June 4, 1963 G. C. NOLL ETAL 3,092,260

BACK-HITCH GANTRY

Filed April 14, 1961 3 Sheets-Sheet 1

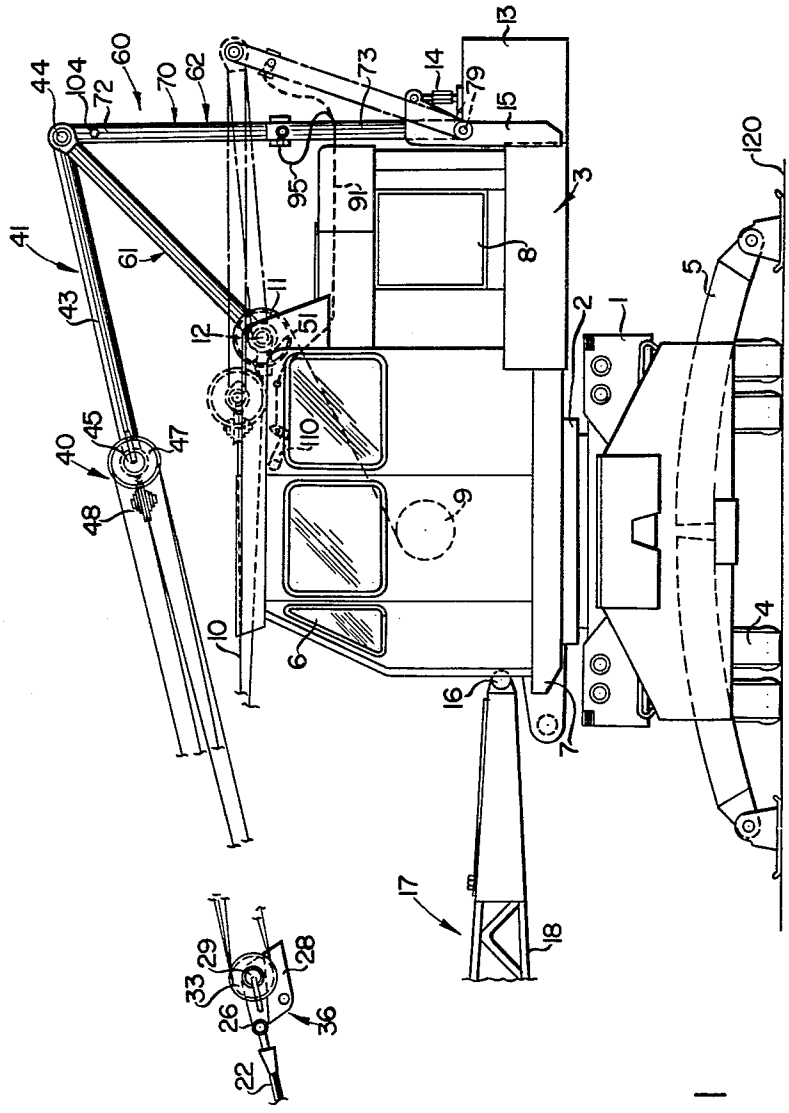


FIG 1

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BACK-HITCH GANTRY

Filed April 14, 1961 3 Sheets-Sheet 2

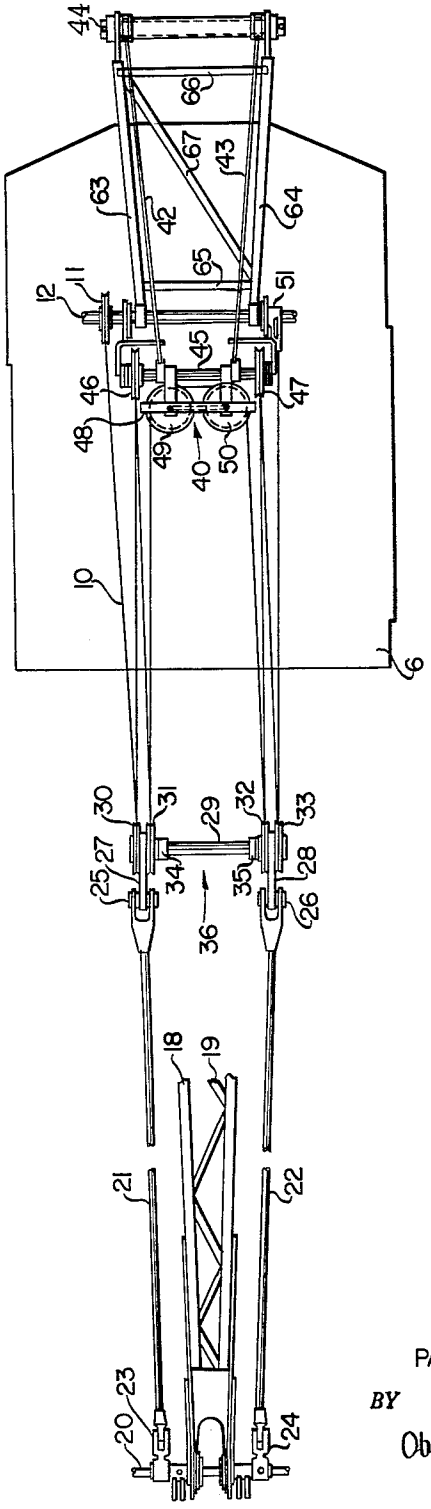


FIG 2

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June 4, 1963 G. C. NOLL ETAL 3,092,260

BACK-HITCH GANTRY

Filed April 14, 1961 3 Sheets-Sheet 3

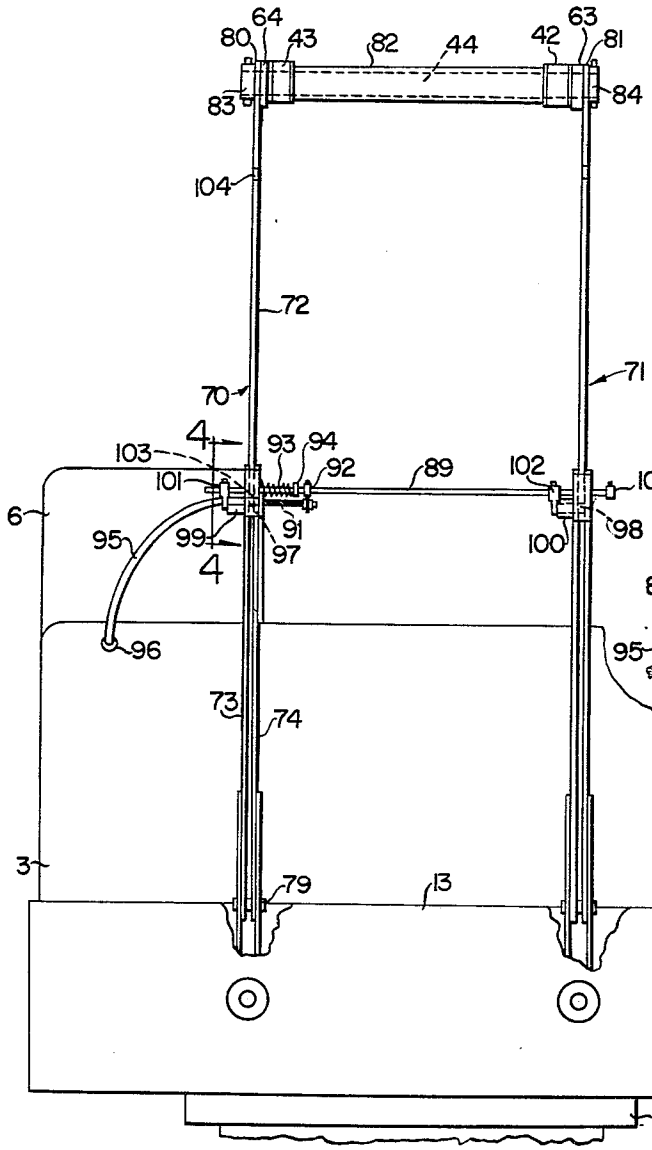


FIG 3

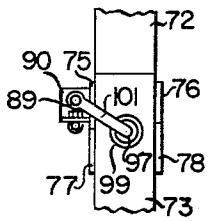


FIG 4

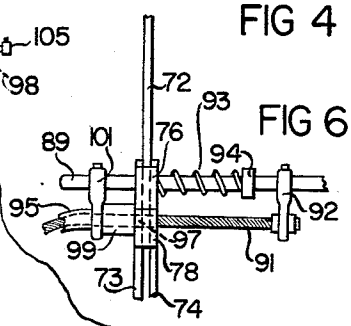


FIG 6

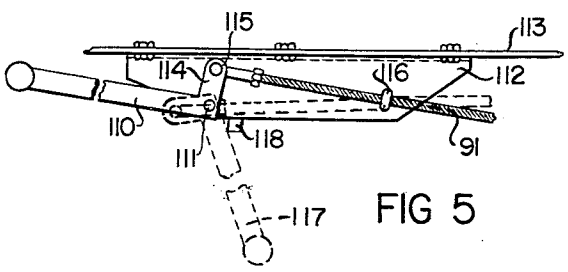


FIG 5

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United States Patent Office 3,092,260 Patented June 4, 1963

3,092,260

BACK-HITCH GANTRY

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Filed Apr. 14, 1961, Ser. No. 103,045
4 Claims. (Cl. 212—59)

This invention relates, as indicated, to a back-hitch gantry and more particularly to a retractible gantry for power cranes, shovels, and the like.

In such power cranes and shovels, a boom is employed which is generally raised and lowered by means of a boom hoist cable trained about a series of sheaves anchored at a point on the crane or shovel cab. It is, of course, desirable to have this anchor point as high as possible on the cab frame to obtain as great an angle as possible between the hoist cable and the crane or shovel boom. It will, of course, be understood that the greater the angle, the higher the lifting capacity.

At the present time, it is a prevalent practice to mount power cranes on wheeled carriers for highway travel and for added mobility in moving from one place to another and if the anchor point for the boom hoist cable sheaves is as high as desired to obtain the required lifting capacity, or indeed, to raise the boom from horizontal position, such presents an obstruction in that the crane cannot readily pass under bridges, power lines or the like when it is being transported over highways. Fixed mast structures for the sheave anchors have been provided, but these are impractical and undesirable since it is required to remove entirely or dismount such anchor before the crane can be transported. Even in retractible masts, such as that disclosed in the Ekbom et al. Patent 2,348,285, it is necessary for the operator to leave the cab or employ a second person to retract the cable anchor to the travelling position of the crane.

It is accordingly a principal object of the present invention to provide a back-hitch gantry which can be raised or lowered by the operator without leaving his seat within the crane cab.

It is another important object to provide a retractible gantry for a crane, shovel, and the like which will provide maximum lifting capacities and minimum clearance heights in its extended and retracted positions respectively.

It is a further important object to provide a back-hitch gantry of simplified construction which can automatically be raised and lowered by the crane operator and which will be completely safe and certain in operation.

It is yet another object to provide a power driven crane or shovel wherein the aforesaid back-hitch gantry will permit maximum operator maneuverability.

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 certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

In said annexed drawings:

FIG. 1 is a side elevation view of a crane in accordance with the present invention showing the back-hitch gantry in its raised (in solid lines) and lowered (in phantom lines) positions;

FIG. 2 is a top plan view of the crane of FIG. 1 with the carrier removed for clarity of illustration showing the back-hitch gantry in its retracted or lowered position;

FIG. 3 is an end elevation partially broken away on a somewhat enlarged scale of the back of the crane showing the back struts only with the back-hitch gantry in its elevated position;

FIG. 4 is a fragmentary sectional view taken substantially on the line 4—4 of FIG. 3;

FIG. 5 is a fragmentary detail view of the mechanism within the operator's cab employed to operate the gantry; and

FIG. 6 is a fragmentary detail view of the locking pin structure as seen from the right in FIG. 4.

Referring now to the drawings and more particularly to FIG. 1, there is illustrated a power driven crane mounted on a crane carrier with the longitudinal axis of the carrier being shown at right angles to the longitudinal axis of the boom of the crane. The crane carrier chassis **1** is power driven and has thereon a turntable **2** which rotatably mounts the crane **3** on the carrier. The carrier chassis **1** is provided with ground engaging wheels **4** and "Power-Set" outriggers **5**, "Power-Set" being the registered trademark of The Thew Shovel Company of Lorain, Ohio. Reference may be had to the copending application of Spencer Bowman, Serial No. 803,597, filed April 2, 1959, now Patent No. 3,021,015, entitled "Outriggers for Power Shovels, Cranes, or the Like," for a more complete description of outriggers that may be employed with cranes of this type. It will, of course, however, be understood that any conventional beam type outrigger may be employed with the present invention.

The crane cab **6** is mounted on a turntable bed and A-frame **7** with the cab housing an internal combustion engine or the like generally shown at **8** to drive hoisting drums **9** with the hoisting cable **10** extending about sheave **11** mounted on axle **12** at the peak of the A-frame. A removable counterweight **13** is fastened to one end of the bed and A-frame removably held by means of turnbuckles **14** depending from L-shape frame support members **15**. At the opposite end of the turntable bed there is pivoted at **16** the crane boom shown generally at **17**. The crane boom has four square section tubular cords **18** which may be interconnected by tubular lacing members **19** welded to the inside faces thereof. Reference may be had to the copending application of Erwin Brekelbaum et al., Serial No. 548,512, filed November 22, 1955, entitled "Tubular Boom," for a more complete disclosure of a crane boom that may be employed with the present invention. However, the crane and boom structures form no part of the present invention.

As seen perhaps more clearly in FIG. 2, the boom peak is provided with a transversely extending shaft **20** to which boom pendants **21** and **22** are secured by means of the cable links **23** and **24**. It will, of course, be understood that the shaft **20** will be provided with central sheaves for the bucket or hook cables or the like and such, of course, forms no part of the present invention. As shown, the pendants **21** and **22** are connected through the pin connections **25** and **26** to right and left hand pendant links **27** and **28** to harness shaft **29** which has rotatably mounted thereon four sheaves **30**, **31**, **32** and **33** with boom hoisting cable **10** trained thereabout. The shape of the links **27** and **28** can be more clearly seen in FIG. 1 and such protect the hoisting cable and sheaves as the harness is lowered onto the boom when the cable is slackened. Collars **34** and **35** are provided on the floating harness shaft **29** to hold the sheaves with minimum clearance.

The aforedescribed harness will be referred to generally as floating harness **36** and it will be seen that the boom hoist cable **10** is also trained about sheaves in a further harness generally shown at **40**. This harness **40** is mounted for movement on the distal end of upper gantry frame

41. Such upper gantry frame comprises side struts 42 and 43 (see FIG. 2) and the proximal end of such frame is pivoted to the gantry hinge pin shaft 44. The harness axle or shaft 45 extends through the distal ends of struts 42 and 43. Mounted at the opposite ends of the shaft 45 are boom hoist cable sheaves 46 and 47. A padlock type harness 48 is secured to the shaft 45 and mounts sheaves 49 and 50 therein for rotation about axes normal to the axis of the shaft 45.

It can now be seen that the boom hoist cable 10 is wrapped around the hoist drum 9 and extends over the sheave 11 or axle 12 fixed to the top of the A-frame. The cable 10 then passes about sheave 30 on axle 29 of the floating harness 36, about sheave 46 on axle 45, about sheave 31 on axle 29, around sheaves 49 and 50 in the padlock harness 48, about the sheave 32 in harness 36, about sheave 47 on axle 45, about sheave 33 in harness 36 and finally, such cable 10 is secured to the axle 12 at the top of the A-frame as shown at 51. By reeling in the cable 10 on the drum 9 or conversely paying the cable out from the drum, the distance between harnesses 36 and 40 can be lengthened or shortened thus to lower or raise boom 17. The lifting force will then substantially always be exerted on the boom peak shaft 20 along the line drawn from such shaft to the hinge pin 44 of the back-hitch gantry shown generally at 60. However, when the boom is nearly horizontal, the side struts 42 and 43 rest on the axle 12 and a slight angle will be formed between the pendants and the side struts.

The back-hitch gantry, which derives its name from being hitched over the back of the cab or turntable as opposed to masts secured to the front of the turntable bed or A-frame, is comprised of the upper frame 41 hereinbefore described, a compression frame 61 extending between the axle 12 and the hinge pin 44 and the retractible back frame 62. The frame or mast 61 is comprised of two longitudinally extending structural members 63 and 64 (see FIG. 2) with transverse frame members 65 and 66, and diagonal brace 67 rigidifying such frame structure and providing the necessary strength to resist compression loading thereof. Structural members 63, 64, 65, 66 and 67 may be tubular or other such structural shapes as will be required to provide the necessary strength and rigidity in the frame 61.

Referring now more particularly to FIGS. 1 and 3, the telescoping back frame member 62 is comprised of two parallel telescoping struts 70 and 71. The struts are generally identical in form and only the struts 70 will be described in detail. The strut 70 includes a top strut member 72 which fits between spaced parallel lower struts 73 and 74. Transverse guide plates 75 and 76 are secured to the edges of struts 73 and 74 at the top thereof holding them in the proper spaced parallel position. The strut 72 has similar plates in the form of flanges 77 and 78 on the lower end thereof which serve to cooperate with plates 75 and 76 to guide and maintain the strut 72 properly aligned and within the struts 73 and 74. The parallel struts 73 and 74 are anchored by the pin 79 adjacent the top of the removable counterweight 13. In this manner, it can be seen that the strut 72 is longitudinally slidable between the parallel struts 73 and 74 from an extended to a retracted position and vice versa.

The tops of the telescoping struts 70 and 71 are secured to the gantry hinge pin 44 as shown at 80 and 81. The struts 63 and 64 are secured next adjacent the struts 70 and 71 and finally the struts 42 and 43 of the upper gantry frame 41 are secured to the hinge pin 44. A spacer collar 82 is provided with thrust washers separating the various frame connections. Bushings will be employed to provide the proper rotation of the frame members about the hinge pin 44. Locking collars 83 and 84 will be employed on the hinge pin 44 properly to hold the assembly together.

The mechanism for operating the telescoping gantry comprises a transversely extending lock pin operating rod

89 mounted between extensions 90 of the members 75 on the top of the lowermost struts 73, 74 (see particularly FIGS. 3, 4 and 6). An operating cable 91 is secured to the locking pin operating rod 89 as shown at 92 and a spring 93 is employed extending between the lower strut member 74 and collar 94 secured to the rod 89. The cable 91 is mounted for longitudinal reciprocation in a cable conduit 95 which passes through grommet 96 into the operator's cab to be operated by the control mechanism shown more clearly in FIG. 5 which will be placed just to the left rear of the operator's seat. The cable mechanism which takes a form similar to that of a Bowden wire can then be employed to reciprocate the locking pin operating rod 89, a pull on the cable 91 moving the rod 89 to the left as seen in FIG. 3 against the pressure of spring 93. Locking pins 97 and 98 are mounted within collars 99 and 100 with such pins being secured to arms 101 and 102 locked to the rod 89. The collars 99 and 100 guide the pins 97 and 98 for longitudinal movement into and out of spaced locking pin holes 103 and 104 in the uppermost strut members 72. A stop collar 195 may be secured to the end of the operating rod 89 to limit the axial movement thereof caused by the movement of operating cable 91. It can now be seen that a longitudinal pull on the cable 91 will cause the operating rod 89 to move to the left in FIG. 3 compressing spring 93 and moving the locking pins 97 and 98 simultaneously out of the holes 103 or 104 in the upper strut members 72 of the telescoping struts 70 and 71 of the back-hitch gantry.

Referring now to FIG. 5, the operating mechanism for the cable 91 comprises a lever 110 pivoted at 111 to a cable mounting bracket 112 secured to the roof or the like 113 of the crane cab. The cable 91 is secured to an offset portion 114 of lever 110 by means of a yoke and pin connection shown generally at 115. A cable guide 116 is mounted on the bracket 112 permitting longitudinal movement of the cable therethrough. In order to exert a longitudinal force on the pull cable 91 to cause the spring 93 to compress, the lever 110 is pulled downwardly to the dotted line position shown at 117. Here, the pin connection 115 will be below the pivot 111 to provide a self-locking toggle mechanism in which the force of spring 93 will maintain the lever 110 in its lowermost position. A suitable stop 118 may be provided to keep the lever 110 from pivoting in a further counterclockwise direction than that shown.

Operation

In order to raise the gantry, the boom 17 is lowered to the ground or suitable cribbing and the derricking cable 10 is slacked off. In such lowered position, it will, of course, be understood that the locking pins 97 and 98 would be engaged within the apertures 104 in the top struts 72. The pins 97 and 98 are released by swinging the lever 110 in the operator's cab or enclosure to the dash line position of FIG. 5. Then by taking up on the boom derricking cable 10, the gantry would be raised, this pivoting frame 61 about axle 12. It is understood that the free weight of the boom will be sufficient to cause the gantry automatically to extend. The locking pin lever 110 may be released from its locked position as soon as the gantry has been raised approximately 3 or 4 inches. This will allow the spring 93 to hold the locking pins 97 and 98 against the sides of the upper gantry struts 72. The gantry will be raised until the guide flanges 77 and 78 hit the stops 75 and 76 and at such time, the lowermost apertures 103 in the upper struts 72 will be aligned with the locking pins 97 and 98 and the locking pins will automatically snap thereinto and the lever 110 will be swung by spring 93 to the solid line position of FIG. 5 to serve as a visual signal of proper engagement of the locking pins 97 and 98 in the holes 103. The operator can then double check the proper engagement of the rear strut pins 97 and 98 by slackening off on the derricking cable and

if the gantry does not start to collapse, he will know that the pins are in proper engagement.

In order to lower the retractible gantry, the boom **17** is again lowered to the ground or placed on cribbing and tension is maintained on the boom hoist derricking cable **10** after the boom is lowered. The locking pins **97** and **98** are released by swinging the lever **110** in the operator's cab to the dotted line position and the gantry is then lowered by paying out the cable **10** from drums **9**. The lever **110** may be released from its self-locking position after the gantry has been lowered approximately 3 or 4 inches and the spring **93** will then hold the pins **97** and **98** in spring pressed engagement against the sides of the upper struts **72** of the telescoping back struts **70** and **71**. The operator then continues to slack off on the derricking cable until the pins **97** and **98** snap into apertures **104** and, at this time, the lever **110** will be swung back by spring **93** to the full line position to indicate to the operator that the pins **97** and **98** are properly engaged in holes **104**. After the gantry is lowered, in order to double check the proper engagement of the pins within such apertures **104**, the operator need only raise the boom slightly. It is noted that in the collapsed or retracted position of the gantry, shown in phantom lines in FIG. 1 and in full lines in FIG. 2, the upper gantry frame **41** nests within the gantry frame **61** so that the sheaves **46** and **47** fit within the sheave **11** and derricking cable fastener **51**. The struts **42** and **43** will then rest upon the axle **12** on the top of the A-frame. In the illustrated embodiments, the height of the gantry from the road or surface **120** can be lowered from 15'–7" in the extended position to 12'–0" in the retracted position. This 12 foot height is sufficient to clear most obstructions such as bridges, wires and the like when the crane is being transported from one location to another in its working position. It can thus be seen that a power operated two-position back-hitch gantry is obtained which can be raised or lowered very quickly by a single operator without leaving the cab seat. Moreover, with this back-hitch type gantry, it is possible to get maximum capacities in the upper operating position and minimum head room or clearance in the lower position. It will be understood, however, that the crane can be operated with the gantry in its lowermost position but such maximum capacities cannot then be obtained.

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. A crane comprising a supporting frame structure, an operating cab in said supporting frame structure, a boom pivotally secured at one end of said frame structure, a back-hitch gantry at the opposite end of said frame structure, said back-hitch gantry comprising a hinge pin, a rigid frame pivotally interconnecting said hinge pin and said frame structure, a pair of telescoping strut members connected to said hinge pin and said frame structure, each of said pair of telescoping strut members comprising upper and lower members adapted longitudinally to telescope one within the other, means to maintain said members parallel to each other at all positions of telescopic adjustment; and means to lock said members in extended and retracted position thus to lock said hinge pin in a raised and lowered position comprising locking pins for each of said pair of telescoping strut members, an operating rod interconnecting said locking pins for conjoint movement, cable means extending from said operating rod to said operating cab, means within said cab to exert a pull on said cable to release said locking pins, and spring means acting on said rod automatically to urge said rod and thus said pins to return upon release of said cable.

2. The crane as set forth in claim 1 including a further frame member pivotally mounted on said hinge pin, and sheaves mounted at the distal end of said further frame member for cooperation with a cable for raising and lowering said boom.

3. The crane as set forth in claim 1 wherein each pair of telescoping strut members comprises lower parallel spaced guide strut members and an upper strut member slidably secured therebetween, said upper strut member having vertically spaced apertures therein, the locking pin for said telescoping strut members being mounted at the top of said lower spaced struts and being adapted automatically to enter the respective apertures upon raising or lowering of said upper strut member when the pull on said cable is released.

4. The crane as set forth in claim 1 wherein said means in said cab to pull said cable comprises a bell-crank operating lever, said cable being pivotally connected to one leg of said lever whereby said lever may be pivoted against the pressure of said spring means to move the pivotal connection of said cable to said lever over center to provide a toggle lock for said cable.

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