April 19, 1966 G. C. NOLL ET AL 3,246,769

CRANE

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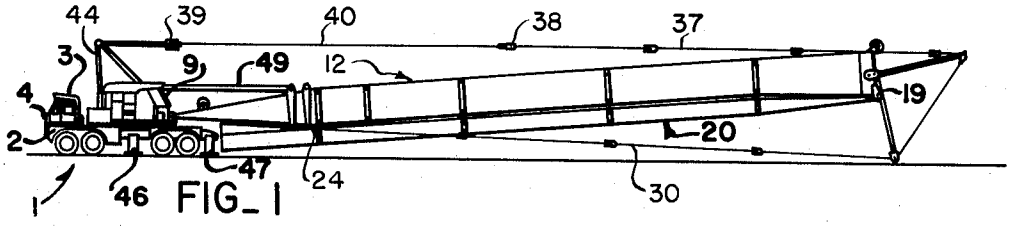


FIG_1

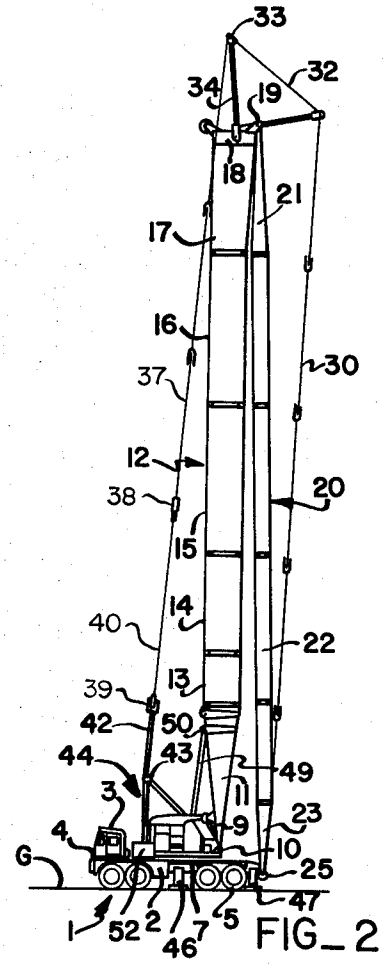


FIG_2

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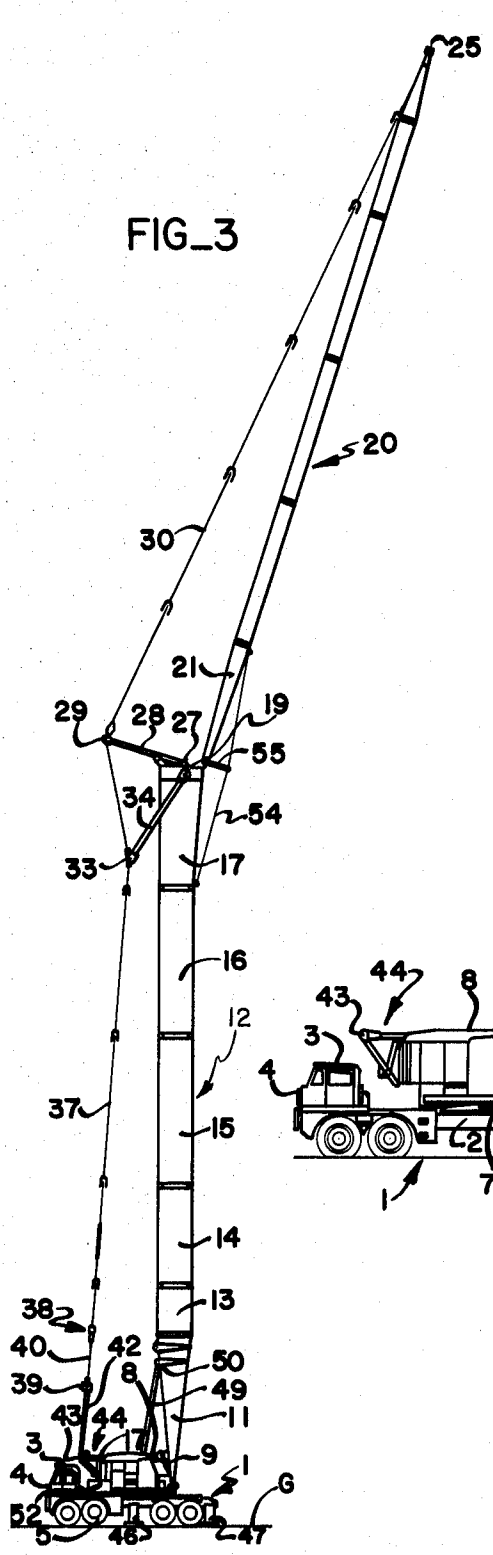
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CRANE

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FIG_3



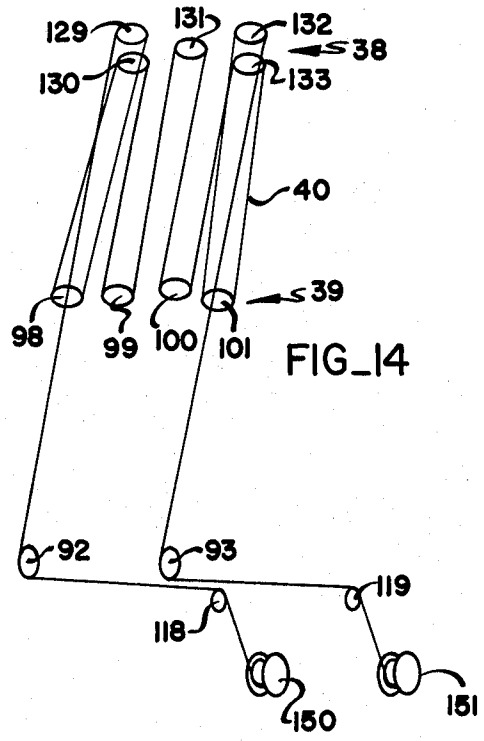


FIG_14

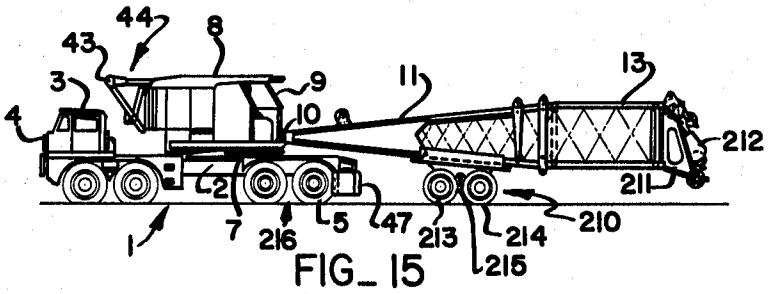


FIG_15

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FIG_5

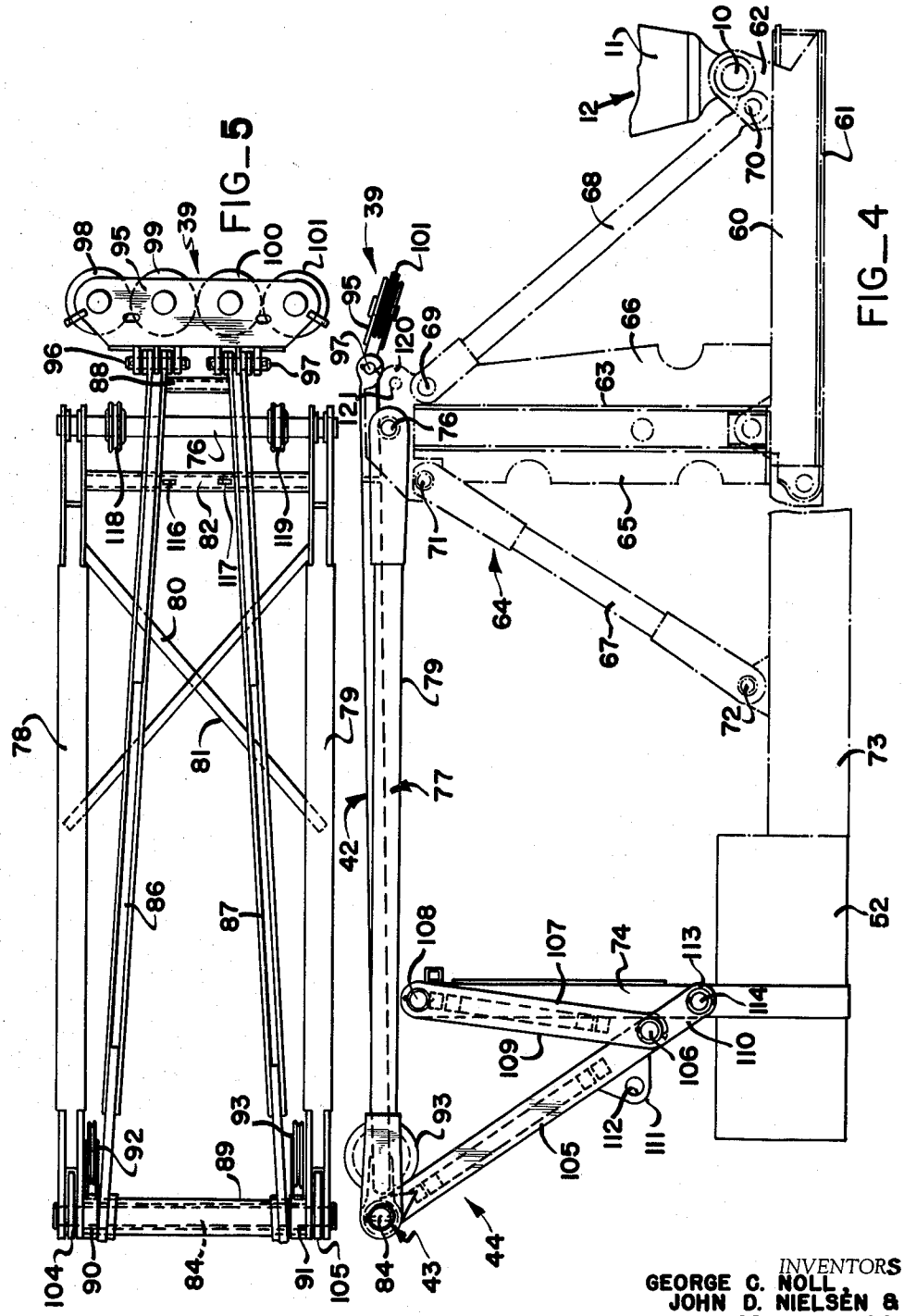


FIG_4

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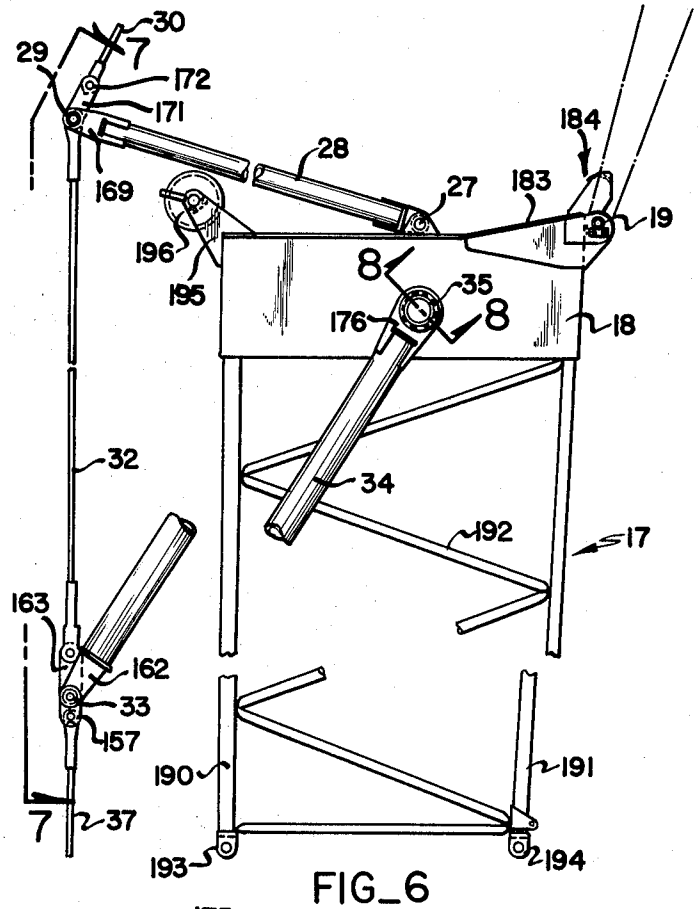


FIG_6

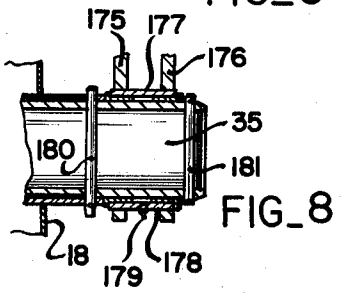


FIG_8

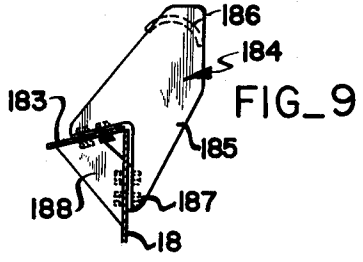


FIG_9

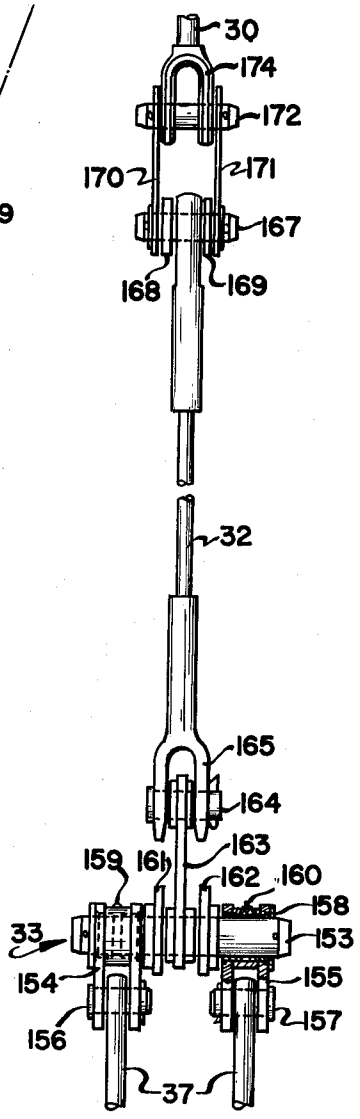


FIG_7

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CRANE

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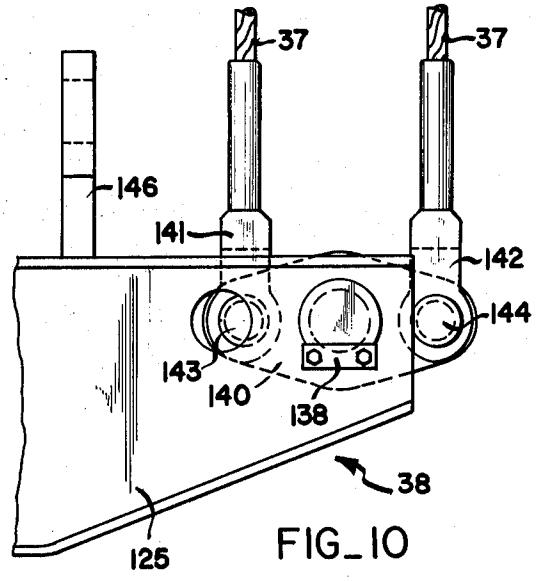


FIG_10

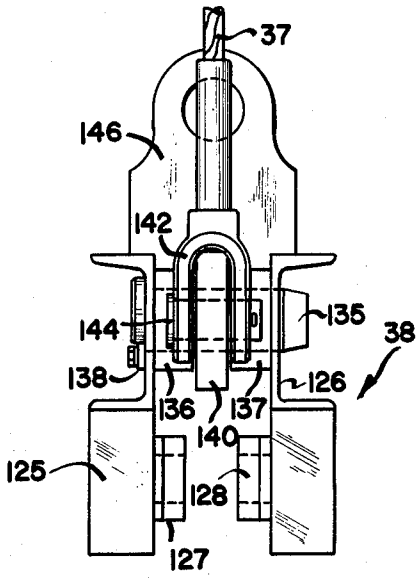


FIG_11

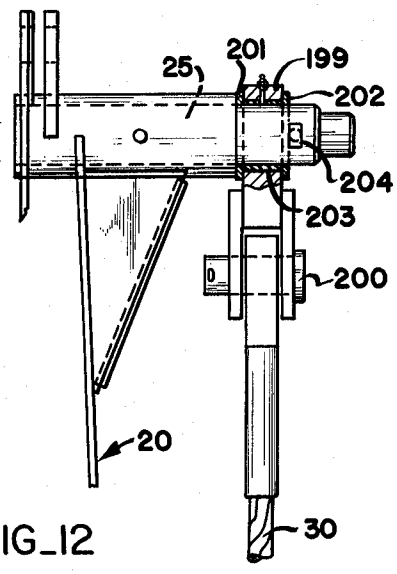


FIG_12

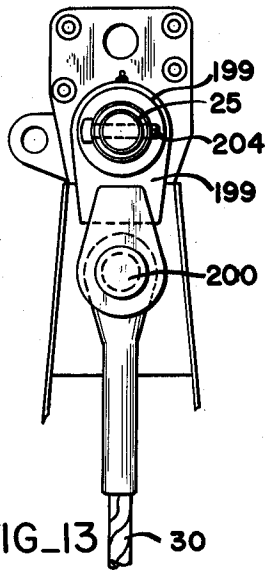


FIG_13

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United States Patent Office 3,246,769 Patented Apr. 19, 1966

3,246,769

CRANE

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Filed Oct. 15, 1963, Ser. No. 316,289
2 Claims. (Cl. 212—59)

This invention relates generally as indicated to a crane and more particularly to certain improvements in a crane such as disclosed in Jones et al. Patent No. 3,083,837 entitled "Crane," dated April 2, 1963.

While the tower crane illustrated in such patent has met with substantial construction industry acceptance, customer demands continue for such tower cranes having substantially greater reaches and load capacities. One of the major problems in tower cranes of the type under consideration is the ability to erect the tower and operating booms in a limited space in a short period of time without outside assistance. The greater the height of the tower, the more difficult it becomes to erect the crane to operating position in a short period of time. In the erection of such cranes, highly paid skilled riggers are required and the length of time involved in the setup of the crane at any desired site has a direct relationship to the cost of utilizing such crane.

It is accordingly a principal object of the present invention to provide certain improvements in a tower crane of the type shown in the aforementioned Patent No. 3,083,837 which will provide greater reaches and capacities and yet still maintain the high degree of mobility and ease of erection desired.

A further object is the provision in a mobile tower crane of a folding back hitch gantry providing in its erected position the proper moment for self erection of the tower and standard boom, and in its folded position, the proper moment for operating the crane when the tower is erected.

Still another object is the provision of such folding back hitch gantry which can be utilized to pay out the boom derricking cables for reuse in operating the standard boom when the tower is erected.

A further object is the provision of a boom derricking system for tower cranes requiring less length of boom derricking cable than than would otherwise be required.

Yet another object is the provision of a boom derricking and pendant system enabling much longer and thus heavier booms to be erected and operated when erected.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail a certain illustrative embodiment of the invention, this being indicative, however, of but one of the various ways in which the principle of the invention may be employed.

In said annexed drawings:

FIG. 1 is a side elevation of a crane in accordance with the present invention with the tower down, the standard operating boom pivoted therebeneath, and the back hitch gantry elevated;

FIG. 2 is a similar side elevation illustrating the tower erected to its vertical position;

FIG. 3 is a similar side elevation illustrating the standard boom elevated to its working range with the back hitch gantry now folded;

FIG. 4 is an enlarged fragmentary side elevation of the superstructure frame illustrating the gantry in its folded position;

FIG. 5 is a fragmentary top plan view of the superstructure frame as seen in FIG. 4;

FIG. 6 is an enlarged fragmentary side elevation of the peak of the tower boom illustrating the arrangement of the masts pivoted thereto as well as that of the standard operating boom;

FIG. 7 is a fragmentary enlarged view of the boom pendants connected to the lower mast structure as seen on the line 7—7 of FIG. 6;

FIG. 8 is an enlarged fragmentary section of the proximal pivot of the lower mast on the tower boom peak;

FIG. 9 is an enlarged detail view of the hoist cable deflector which is mounted on the peak of the tower;

FIG. 10 is a fragmentary detail view of the floating harness of the boom derricking system;

FIG. 11 is a side elevation of such floating harness as seen from the right in FIG. 10;

FIG. 12 is a fragmentary detail view of the standard boom peak link assembly to which the boom pendant system is attached;

FIG. 13 is an end elevation of such link assembly as seen from the right in FIG. 12;

FIG. 14 is a diagrammatic illustration of the reeving system for the boom derricking cable; and

FIG. 15 is a side elevation of the crane in condition for highway travel utilizing a load transfer device to support a portion of the tower boom.

Referring now to the annexed drawings and more particularly to FIGS. 1 to 3, there is illustrated a tower crane embodying the improvements of the present invention. Such figures show successively the steps involved in erecting the tower and operating booms of the crane. In FIG. 1, the booms have been assembled on the ground with the standard or secondary boom folded to lie beneath the tower. In FIG. 2, the tower has been elevated to a vertical position and locked to the crane superstructure, while in FIG. 3, the operating boom has been elevated to its maximum height within its operating range.

The crane comprises a crane carrier 1 which includes a chassis or frame 2 having a driver's cab 3 and a prime mover 4 laterally thereadjacent which can be employed to propel the carrier by driving the rubber tired wheels 5 which support the carrier and thus the crane for highway or off-the-road mobility. Such wheels 5 may be sixteen in number with four being mounted on each of the four axles illustrated.

A turntable 7 is provided on the bed of the carrier frame 2 supporting crane superstructure 8 for swinging movement about the vertical axis of such turntable. The superstructure 8 includes the engine driven hoisting mechanisms for elevating or derricking the boom as well as the hoisting mechanism for the hoist lines and additionally the means to swing the superstructure about such axis of the turntable, all controlled by the operator in cab 9.

The frame of the superstructure, shown in more detail in FIG. 4, includes a forwardly projecting portion supporting boom foot 10 to which the foot of base section 11 of the tower boom 12 is pivoted. The tower boom, in addition to the base section 11, includes intermediate sections 13, 14, 15 and 16 and a peak section 17, all of which may be pin-connected together to form the tower boom 12 which is pivotally supported on the foot 10 of the superstructure 8. While the base section 11 tapers to the boom foot 10, the peak section 17 increases in depth toward the cap or peak frame 18 which is provided with a flat top. At the forward edge of the frame 18, there is provided a foot 19 to which the foot of the operating boom 20 is pivotally connected. The tower boom 12 then provides a forwardly offset boom foot 19 for the operating boom 20,

the latter comprising a tapered base section 21, intermediate sections 22, four in number, and a peak section 23. Each of the boom sections of both the tower and operating booms may preferably comprise square tubular chord members at each corner of the boom section interconnected by continuous tubular zig-zag lacing members, not shown in FIGS. 1 to 3 for convenience of illustration.

The crane illustrated in FIGS. 1 to 3 has a tower which may be 145 feet in height from the foot 10 to the foot 19, and with the foot 10 approximately seven feet from the ground G, it will be seen that the foot 19 for the operating boom 20 will be in excess of 150 feet from the ground when the tower is in its vertical position. The operating boom 20 illustrated completely assembled in FIGS. 2 and 3 may be 150 feet in length from the foot 19 on top of the tower 12 to the peak or head shaft 25. Accordingly, the height that the peak of the operating boom 20 may obtain when the crane is fully erected is approximately 300 feet. It is noted that the peak section 23 of the operating boom 20 is not connected when the tower and operating booms are folded in their initial erecting position as seen in FIG. 1. The peak section 23 may be connected after the tower is elevated to the FIG. 2 position.

Pivoted to the frame or cap 18 of the tower 12 at 27 is a mast structure 28, the peak 29 of which is interconnected with the peak or head shaft 25 of the boom 20 by pendants 30. It will be understood that two such pendants are provided connecting the peak 29 of the mast structure 28 and each side of the peak or head shaft 25. The foot 27 of the mast structure 28 is pivoted on top of the frame or cap 18 directly horizontally rearwardly of the foot 19 and is adapted to swing to a substantially horizontal position either forwardly or rearwardly of the tower as seen in comparing FIGS. 2 and 3. The pendants 30, like the operating boom 20, may be comprised of interconnected sections which can be removed or replaced so that the length of the operating boom may be varied. It will, of course, be understood that the tower may similarly be increased or decreased in height.

The peak 29 of the mast structure 28 is also connected by means of pendants 32 to the peak 33 of mast structure 34 which straddles the frame 18 and is pivoted to shaft 35 extending through the frame 18. The axes of the pivots for the mast structures 28 and 34 are directly vertically beneath each other and both are offset forwardly from vertical centerline of the tower. The pendants 32 which interconnect the peaks 29 and 33 of the mast structures 28 and 34, respectively, may be cables such as the pendants 30, but it will, of course, be understood that bars or rods may equally well be employed in that the peak distance between the two mast structures will be constant during the operation of the crane.

Two pairs of pendants 37, a total of four, are employed to connect the peak of the mast structure 34 with a first or floating harness 38 which is in turn connected to a second or gantry harness 39 by means of hoist cable 40. The gantry harness 39 is mounted on the distal end of gantry harness strap 42 which is pivoted at 43 to the peak of folding back hitch gantry 44. The gantry 44 is connected to the back of the superstructure frame as illustrated in more detail in FIG. 4. Such gantry can be elevated to its raised position for elevating the tower 12 and operating boom 20 folded thereagainst as illustrated in FIGS. 1 and 2 and then folded moving the pivot point 43 downwardly and rearwardly and locked in its folded position providing greater lateral stability and moment on the tower to elevate the operating boom from its FIG. 2 to its FIG. 3 position. The gantry is shown folded in FIGS. 3 through 5 and 15.

The carrier frame 2 is provided with hydraulically operated outriggers 46 and 47 which may quickly be extended and retracted at the direction of the crane operator to provide a firm enlarged supporting base for the crane when the booms are erected and during operation of the boom 20. Such outriggers may be completely or partially retracted so that the crane can be moved at the site. Briefly, with the outriggers extended, the boom 20 folded beneath the tower 12 as indicated in FIG. 1, and with the peak section 23 removed, the pendants 30 may be connected to the tower base section 11 and the boom 20 hooked or secured to the front of the tower by separable tie means 24. With the gantry in its elevated position, the boom derricking cable 40 may then be employed to erect the tower together with the boom 20 tied thereto more or less to the FIG. 2 position. The peak section 23 is then added to the boom 20 and the pendants 30 are connected to the head shaft or peak 25 of the boom 20.

In the vertical position of the tower, back stays 49, which may comprise telescoping tubular members, may be pin-connected together to lock the tower in its vertical position. The stays 49 are pivoted at one end to the peak of the A-frame of the superstructure and at the other end at 50 to the top of the tower base section 11. With this procedure accomplished, the gantry 44 may now be dropped by gravity moving the pivot 43 downwardly and rearwardly to the FIG. 3 position and pin-locked in its folded or down position. This not only moves the pivot 43 rearwardly providing greater moment acting on the tower 12, but also may serve to pay out the derricking cable 40 for reuse in elevating the boom 20 to its working position. Accordingly, a shorter length of derricking cable may be employed than would otherwise be required. With the gantry down, the boom 20 is weighed and the hoisting mechanism in the revolving superstructure can now be employed to pivot the operating boom 20 about its foot 19 to the working position, the maximum elevation thereof being shown in FIG. 3. If desired, a counterweight may be added to the front end of the carrier 1 to preclude rearward tipping of the carrier as the booms are erected and the superstructure may be tied to the carrier frame 2 to prevent undue bending moments in the carrier frame and to preclude excess loading on the bearing of the turntable 7. This counterweight may be in addition to the counterweight 52 normally provided at the rear of the superstructure to balance the weight of the booms and the load carried thereby about the vertical axis of the turntable 7.

As seen in FIG. 3, a Kelly stop 54 may be provided which may comprise a pair of cables interconnecting the bottom of the peak section 17 of the tower and the top of the base section 21 of the boom 20. A spacing strut 55 is employed to space the cables of the Kelly stop 54 from the boom pivot 19. The Kelly stop precludes the operating boom 20 from pivoting back over the top of the tower.

Referring now more particularly to FIGS. 4 and 5, the revolving superstructure 8 includes a bed frame 60, the bottom 61 of which constitutes the finished bottom of the bed of turntable 7 on which the superstructure revolves. Brackets 62 at the forward end of the frame 60 support the foot 10 for the tower boom 12 and at the rear of the bed 60 column structures 63 are provided which constitute the center post of A-frame 64. Mounting plates 65 and 66 may be provided recessed as indicated to support the various shafts of the hoisting mechanism which will be housed within the superstructure. The A-frame 64 also includes inclined struts 67 and 68 on each side of the center column structure 63 with the latter being pin-connected at 69 to the top of the A-frame and at 70 to the brackets 62. The strut 67 extends from the top of the column structure 63 at 71 rearwardly and is connected at 72 to a rearwardly extending frame 73 supporting the engine, counterweight 52, and vertically extending pairs of straps 74 to which the back hitch gantry 44 is connected.

The peak of the A-frame 64 is provided with a horizontally extending axle shaft 76 on which is pivoted the proximal end of gantry strut 77 which is comprised of

main side frame members 78 and 79 interconnected by diagonals 80 and 81 as well as a tubular transverse frame member 82. The outer ends of the main side frames 78 and 79 of the gantry strut 77 are interconnected by a gantry hinge pin or shaft 84 which provides the pivot 43 for the proximal end of the gantry harness strap 42. The harness strap 42 is comprised of two longitudinally extending strap members 86 and 87 joined at their outer ends by member 88. A collar 89 spaces the proximal ends of the straps 86 and 87 on the gantry pin 84. Outwardly adjacent the straps 86 and 87 are sheave links 90 and 91 supporting sheaves 92 and 93, respectively.

The frame 95 of the gantry harness 39 is secured by means of pins 96 and 97 to the distal ends of the straps 86 and 87, respectively, and four coplanar sheaves 98, 99, 100 and 101 are mounted in the frame 95. Such frame is thus pivotally mounted on the end of the harness strap 42 on the aligned axes of the pins 96 and 97.

It is noted that the outer ends of the main longitudinal frames 78 and 79 of the gantry strut 77 are bifurcated and between such bifurcated ends, gantry links 104 and 105 are mounted on the gantry hinge pin 84. The gantry links 104 and 105 are thus connected at their upper ends to the hinge pin 84 and at their lower ends by means of pins 106 to intermediate portions of dog-leg links 107 which in turn are pin-pivoted at 108 to the tops of the straps 74 secured to the frame of the superstructure 8. The links 107 each include an elongated portion 109 and a relatively short offset portion 110 beyond the pivotal connection 106 with the link 105. Brackets 111 are provided on the links 105 having pin apertures 112 therein, the centers of which are the same distance from the centers of pins 106 as are the apertures 113 in the ends of the offset portions 110 of the links 107. A locking pin 114 may be inserted through each aperture 113 and a corresponding aperture in the straps 74 to lock the gantry in its folded or down position. To raise the gantry, the pin 114 is removed, and the derricking line 40 may be employed to swing the hinge pin 84 upwardly causing the links 105 and 107 to pivot about the interconnecting pin 106 until the aperture 113 is aligned with the aperture 112 in the bracket 111. The pin 114 may then be reinserted through the apertures 112 and 113 locking the gantry in its elevated position. In such elevated position, the links 105 and the elongated portions 109 will be vertically aligned and in alignment with the straps 74. The hinge pin 84 may then be elevated above the pin connection 108 by the combined height of the links 105 and the elongated portions 109 of the links 107. Reference may be had to the copending application of George C. Noll and John D. Nielsen, Serial No. 246,206, filed December 20, 1962, entitled "Folding Back Hitch Gantry" for a more complete disclosure of the structure and operation of a gantry which may be employed with the present invention.

In the folded position of the gantry when the crane is not in use, the harness strap 42 may be supported horizontally by the hinge pin at the rear end thereof and between guides 116 and 117 on the cross frame 82 of the gantry strut 77. In this folded position of the gantry (see FIG. 15), the crane will present no vertically extending obstructions which would preclude the same from highway travel.

The axle 76 at the peak of the A-frame 64 is provided with sheaves 118 and 119 which cooperate with the sheaves 92 and 93, respectively, passing the derricking cable thereabout along the length of the gantry strut 77. If cable 40 were passed directly from sheaves 118 and 119 to the floating harness, there would be a tendency to pull the floating harness 38 closer to the tower boom 12 thus reducing and changing the moment acting on the tower as the position of the harness changes. The peak of the A-frame 64 is also provided with projections 120 to which the struts 49 may be pin-connected as at 121 so that when the tower boom 12 is in its vertical position, the struts 49 will connect the top of the base section 11 with the peak of the A-frame 64 of the superstructure 8.

Referring now to FIGS. 10, 11 and 14, the floating harness 38 which is connected to the gantry harness 39 by means of the derricking cable 40 comprises two parallel frame members 125 and 126 having aligned inwardly projecting shaft hubs 127 and 128 accommodating axles for the five sheaves 129, 130, 131, 132 and 133 illustrated diagrammatically in FIG. 14. Each side of the floating harness is provided with equalizer pins 135 extending through aligned hubs 136 and 137 and held in place by a keeper plate 138. Mounted on each equalizer pin 135 is an equalizer bar 140 to which the pendants of each pair 37 are connected by clevices 141 and 142. Pins 143 and 144 may be employed to secure the clevices to the ends of the equalizer bar 140 equidistant from the pivot or pin 135. The pair of pendants 37 on the opposite side of the floating harness will be connected to the frames 125 and 126 in precisely the same manner. Eyes 146 may be provided to connect the harness to single pendants on each side thereof or to pin the harness to the boom. With the employment of such equalizer bars, the loads on the four pendants will be substantially the same despite any lateral movement of the floating harness.

As seen in FIG. 14, the cable 40 may be wrapped on drums 150 and 151 of a dual drum boom hoist which is situated in the superstructure 8. The cable from the drum 151 passes about the sheave 119 on the axle 76 at the centerline of the A-frame 64 and then about the sheave 93 adjacent the hinge of the gantry 44. From the hinge of the gantry, the cable then passes upwardly to the sheave 132 of the floating harness 38. The cable then continues to be trained about the sheaves 101, 133, 100, 131, 99, 130, 98 and 129, between the floating harness 38 and the gantry harness 39. From the floating harness sheave 129, the cable 40 then passes about the sheave 92 adjacent the hinge of the gantry and then about the sheave 118 on the axle 76 at the center of the A-frame 64 and finally about the drum 150. When the cable 40 is wound on or payed from the drums 150 and 151, the distance between the floating harness 38 and the gantry harness 39 will decrease (FIG. 2) or increase (FIG. 1) respectively. It will also be understood that if the floating harness 38 is held stationary, as when the tower is up and locked in position with the operating boom 20 folded and secured thereagainst, and the gantry harness 39 is lowered by collapse of the gantry 44 from its raised FIG. 2 position to its collapsed FIG. 3 position, the cable 40 will be payed from the drums 150 and 151 for reuse in elevating the operating boom 20 to its working position.

Referring now to FIGS. 6, 7 and 8, it will be seen that each pair of pendants 37 is connected to the lower mast structure 34 by means of pins 153 which extend through links 154 and 155 to which the pendants are connected by means of the pins 156 and 157. Such links are mounted on each pin 153 by means of bushings 158 which may be lubricated through nipples 159 and 160. The pins 153 also extend between the bifurcated plates 161 and 162 projecting from the distal ends of each arm of the mast 34. Centrally mounted on each pin 153 between the plates 161 and 162 and thus the links 154 and 155 are mast pendant links 163, the upper ends of which are connected by pins 164 and clevises 165 to the pendants 32.

The upper ends of the pendants 32 are connected directly to pins 167 between the projecting bifurcated plates 168 and 169 on the distal ends of each arm of the upper mast structure 28. Links 170 and 171, exterior of the plates 168 and 169, join pins 172 and 167 and thus the pendants 32 and 30, the latter being connected to the pin 172 by the clevis 174.

It is here noted that the lateral spacing on each pair of pendants 37 at the floating harness 38 is somewhat greater than the lateral spacing of such pendants at the peak of the lower mast structure 34. The pendant system thus provided is accordingly of an extremely heavy

duty nature being able not only to erect and operate the long and heavy booms, but to maintain the load carried thereby. Also, a high degree of lateral stability is provided.

The pins 153 and 167 provide the pivots for the peaks 33 and 29 at the distal ends of the lower and upper mast structures 34 and 28, respectively, and also connect the pendants together for operation as a unitary tension member.

As seen in FIG. 8, the proximal ends of the mast structure 34 are provided with spaced or bifurcated plates 175 and 176 which are mounted on hubs 177 in turn mounted on bushings 178 on the shaft 35 projecting through the tower peak frame 18. The hollow shaft 35 then comprises a head shaft for the tower boom 12, the axis of which is located directly beneath the proximal pivot 27 of the upper mast structure 28. A nipple 179 may be provided between the plates 175 and 176 to lubricate the proximal pivot for the lower mast structure. Locking pins 180 and 181 may be provided to secure the mast to the shaft 35. In the illustrated embodiment, the upper mast may be approximately 17 feet in length while the lower mast is approximately 21 feet in length. Whereas the upper mast 28 will always be a compression member, the lower mast 34 will shift from a compression member to a tension member as the pivot 33 moves overcenter between the pivot 29 and the pivot 43 at the peak of the back hitch gantry 44 as illustrated in FIG. 3. As a tension member, the mast 34 will tend to pull the top of the tower 12 backwardly automatically compensating for the tendency of the tower to bow forwardly under load.

The peak frame 18 of the tower is provided with an upwardly inclined forward section 183 which elevates and projects forwardly the upper edge thereof in order to provide the foot 19 elevated and forwardly offset. The upper edge of the frame 18 is also provided with a hoist cable deflector 184 which comprises parallel plates 185 which support therebetween an arcuate cable deflector plate 186. Such plates 185 may be secured to the frame 18 as by suitable fasteners as indicated at 187 and reinforcing gusset plates 188 may also be provided as seen in FIG. 9.

FIG. 6 also illustrates the square section tubular chords 190 and 191 which may be provided at each corner of the boom sections and the continuous zig-zag tubular lacing members 192 which interconnect such chords. Eyes 193 and 194 are provided to facilitate the pin connection of the peak section 17 of the tower 12 with the next adjacent section 16. At the top rear corner of the frame 18, a bracket 195 is provided mounting a pair of sheaves 196 thereon over which hoist cables may be trained.

As seen in FIGS. 12 and 13, the pendants 30 are connected to each side of the peak shaft of the operating boom 20 by means of links 199 and pins 200. Spacers 201 and 202 on either side of the link confine the link on a bushing 203 and a locking pin 204 secures the link to the head shaft.

It can now be seen that the pendants 30, 32 and 37 which are connected by the derricking cable 40 to the gantry harness 39 serve both to erect the tower and operating boom as well as work the operating boom through its operating ranges. The machine, of course, can be employed without the operating boom 20 simply using the tower boom 12 as an operating boom and the struts 49 may then be employed as boom stops precluding the tower from pivoting over the back of the machine. In either mode of operation, the gantry 44 may be operated from its extended FIG. 2 position which affords a relatively short horizontal spacing between the erected tower boom 12 and the swinging end of the gantry strut 77, or from its collapsed FIG. 3 position which affords an increased horizontal spacing between the erected tower boom and the swinging end of the gantry strut 77, depending upon the moment desired with respect to the tower boom. In its tower crane capacity, the gantry 44 not only serves to increase the moment acting on the tower, but also to pay out the derricking cable 40 for reuse after the tower 12 has been elevated and locked in its vertical position. It will accordingly be seen that a crane of extremely large reach and capacity is provided yet still having all of the mobility afforded by its truck carrier. Moreover, the extremely high gantry 44 enables the tower and boom 20 folded therebeneath to be erected without outside help. The illustrated crane can be moved to and from the job in the same way that a more conventional long-boom truck crane can be moved.

As seen in FIG. 15, the tower boom 12 need not be completely disassembled for highway movement, but may be provided with a load transfer bogey as indicated at 210 in FIG. 15. All but the base section 11 and the first relatively short section 13 of the tower may be removed and a hammer head section 211 may be mounted on the section 13 with the fall block and hook 212 also secured thereon. The load transfer bogey 210 becomes an integral part of the total machine, being pin-bolted to the underside of the boom base section 11, which, in turn, is hinged to the superstructure 8 at the boom foot 10. The sets of wheels 213 and 214 of the bogey 210 may be mounted on equalizing bars 215 in conventional manner so that the load transfer bogey has sufficient oscillation in both directions properly to distribute the load between the sets of wheels. The bogey 210 is spaced rearwardly from the carrier 1 a sufficient distance to meet, for example, the 18-foot spacing required in the state of California. However, the bogey 210 is sufficiently close to the carrier to obtain a substantial overhang to the rear of the vehicle by the boom sections. With this substantial overhang, the boom actually acts as a lever pivoted on the fulcrum of the bogey 210 to create a substantial uplift on the rear bogey 216 of the carrier 1. The bogey thus mounted on the boom then acts to transfer some of the load from the rear bogey of the carrier 1 more or less equalizing the loads on the sets of wheels provided permitting the crane and that portion of the boom shown in FIG. 15 readily to be carried by highway. The counterweight 52 as well as the center outrigger 46 may be removed as indicated to reduce the overall weight of the machine. Since the boom is mounted through the foot 10 on the superstructure 8 which is in turn vertically pivoted through the turntable 7 to the carrier frame 2, the boom 11 acts as an articulated trailer which will readily transverse most highway streets.

The crane of the illustrated embodiment has a maximum rated lifting capacity of 115 tons which is the largest lifting capacity of any crane known to applicants which is mounted for highway travel. It is accordingly believed that applicants have provided a crane of great reach and capacity yet having features which permit it to be easily erected and transported.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

We, therefore, particularly point out and distinctly claim as our invention:

1. In a mobile crane of the type comprising of horizontally rotatable superstructure, the combination of an up and down swingable tower boom pivoted on said superstructure; a standard boom pivoted on said tower boom for swinging movement into and out of a folded position alongside said tower boom; separable tie means for retaining said standard boom in folded relation to said tower boom during swinging movement of the latter from a generally horizontal to an erected position on said superstructure; separable connecting means for securing said tower boom in said erected position; a folding back hitch gantry including an up and down swingable strut member pivoted on said superstructure; releasable locking means

for securing said strut member against upward swinging movement from a gantry collapsed toward a gantry raised position; a first cable harness connected in force transmitting relation with said tower and standard booms; a second cable harness connected in force transmitting relation with said strut member; a cable reeved over said first and second harnesses; and hoist means operatively connected with said cable; said cable and hoist means being operable to pull said second harness toward said first harness for raising said strut member and thereafter to pull said first harness toward said second harness for erecting said tower boom with said standard boom tied thereto; to release said pull after said tower boom has been secured in said erected position thereby causing said strut member to drop to its gantry collapsed position and said second harness to drop away from said first harness; and thereafter to pull said first harness toward said dropped second harness while said strut member is locked in its gantry collapsed position and said tie means are separated, thereby causing unfolding of said standard boom from said erected tower boom.

2. The combination set forth in claim 1 wherein said

back hitch gantry is arranged on said superstructure in such relation to said tower boom that the horizontal spacing between the erected tower boom and the swinging end of said strut member will be increased by movement of said strut member from its gantry raised to its gantry collapsed position.

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