the hook lift member.

From the foregoing description, the operation of the embodiment shown in FIGURE 1 will be apparent.

With the boom **12** positioned as shown in solid lines (FIGURE 1), the articulation of the boom will not affect the angular relationship of the jib. In this instance, in the position shown in dot and dash and labeled A, the boom **12** has been lowered from the solid line position through a desired angle. In the course of such movement, increments of the quadrant ties **19** have been wrapped over the lower quadrant **13** and comparable increments have been unwrapped from the upper quadrant **17**, thus to effect the desired continued parallelism of the said quadrants. Since the jib is supported by ties wrapped over the quadrant **17**, i.e. since the angular relationship of the jib with respect to the horizontal will be a function only of the length of the guy extending between the end **36** of the jib and overlying the quadrant **17**, and since this length will not vary upon articulation of the main boom, the angle of the jib will not be affected by such articulation. It is, however, possible to vary the angle of the jib with respect to the horizontal by merely shortening to distance between the harnesses **33** and **41** by drawing in the jib control cables **44**. The B position as shown in FIGURE 1 illustrates the movement from the solid line position which results from taking up on cables **44**.

In the C position shown in FIGURE 1, the boom **12** has been lowered from the B position to a fully horizontal position, whereupon it will be seen that the angular relationship of the jib with respect to the ground has remained constant in shifting from the B to the C position.

The D position of FIGURE 1 may be reached either by articulating the boom from the A position to a horizontal position or by causing the jib to be lowered from the C position by slacking out on the falls or cables **44**.

From the foregoing it will be evident that an almost infinite variety of positions may be achieved by properly maneuvering the boom and jib controls.

It is an important feature of the invention that the load resisting force moment arm of the jib about the boom remain a constant throughout all articulated positions of the jib with respect to the horizontal. This result inheres in the illustrated structure since the jib supporting guys **31** at all times are tangentially engaged over the upper quadrant **17**. Thus, notwithstanding the articulated position of the jib about the trunnion **15**, the resistive or load supporting moment is at all times defined by the spacing between the radius of the trunnion **15** and the point of tangency of the cables **31** over the quadrant **17**. This distance or moment arm will, of course, be at all times a constant.

The load carrying capacity of the jib will, of course, vary in accordance with the angle between the jib and the horizontal it being readily recognized that the moment or torque arm which opposes the resistance moment arm previously described will be a function of the rotative position of the jib. Thus, if the jib is disposed in a substantially vertical position, a considerably greater lifting force may be exerted, since the lifting force will be applied through a short moment arm defined by the horizontal displacement of the load lifting fall from the trunnion **15**. Correspondingly, when the jib is disposed horizontally, the weight will be applied to the jib through the greatest possible moment arm and, thus, the lifting capacity will be most restricted in this position.

A great advantage of my invention lies in the facility of computing the lifting stresses of the component members in the jib structure in the field. Since, as above noted, the force resistive moment arm is a constant, the load moment determined by the product of the load by the horizontal displacement, both known factors, when divided by this constant, give the strain on the topping life directly and the jib indirectly or, vice-versa, knowing the allowable strain on jib and topping lift, the allowable load and horizontal displacement can thus be readily determined. The simplicity of calculating the force components under such circumstances is to be contrasted with prior jib structures wherein, upon articulation of the jib, the resistive moment arm varies radically and in a manner not subject to measurement with any degree of exactitude, making the calculation of the stresses in all component members difficult and hazardous.

In FIGURE 6 there is shown an embodiment of invention wherein there is included a main boom **100**, pivotally supporting an auxiliary boom **101**, which boom in turn supports an articulatable jib **102**. In this construction, the principles of operation are identical with the device previously described.

There is, in the embodiment of FIGURE 6, a lower quadrant **103**, an intermediate quadrant **104**, and an upper quadrant **105**, the intermediate and upper quadrants **104**, **105**, respectively, being mounted so that their radii are coaxilly disposed with respect to the pivot point between the booms **101** and **100**, and the jib and boom **102**, **101**, respectively.

In this case, a guy **106** is wrapped over the lower and intermednate quadrants **103**, **104**, respectively, to keep these quadrants in parallelism through all movement of the boom **100**.

Similarly, guy **107** is wrapped over the quadrants **104**, **105**, to maintain the latter mentioned quadrants in parallelism, notwithstanding any relative movement between the auxiliary boom **101** and the main boom **100**.

The jib **102** is pivotally mounted with respect to the auxiliary boom **101**, including a shortenable tie **108** which is led to the hoisting engine of the crane, the tie **108** being connected adjacent the end of the jib **102** and being wrapped over the quadrant **105**. It will be understood that the shortening of the tie **108** may articulate the jib angularly in a vertical plane, in the manner described in connection with the embodiment of FIGURE 1. In a similar manner, the boom **101** may be articulated with respect to the boom **100**.

To accomplish this end, a tie **109** is fixed to the end of auxiliary boom **101** and is wrapped over quadrant **104**, provision being made to shorten the effective length of this tie between the quadrant and boom end, thus to enable an articulation of the auxiliary boom about the main boom. Any suitable means for shortening this connection may be employed, as is the case with the connection between the jib and uppermost quadrants in both embodiments.

As in the prior described embodiment, a main boom topping lift **110** is provided, to permit the usual articulation of the main boom **100** about the chassis.

From the foregoing description of the embodiment of FIGURE 6, it will be evident that the jib may be shifted from the solid line position to the position E by shortening the lift or cable **108**. By thereafter articulating the main boom **100**, shifting it to a downward position through a slacking off of the topping lift **110**, the components may be disposed in the position shown in FIGURE F.

Again, by slacking off on the cable **109** controlling auxiliary beam **101**, the device may be further altered to position G.

Finally, the jib may be lowered, leaving the device in position H by slacking off on jib control cables **108**. Obviously the device may be erected beginning with position H by reversing the order of steps.

From the foregoing it will be readily recognized that by using the novel principles employing one or more floating quadrants, an extremely versatile crane construction may be provided. The construction may be made even more versatile by using a plurality of booms and floating quadrants, the resultant crane structure being capable of adjustment so as to reach over or around buildings in the most efficient manner possible. Thus, the structure of the present device will accomplish all of the ends set forth in the said prior patented devices and will provide even greater flexibility.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is:

1. An infinitely variable multi-boom crane structure having an adjustable jib comprising:

(a) a chassis;

(b) a main boom pivotally mounted on said chassis for retraction and reach;

(c) an auxiliary boom having an end pivotally mounted to the free end of said main boom and having a free end;

(d) a jib pivotally mounted to the free end of said auxiliary boom;

(e) a fixed quadrant mounted on said chassis,

(f) first and second auxiliary quadrants of radius equal to said fixed quadrant pivotally mounted at the free ends, respectively, of said main boom and said auxiliary boom, the axes of said auxiliary quadrants being coincident, respectively, with the pivotal connections between said main and auxiliary booms and said auxiliary boom and said jib,

(g) a flexible guy wrapped over said fixed quadrant and the auxiliary quadrant at the free end of said main boom, and tangentially engaging both said quadrants throughout all pivoted positions of said boom,

(h) a flexible guy wrapped over said auxiliary quadrants and tangentially engaging said quadrants throughout all pivoted positions of said auxiliary boom,

(i) auxiliary boom adjustment means for controlling the angular relation of said main and auxiliary booms comprising a flexible topping lift wrapped over said first auxiliary quadrant and extending to a point adjacent the free end of said auxiliary boom,

(j) jib adjustment means for controlling the angular relation of said job and auxiliary boom comprising a second flexible topping lift wrapped over said second auxiliary quadrant and extending to a point adjacent the free end of said jib, and

(k) means for varying the length of said first and second topping lifts, thereby to articulate said auxiliary boom with respect to said main boom and said jib with respect to said auxiliary boom.

2. A device in accordance with claim **1** and including prestressor quadrants of equal radius mounted, respectively, in opposition to and coaxially with said fixed first and second quadrants, each said prestressor quadrant being connected to the next adjacent prestressor quadrant by a flexible tensioning guy member wrapped under and tangentially engaging the surfaces of said prestressor quadrants.

References Cited by the Examiner

UNITED STATES PATENTS

3,034,661	5/1962	Pollack et al.	212—59
3,037,641	6/1962	Potter et al.	212—144
3,062,384	11/1962	Pollack	212—144

ANDRES H. NIELSEN, *Primary Examiner.*