

[54] **MOBILE CRANE WITH TELESCOPIC BOOM AND JIB AND METHOD FOR CONNECTING THE LATTER**

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[52] U.S. Cl. **212/55, 212/144**

[51] Int. Cl. **B66c 23/06**

[58] Field of Search. **212/55, 144**

[56] **References Cited**

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Assistant Examiner—Hadd Lane

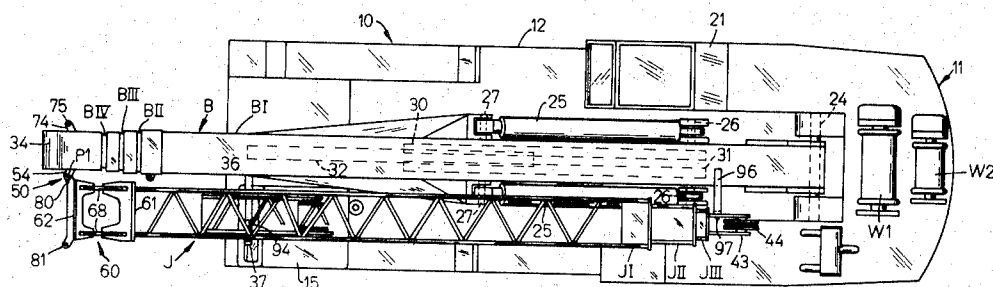
Attorney, Agent, or Firm—James E. Nilles

[57] **ABSTRACT**

A mobile crane comprises a multisection telescopic boom and an optionally usable multisection telescopic lattice type jib (having a base section and axially movable intermediate and fly sections) which when not in use is telescoped and stored on a support in parallel reverse disposition alongside the boom. Each jib section comprises four hollow tubular longitudinal members (each of rectangular cross-section) arranged in parallel spaced apart relationship with a plurality of

angularly disposed tubular cross braces connected between each pair of members to define a jib section of rectangular cross section. Each longitudinal member is rotated on its axis to present opposite inwardly and outwardly facing flat bearing surfaces and also to present two other opposite flat surfaces to which the ends of the cross braces are welded. Bearing means are provided to facilitate relative sliding motion and to transmit thrust forces between adjacent jib sections. The bearing means comprises inwardly facing slide pads mounted at the lower front ends of the base and intermediate sections and outwardly facing slide pads mounted at the upper and lower rear ends of the intermediate and fly sections; each slide pad being mounted on a support secured within the hollow end of a tubular longitudinal member and engaged with an appropriate bearing surface on an adjacent jib section. To unstore the jib and set it up for use, the foot end of the jib is releasably connected by pivot pin means to the point end of the boom and the boom is partially extended to axially move the jib forward clear of its support. At this stage the unextended jib may be swung 180° about the pivot pin means into axial alignment with the boom and rigidly secured thereto by suitable attachment means. Or, the jib may be partially or fully extended prior to being swung 180° by connecting either the jib intermediate section or the jib fly section, respectively, by releasable rear pin means to the boom base section and by then further extending the boom, either partially or fully, respectively. In all cases, prior to swinging the jib, a guy wire jib mast pivotally attached to the boom point and folded back alongside the boom is swung into upright position. The jib is designed so that it can be rigidly connected at an angle to the boom axis and so that the jib fly section can be rigidly connected at an angle to the jib axis.

22 Claims, 24 Drawing Figures



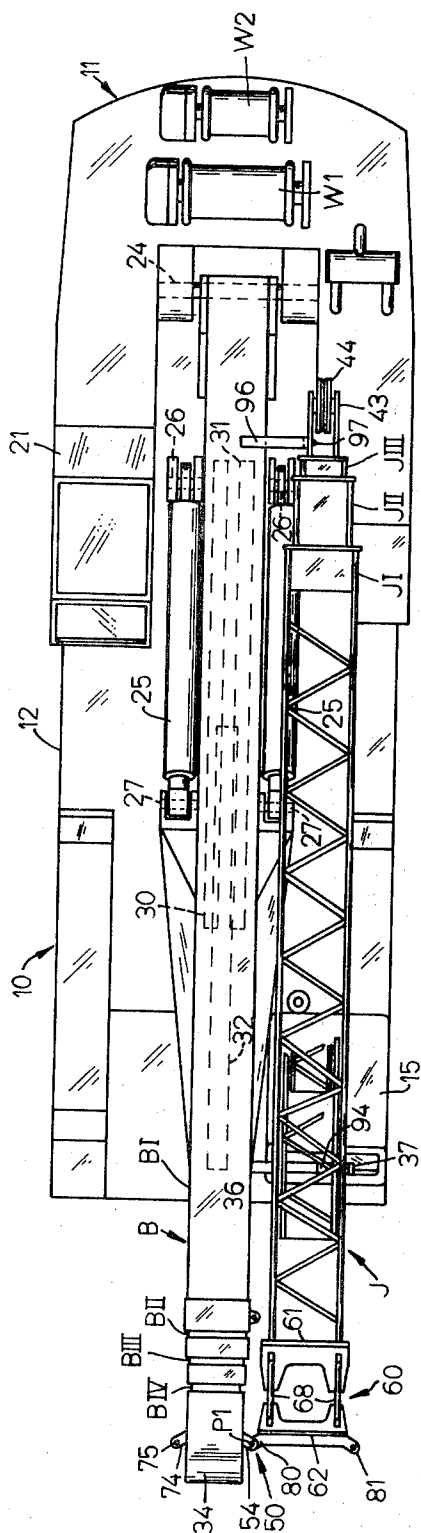


FIG. 2

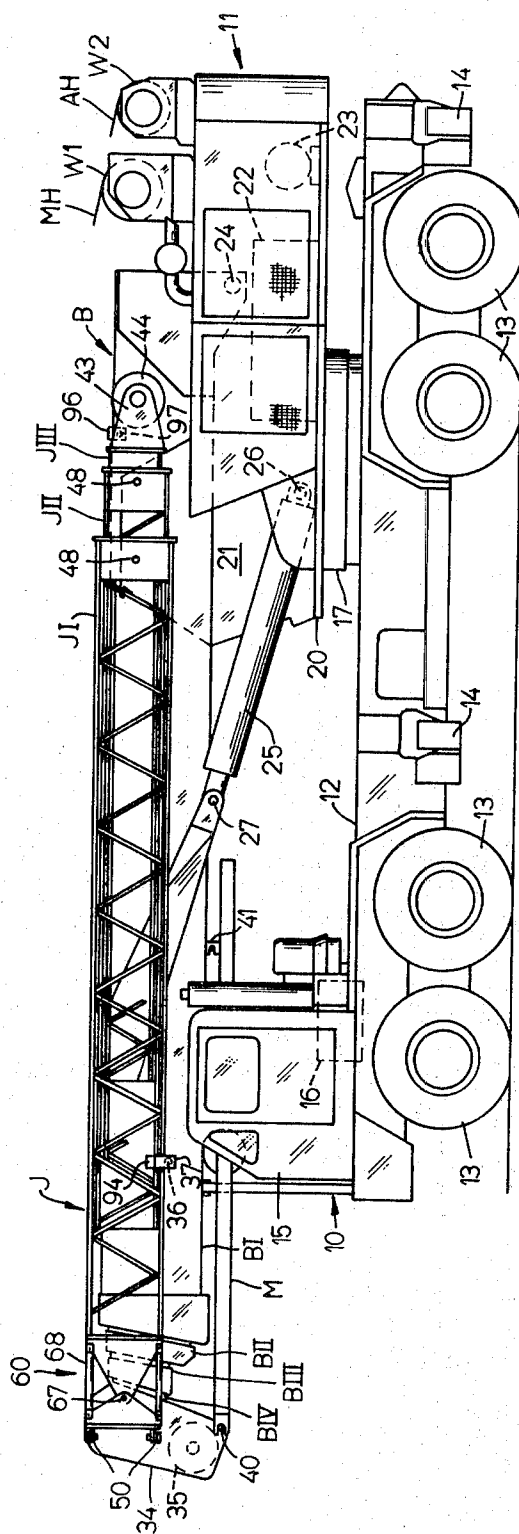


FIG. 1

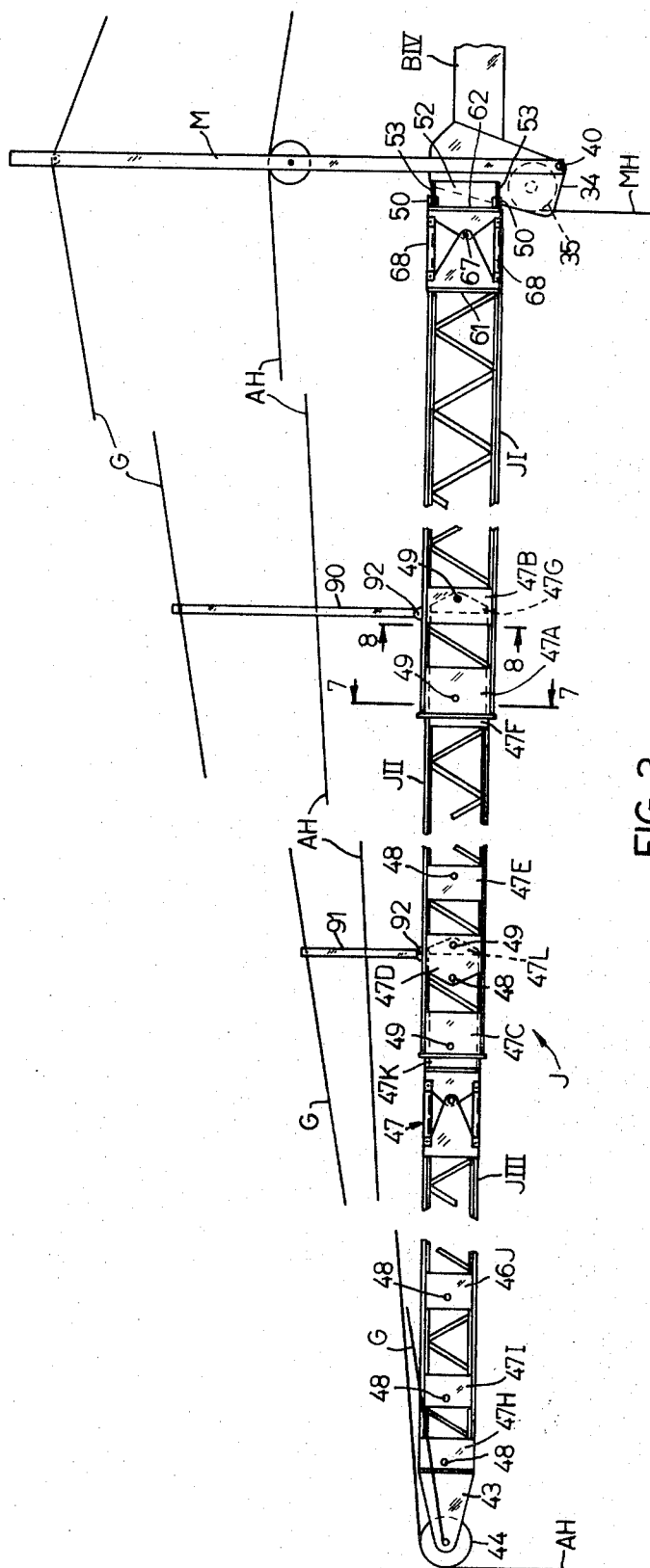


FIG. 3

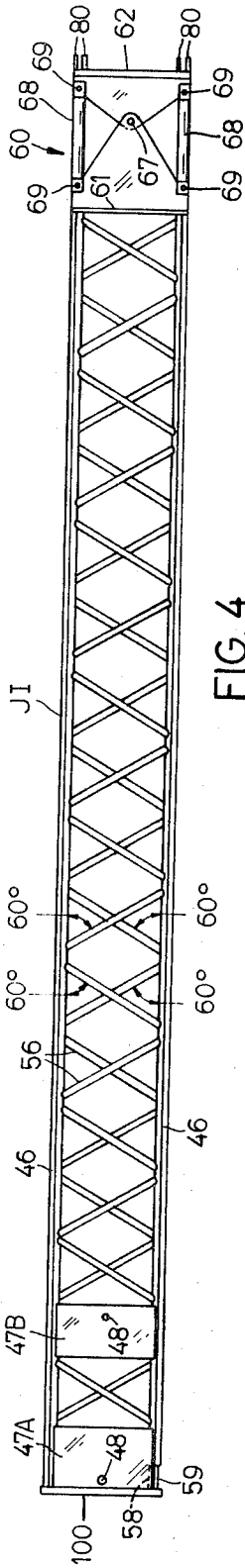


FIG. 4

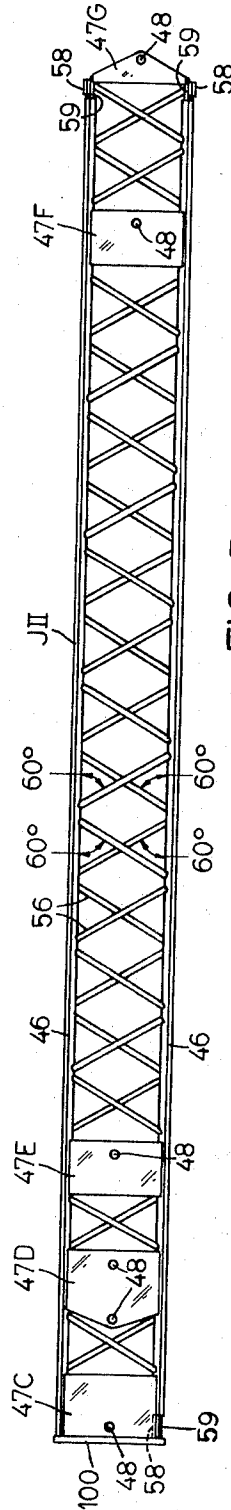


FIG. 5

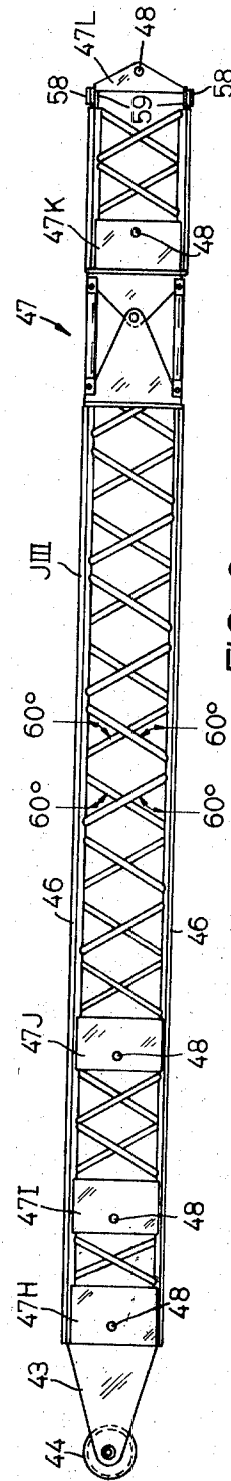


FIG. 6

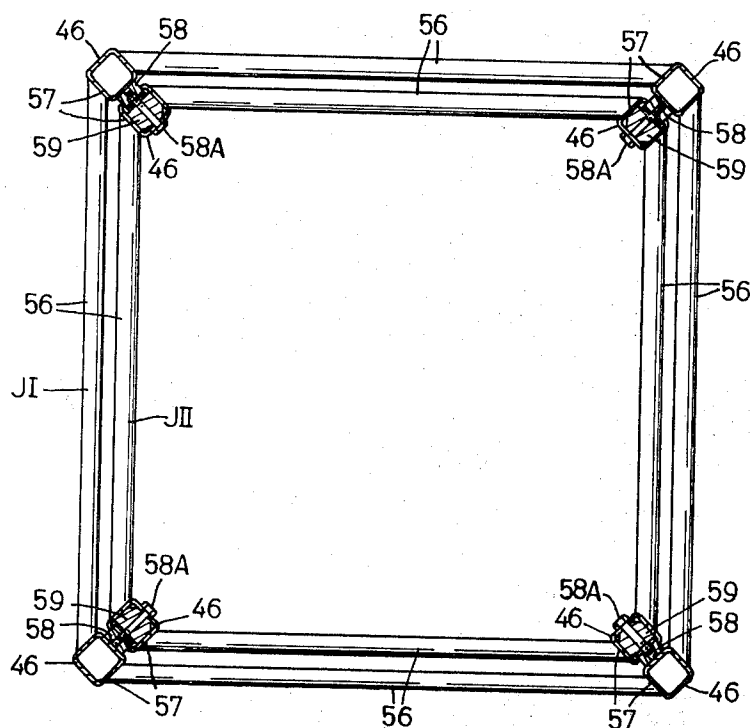


FIG. 8

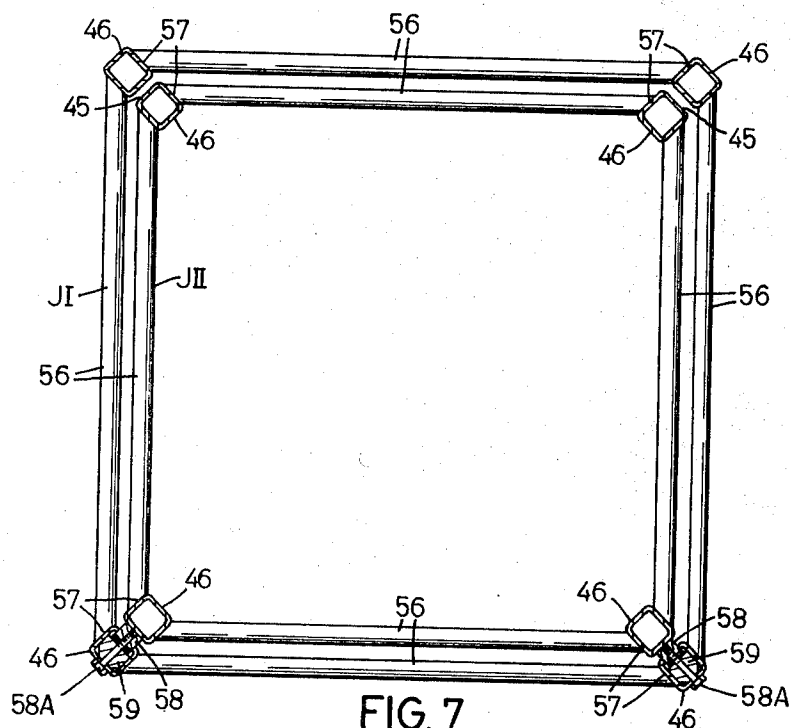
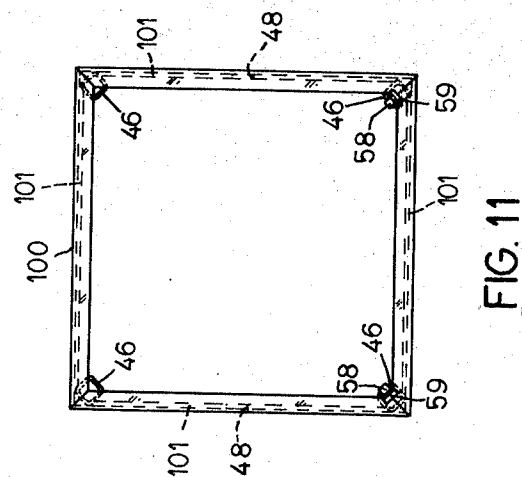
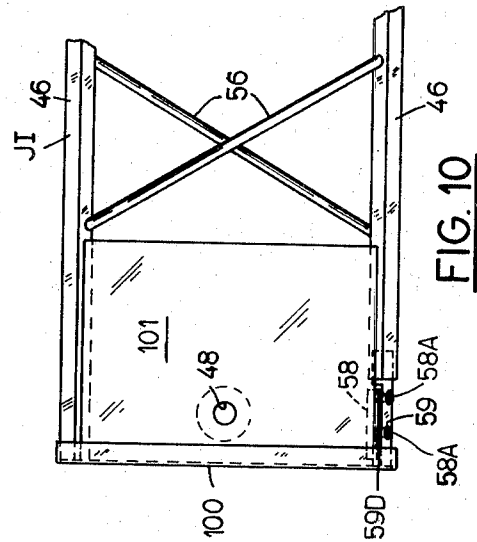
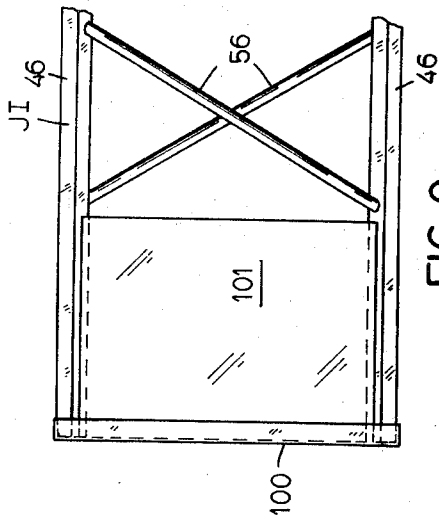
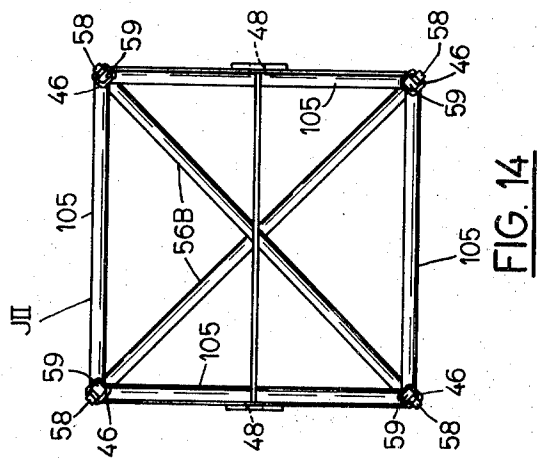
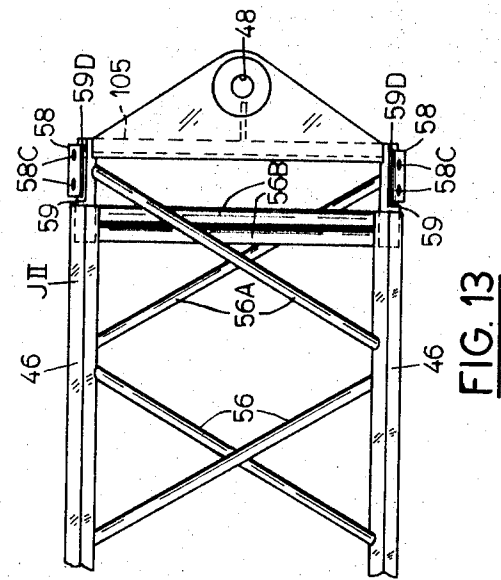
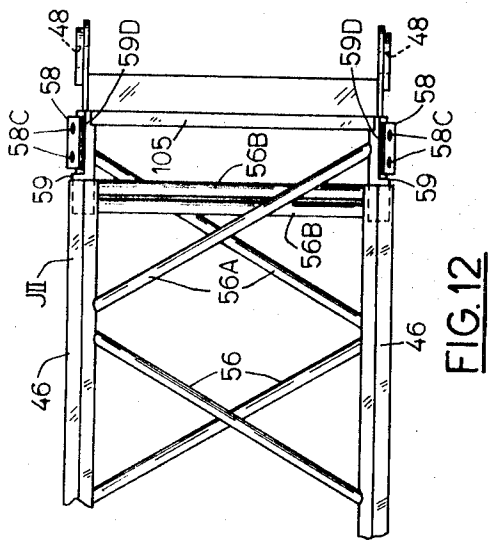


FIG. 7





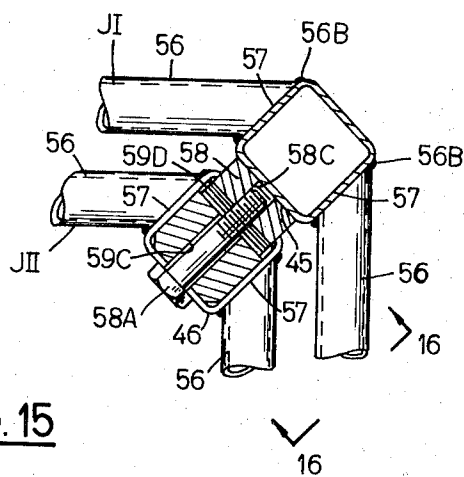


FIG. 15

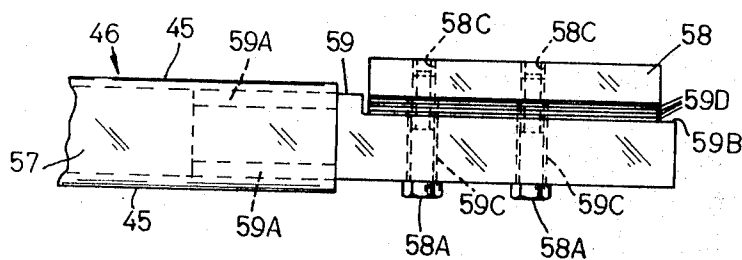


FIG. 16

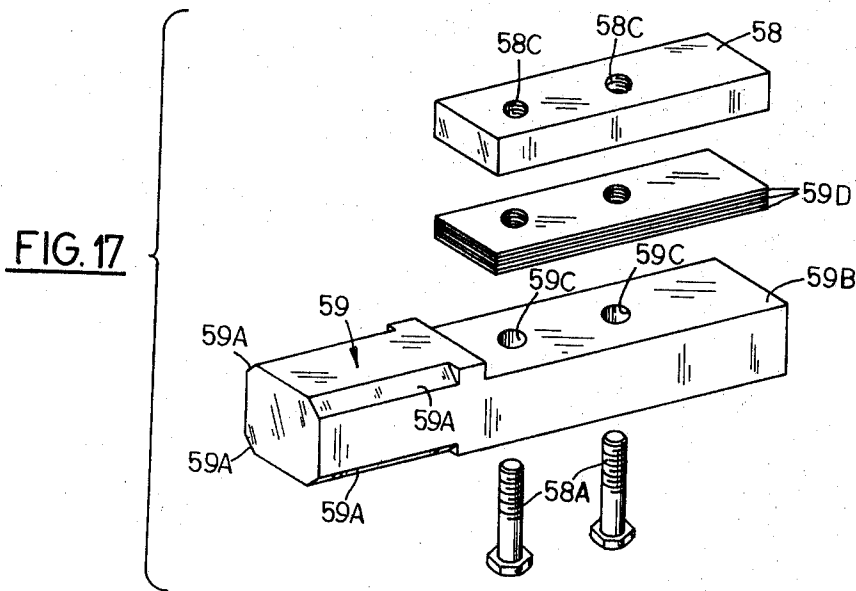


FIG. 17

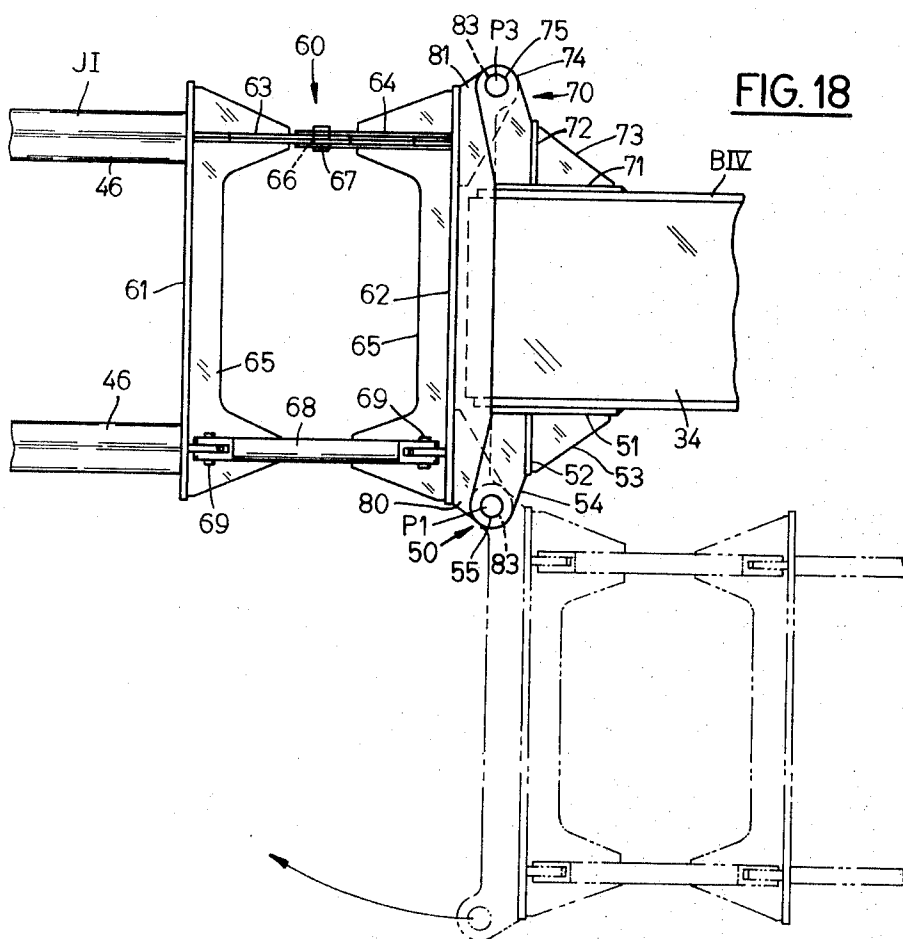


FIG. 18

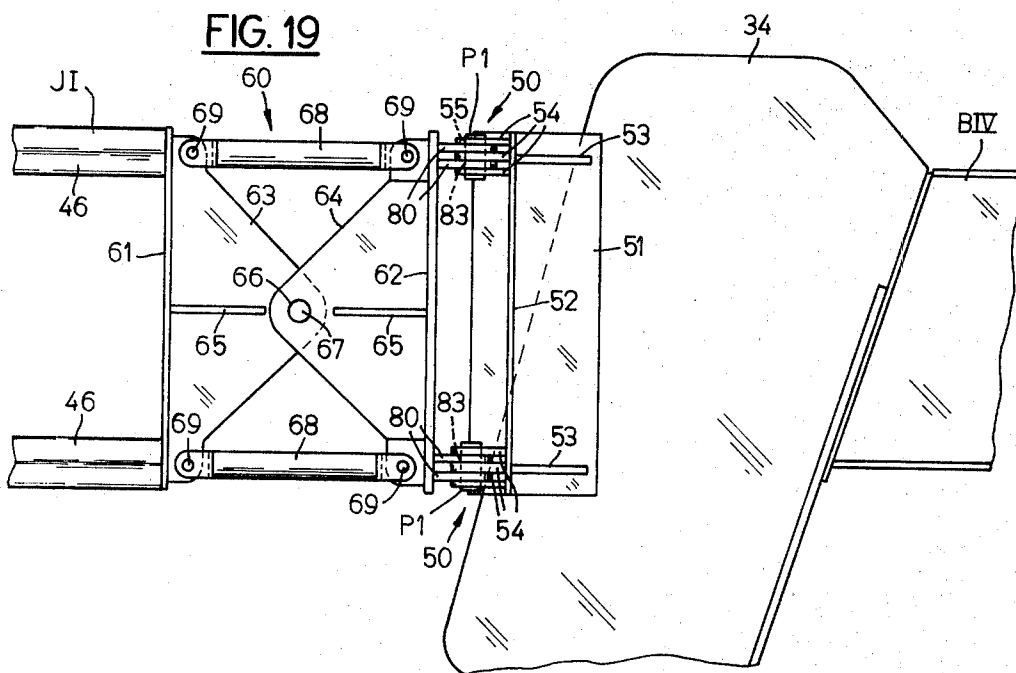


FIG. 19

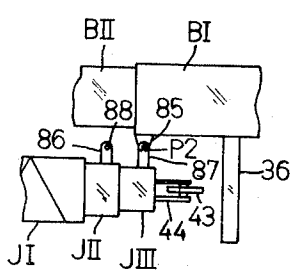


FIG. 24

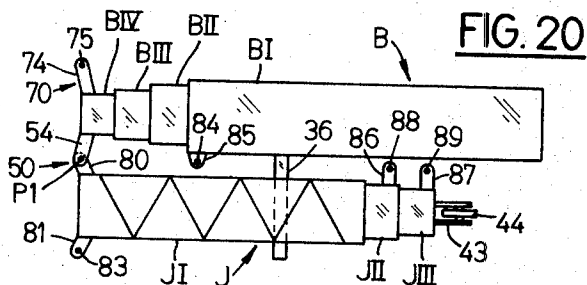


FIG. 20

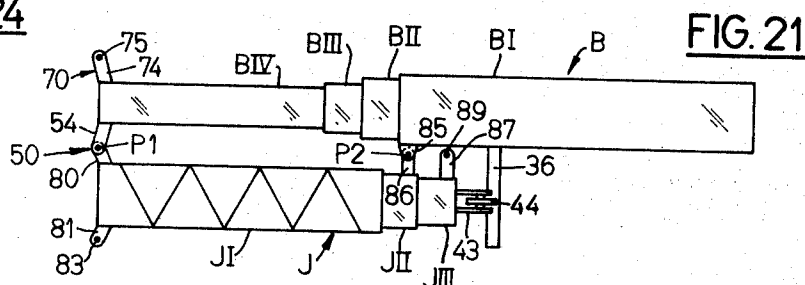


FIG. 21

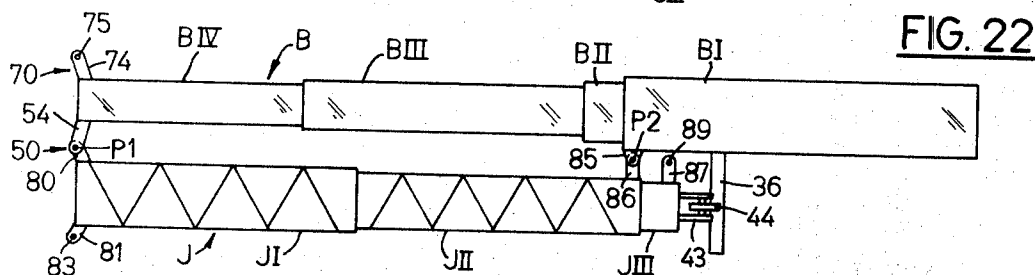


FIG. 22

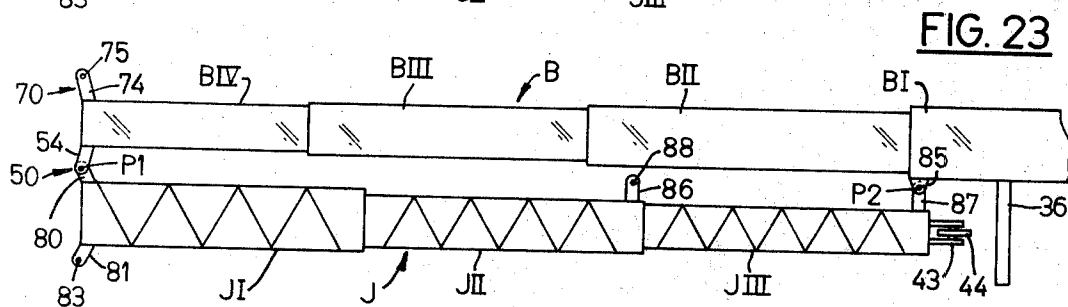


FIG. 23

MOBILE CRANE WITH TELESCOPIC BOOM AND JIB AND METHOD FOR CONNECTING THE LATTER

BACKGROUND OF THE INVENTION

1. Field of Use

This invention relates generally to cranes, such as mobile cranes, having a multisection telescopic boom and an optionally usable multisection telescopic jib, such as a lattice-type jib, for use with the boom.

In particular it relates to such a crane wherein the jib, when not in use, is telescoped and stored on a support in parallel reverse disposition alongside the boom and to methods for storing and unstoring the jib.

The invention is particularly well-adapted for use in a crane such as disclosed in copending U.S. patent application Ser. No. 333,376, for "Telescopic Jib and Bearing Means Therefor," filed by Robert A. Fritsch and assigned to the same assignee as the present application.

2. Description of the Prior Art

It is known practice to provide a jib for optional attachment to the point of a telescopic boom on a mobile crane. In some cranes, the jib comprises a relatively small single jib section which is stored alongside the boom and pivotally attached to the boom point and can be swung (horizontally or vertically) into alignment with the boom. U.S. Pat. No. 3,698,569 for "Mobile Crane With Jib Extension," issued Oct. 17, 1972 to Lamer et al. discloses an example of this type of crane. In other cases, the jib is relatively large and comprises several telescopic jib sections. Such a jib, although stored alongside the boom in telescoped condition on a support, must be physically removed from its support, extended to desired length by an elaborate system of cables and pulleys, and manually attached to the boom point, usually while partially supported on the ground. Setting up and dismantling a large jib of the latter type usually requires the services of several men, provision of complex tackle, and is relatively time consuming.

SUMMARY OF THE INVENTION

In accordance with the invention, a mobile crane comprises a multisection telescopic boom (having a base section and axially movable intermediate and fly sections) and an optionally usable multisection telescopic lattice type jib (having a base section and axially movable intermediate and fly sections) which when not in use is telescoped and stored on a support (in the form of a roller) in parallel reverse disposition alongside the boom with the foot of the jib toward the boom point and with the point of the jib toward the foot of the boom. Each boom and jib section takes the form of a hollow tubular telescopic member, each preferably of rectangular cross section. Each jib section presents opposite inwardly and outwardly facing flat bearing surfaces. Bearing means are provided to facilitate relative sliding motion and to transmit thrust forces between adjacent jib sections. The bearing means comprises inwardly facing slide pads mounted at the lower front ends of the base and intermediate sections and outwardly facing slide pads mounted at the upper and lower rear ends of the intermediate fly sections, each slide pad being engaged with an appropriate bearing surface on an adjacent jib section.

In further accordance with the invention, means, including an upright pin, is provided to releasably and

pivotally connect the foot of the jib to the boom point so that partial extension of the boom effects forward axial movement of the jib clear of its support means and so that the jib can then be swung horizontally 180° into axial alignment with the boom, while the jib is fully telescoped or partially or fully extended.

Means, including a rear pin is provided to releasably connect one of the axially movable telescopic jib sections to the boom base section so that further extension of the boom effects either partial or full extension of the jib, prior to horizontal swinging of the jib.

Means, including a third pin, is provided to releasably secure the jib foot to the boom point after the jib is swung into alignment with the boom.

The boom is provided with a jib mast which is pivotally connected at one end to the boom point and swingable from a position alongside the boom into an upright position wherein it can support one or more guy lines which are attached between the boom and jib and help support the latter.

In accordance with the method of unstoring and using the jib, the foot end of the jib base section is releasably pinned to the boom point by an upright pivot pin and the boom is partially extended to move the jib axially forward clear of its roller support. At this stage, the jib still fully telescoped may be swung horizontally 180° into alignment with the boom and the jib foot releasably secured thereto by suitable attachment means. Or, the jib may be partially or fully extended and then swung into position and secured to the boom. To partially extend the jib, an intermediate jib section is releasably connected to the boom base section by a rear pin and the boom is further extended to partially extend the jib. To fully extend the jib, the jib point section is releasably connected to the boom base section by the rear pin and the boom is extended to fully extend the jib. In all cases, prior to horizontally swinging the jib, a jib mast pivotally mounted on the boom point and stored beneath the boom is swung into upright position in readiness for eventual attachment of guy lines connected between the boom and jib. The jib is designed so that it can be rigidly connected at an angle to the boom axis and so that the jib fly section can be rigidly connected at an angle to the jib axis.

The present invention contemplates a jib comprising a single section only which can be moved forward by extension of the main boom to a position wherein it can be swung into proper position with respect to the main boom.

The present invention also contemplates a multisection jib which can be moved forward axially by extension of the main boom to effect extension of one or more of the jib sections prior to swinging the jib into position and securing it therein.

The apparatus in accordance with the invention facilitates connection of a single or multisection jib to the telescopic main boom of a mobile crane. It makes use of the power for operating the main boom instead of manpower to effect positioning and extension of the jib. The apparatus and method in accordance with the invention also permit a multisection jib to be extended to wherever degree desired within its limits prior to its final connection to the main boom. Other advantages and objects of the present invention will hereinafter appear.

DRAWINGS

FIG. 1 is a side elevational view of a mobile crane having a multisection telescopic main boom and having a multisection telescopic jib disposed alongside the main boom in stored position according to the invention;

FIG. 2 is a top plan view of the mobile crane shown in FIG. 1;

FIG. 3 is a side elevational view, with portions broken away to conserve space, of a multi-section jib in accordance with the invention, showing the jib in fully extended condition;

FIG. 4 is an enlarged side elevational view of the jib base section shown in FIG. 3;

FIG. 5 is an enlarged side elevational view of the jib intermediate section shown in FIG. 3;

FIG. 6 is an enlarged side elevational view of the jib fly section shown in FIG. 3;

FIG. 7 is an enlarged cross sectional view taken on line 7—7 of FIG. 3;

FIG. 8 is an enlarged cross sectional view taken on line 8—8 of FIG. 3;

FIG. 9 is an enlarged top plan view representative of the front end of both the jib base and jib intermediate sections;

FIG. 10 is a side view of the jib section end shown in FIG. 9;

FIG. 11 is an end view of the jib section shown in FIG. 10;

FIG. 12 is an enlarged top plan view representative of the rear end of both the jib intermediate and jib fly sections;

FIG. 13 is a side view of the jib section shown in FIG. 12;

FIG. 14 is an end view of the jib section shown in FIG. 13;

FIG. 15 is an enlarged cross sectional view of one of the slide pad supports and attached slide pad shown in FIG. 8;

FIG. 16 is a side view of the slide pad support and attached slide pad taken on line 16—16 of FIG. 15;

FIG. 17 is an isometric exploded view of the slide pad support and attached slide pad shown in FIGS. 15 and 16;

FIG. 18 is an enlarged top plan view of the point of the main boom and the foot end of the jib showing the foot end of the jib in fully connected position and also showing, in phantom, the jib folded alongside the main boom;

FIG. 19 is a side elevational view of the point of the main boom and the foot end of the jib, showing them in fully connected condition;

FIG. 20 is a top plan view of the main boom and the jib, shown schematically, wherein the main boom is fully retracted and the jib is fully retracted and stored alongside;

FIG. 21 is a view similar to FIG. 20 but showing one section of the main boom extended and showing the jib moved axially forward of its stored position;

FIG. 22 is a view similar to FIG. 20 wherein two sections of the main boom are shown extended and wherein one section of the jib is shown extended;

FIG. 23 is a view similar to FIG. 20 but showing all main boom sections extended and all jib sections extended, prior to swinging of the jib into final position; and

FIG. 24 is a view similar to FIG. 20 but showing details of an alternative connection between one of the boom sections and one of the jib sections.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, there is shown apparatus such as a mobile crane in accordance with the invention and which comprises a lower unit 10 in the form of a vehicle such as a truck and an upper unit 11 which is mounted for horizontal rotation in either direction on the lower unit by means of a conventional turret 17. Truck 10 comprises a chassis 12 on which are mounted ground wheels 13, extendable outriggers 14, a driver's cab 15 and an internal combustion engine 16 beneath the cab for driving the ground wheels. Upper unit 11 comprises a supporting framework 20 on which are mounted a telescopic boom B, main and auxiliary winches W1 and W2, respectively, on which load hoist lines MH and AH, respectively, are wrapped, a crane operator's cab 21, and an internal combustion engine 22 for driving a hydraulic pump 23 which supplies operating fluid for the winches W1 and W2 and hydraulic cylinders hereinafter described.

Boom B, which is shown in a generally horizontal stored position lengthwise of truck 10, comprises four hollow boom sections, namely: a base section BI, an inner mid section BII, and outer mid section BIII, and a fly section BIV. Boom base section BI is pivotally connected to framework 20 of upper unit 11 by pin means 24. Extendable and retractable hydraulic boom hoist cylinders 25 are provided to raise and lower boom B and each is pivotally connected to and between framework 20 and boom base section BI by pin means 26 and 27, respectively. Fly section BIV is provided with a working head 34 at the boom point on which a sheave 35 for load hoist line MH is rotatably mounted.

A jib mast M is pivotally connected at one end by a pin 40 to working head 34 and is pivotable from a stored position alongside and beneath boom B, as shown in FIG. 1, to a raised position as shown in FIG. 3. Mast M is releasably secured in stored position by a bracket 41 attached to and beneath boom base section BI. In an actual embodiment, for example, boom B is fully extendable to about 105 feet.

Extendable and retractable hydraulic boom extension cylinders 30, 31 and 32 are located within boom B and are connected to boom sections BII, B III and B IV, respectively, to effect axial extension and retraction of the latter. Control means (not shown) are understood to be provided to operate the cylinders 30, 31 and 32 either individually or in unison, depending upon the crane operator's choice.

A telescopic jib J for optional use with boom B is shown in generally horizontal stored position on the crane alongside and parallel to the boom. Jib J is stored at rest on jib storage means such as a roller 36 rotatably mounted on a bracket 37 which is shown attached to a side of base section BI of boom B but which, for example, could be attached to and extend from, another component. Releasable jib locking means 94 are provided on bracket 37 to maintain telescoped jib J securely in place on its support during road transport. Preferably, additional locking means are provided for the point end of the stored jib and comprise a side-wardly projecting member 96 rigidly secured as by

welding to the top of boom base section BI and to which the jib head is secured by bolt means 97. Jib J comprises three hollow lattice type jib sections, namely, a jib base or foot section JI, a jib mid or intermediate section JII, and a jib fly or point section JIII. When jib J is fully telescoped and stored, as shown in FIGS. 1 and 2, it is reversely disposed with respect to boom B, i.e., its foot end is adjacent, near or toward the point of boom B and its point end is adjacent, near or toward the base of foot end of boom B. Jib fly section JIII is provided with a working head 43 at the jib point on which a sheave 44 for load hoist line AH is rotatably mounted. Jib J is adapted, for example, to extend the length of boom B by about 30, 50 or 70 feet, depending on how far it is extended for use.

As FIGS. 4 through 15 show, each jib section J I, J II and J III comprises, for example, four longitudinal parallel spaced apart tubular members 46, each of rectangular (preferably square) cross-sectional configuration, pairs of which are interconnected by short transversely (preferably at an angle of 60° as shown in FIGS. 4, 5 and 6) disposed hollow circular tubular members or cross braces 56 bevel cut at their ends and welded therebetween to define a jib section of rectangular cross section. Each longitudinal member 46 is rotated 45° on its axis (as shown in FIG. 15) to present opposite inwardly and outwardly facing flat bearing surfaces 45 and also to present two other opposite flat surfaces 57 to which the ends of the cross braces 56 are welded, as at 56B in FIG. 15. Bearing means are provided to facilitate relative sliding motion and to transmit thrust forces between adjacent jib sections. The bearing means comprises inwardly facing slide pads 58 mounted at the lower front ends of the base section JI and intermediate section JII and outwardly facing slide pads 58 mounted at the upper and lower rear ends of the intermediate section J II and fly section J III; each slide pad 58 being mounted by bolts 58A on a slide pad support 59 secured as by welding within the hollow end of a tubular longitudinal member 46 and engaged with an appropriate bearing surface 45 on an adjacent jib section.

As FIGS. 15, 16 and 17 show, a slide pad support 59 takes the form of a length of square steel bar stock having its corners chamfered as at 59A to adapt it to fit snugly within the substantially square hollow end of a longitudinal member 46 and having a relieved portion or surface as at 59B. Support 59 is provided with two bolt holes 59C which extend therethrough from surface 59B to the opposite side and accommodate the bolts 58A which take into threaded holes 58C in slide pad 58 and secure slide pad in place. Shims 59D are disposed between relieved surface 59B and the bottom of slide pad 58 as required to maintain a proper fit or mating between slide pad 58 and the 45 on longitudinal member 46 against which it bears. Relieved portion or surface 59B enables a greater choice in the spacing or location of slide pad 58 with respect to surface 45.

To further strengthen and rigidify each slide pad support 59, each is connected to a supporting framework at the end of a jib section. Thus, as FIGS. 9, 10 and 11 show, the two slide pad supports 59 at the front end of jib base section J I (and also jib intermediate section J II) are connected as by welding at their outermost ends to a rectangular framework 100 formed of four lengths of angle iron. Only the lower two of the supports 59 carry inwardly facing slide pads 58. The framework 100, in turn, is secured as by welding to four metal

plates 101, each of which extends between and is welded to adjacent pairs of longitudinal members 46. As FIG. 10 shows, two of the plates 101 are side plates and each of these is provided with a pinning hole 48.

As FIGS. 12, 13 and 14 show, the four slide pad supports 59 at the rear end of jib intermediate section J II (and also jib fly section J III) are connected as by welding at their outermost ends to a rectangular framework 105 formed of four lengths of square tubing. All four of these supports 59 carry outwardly facing slide pads 58. A cross brace 56A is connected to and between each support 59 and a longitudinal member 46. Additional transverse braces 56B are connected to and between oppositely disposed longitudinal members 46. Each smaller jib section is slidable or telescopic within the next larger jib section on the bearing means provided between the inner and outer surfaces of the longitudinal members 46 of adjacent jib sections.

As FIGS. 3, 4, 5 and 6 show, means are provided to secure the ends of adjacent jib sections together when the jib is fully extended and such means comprises suitable pinning plates rigidly secured as by welding to the sides of the jib sections at or near the forward end of jib section J I, to both ends of jib section J II, and to the rear end of jib section J III. The pinning plates are provided with pin holes such as 48 for receiving manually insertable and removable locking pins 49. More specifically, jib base section J I comprises pinning plates 47A and 47B near the front or forward end thereof, as FIG. 4 shows. Jib base section J I is also provided at the rear end thereof with connecting means hereinafter described in connection with FIGS. 18 and 19 which are adjustable to enable jib J to be mounted in axial alignment with boom B or angularly offset upwardly or downwardly with respect thereto, as hereinafter described. Jib intermediate section J II comprises pinning plates 47C, 47D and 47E near the front end thereof and with pinning plates 47F and 47G near the rear end thereof, as FIG. 5 shows. Jib fly section J III comprises pinning plates 47H, 47I and 47J near the front end thereof and with pinning plates 47K and 47L near the rear end thereof, as FIG. 6 shows. In addition, section J III is provided with an assembly 47, similar in construction to the assembly 60 at the foot end of jib base section J I hereinafter described in detail, which enables jib fly section J III to be used in axial alignment with jib J or angularly offset upwardly or downwardly with respect thereto.

As FIG. 3 shows, when jib J is fully extended, the plates 47K and 47L in section JIII are pinned to the plates 47C and 47D, respectively, of section JII. The plates 47F and 47G in section JII are pinned to the plates 47A and 47B, respectively, of section JI. When jib J is fully telescoped, as shown in FIGS. 1 and 2, other plates in the several sections come into alignment to enable the three boom sections to be securely pinned for storage and road transport purposes.

As FIGS. 1, 2, 3, 18 and 19 show, means are provided to connect the foot of jib J to the point of boom B so that, first, partial extension of the boom can effect forward axial movement of the jib from the position shown in FIG. 20 to a position clear of its support roller 36 as shown in FIG. 21; so that, second, further extension of the boom from the position shown in FIG. 21 can effect partial or full extension of the jib (see FIGS. 22 and 23, respectively); so that, third, the jib can be swung hori-

zontally 180° into axial alignment with the boom, as FIG. 18 shows; and so that, fourth, the jib can be rigidly secured in axial alignment with the boom.

Thus, the working head 34 at the point end of boom fly section B IV is provided, on the lateral side thereof closest to jib J, with side mount pivot means 50. Pivot means 50 comprises a base plate 51 secured as by welding to head 34, a supporting plate 52 secured as by welding to base plate 51 and extending transversely therefrom, a pair of supporting gussets 53 welded between the plate 51 and the rear of plate 52, and a plurality of vertically arranged grouped pinning members 54 welded between plate 51 and the front of plate 52. Each pinning member 54 is provided with a pinning hole 55 therethrough and all such pinning holes are in vertical alignment or registry with each other. The pinning holes 55 in the top and bottom groups of pinning members 54 are adapted to receive vertically disposed removably insertable top and bottom pins P1, respectively, as FIGS. 18 and 19 show.

The foot end of jib base section J I is provided with a jib attachment assembly 60 comprising a base plate 61 rigidly secured as by welding to the base end of jib section J I and a boom attachment plate 62. The plates 61 and 62 are each provided with a pair of triangularly shaped jib foot plates 63 and 64, respectively, which are secured thereto as by welding and extend transversely therefrom. The plates 63 and 64 are supported by gussets 65 welded between them and plates 61 and 62, respectively. Each plate 63 and its associated plate 64 overlap, as FIG. 19 shows, and each is provided with a hole 66 for receiving a jib foot pin 67. The base plate 61 and the attachment plate 62 are also interconnected near their corners by four offset links 68, each of which is pivotally interconnected to the plates 61 and 62 by offset link pins 69. The lengths of the offset links 68 determine the relative planar disposition between the plates 61 and 62 and, therefore, determine whether the jib J will be in axial alignment with the boom B when connected thereto or whether the jib will be angularly offset upwardly or downwardly. In the embodiment shown, the offset links 68 are all of equal length and, therefore, the plates 61 and 62 are parallel and the axes of the jib J and the boom B would be in alignment with each other. Use of two top offset links of greater length than the two bottom offset links or vice versa, would result in the plates 61 and 62 being non-parallel and cause the jib J to be offset upwardly or downwardly when attached to boom B.

As FIG. 18 shows, the working head 34 at the point end of boom fly section B IV is provided on its lateral side farthest from stored jib J with side mount attachment means 70. Attachment means comprises a base plate 71 secured as by welding to head 34, a supporting plate 72 secured as by welding to plate 71 and extending transversely therefrom, a pair of supporting gussets 73 welded between the plate 71 and the rear of plate 72, and a plurality of vertically arranged grouped pinning members 74 welded between plate 71 and the front of plate 72. Each pinning member 74 is provided with a pinning hole 75 therethrough and all such pinning holes are in vertical alignment or registry with each other. The pinning holes 75 in the top and bottom groups of pinning members 74 are adapted to receive vertically disposed, removable insertable top and bottom pins P3, respectively, as FIG. 18 shows.

As FIGS. 18 and 19 show, the boom attachment plate 62 at the foot end of jib section J I is provided on its rear side with two groups of laterally projecting pinning members 80 and 81, each having a hole 83 therethrough, which are movable into cooperative relationship and alignment with pinning members 54 and 74, respectively, on boom B, as hereinafter explained.

As FIGS. 2 and 20 through 24 show, boom base section BI is provided near its forward end on its lateral side closest to jib J with a pinning ear 85 having a hole 84 therein for receiving a removably insertable pin P2, shown in FIGS. 20 through 24. Pin P2 is used to secure pinning ear 85 either to a pinning ear 86 on the fore end of jib section J III (for use in partial jib extension or to a pinning ear 87 in the fore end of jib section J III (for use in full jib extension). The ears 86 and 87 are provided with pinning holes 88 and 89, respectively.

As FIG. 3 shows, the jib sections JI and JII are provided with stiff legs 90 and 91, respectively, which are shown in upright position and to which guy wires G are attached. Each stiff leg 90 and 91 is pivotally attached by a pin 92 to its respective jib section and is foldable downwardly to a stored position (or removable) when not in use.

Operation

Assume that the crane is in the condition shown in FIGS. 1 and 2 with both the boom B and the jib J telescoped and stored, with all pins P1, P2 and P3 removed, and with jib J resting on the support roller 36 with the locking means 94 unlocked and locking bolt means 97 unsecured. To set up the jib, the pins P1 are manually inserted to connect the ears 80 of jib base section J I to the ears 54 of boom fly section B IV. Boom cylinder 32 is then operated to extend boom fly section B IV and thereby effect forward axial movement of the entire telescoped jib J from the position shown in FIG. 20 to a position shown in FIG. 21 clear of its support roller 36.

At this point, the crane operator can choose to use the jib J in telescoped condition shown in FIG. 21, in partially extended condition shown in FIG. 22, or in fully extended condition shown in FIG. 23.

In the jib is to be used in fully telescoped condition as shown in FIG. 21, the jib mast M is swung into upright position and the jib is swung horizontally 180° about pin P1 until the holes 83 in the ears 81 on jib section JI align with the holes 75 in the ears 74 on boom fly section B IV, whereupon the pins P3 are inserted to lock the jib in position. Then, if necessary, the stiff leg 90 is raised or put in place, the guy line G is rigged thereto and the hoist line AH is reeved about sheave 44.

However, if the jib J is to be used in partially extended condition as shown in FIG. 22, the holes 84 and 88 in the ears 85 and 86, respectively, are aligned by appropriate boom section movement and the pin P3 is inserted therethrough, as shown in FIG. 21, and the boom section B III is extended by operation of cylinder 31 to the position shown in FIG. 22 wherein the jib J is partially extended. Thereupon, pin P2 is removed and the jib J is swung horizontally 180° about pin P1 and the pin P3 is inserted, as hereinbefore explained. Prior to swinging jib J, the mast M must be erected. After the partially extended jib J is pinned in place, the stiff legs 90 and 91 are erected and the guy line G and hoist line AH are rigged, as hereinbefore explained.

If the jib J is to be used in fully extended condition as shown in FIG. 23, the holes 84 and 89 in the ears 85 and 87, respectively, are aligned by appropriate boom section movement, as shown in FIG. 24, and the pin P2 is placed therethrough. Thereupon, the boom section BIII is extended by operation of cylinder 30 to the position shown in FIG. 23 wherein the jib J is fully extended. Thereupon, pin P2 is removed and the jib J is swung 180° into position (after swinging and placement of mast M) and the pin P3 is inserted, as hereinbefore explained. With the jib in place the stiff legs 90 and 91 are erected and the guy line G and hoist line AH are rigged, as hereinbefore explained.

After the jib J is in place and its sections properly secured by placement of the pins 49 in the holes 48, it can be raised or lowered in accordance with the operation of boom B in the conventional manner.

To store the jib J after use, the boom B is lowered to horizontal position, the guy line G and hoist line AH are disconnected, the stiff legs 90 and 91 (if used) are folded down or removed, and the jib section pins 49 are removed (to permit jib section telescoping). The pins P3 are removed and the jib J is swung about pins P1 back alongside boom B. Thereupon, the appropriate jib section (either section J II or J III) is connected to boom base section BI by pin P2, provided the jib is partially or fully extended, and the appropriate boom sections are retracted to fully telescope the jib sections. When jib J is fully telescoped, pin P2 is removed to detach the point end of the jib from boom base section BI, and cylinder 30 is operated to retract boom fly section B IV and thereby slide the jib back along the support roller 36 into stored position. Thereupon, the pins P1 are removed and jib J is secured in stored position. If desired, pins P1 may be left in place to prevent axial shifting of jib J during road transport, although such movement is also prevented by use of the jib locking means 95 provided on the jib support bracket 37 and the locking bolt 97 on bracket 96, as shown in FIGS. 1 and 2, which are understood to be releasably connectable to the jib.

In the embodiment disclosed, jib J is shown stored in reverse parallel relationship alongside one lateral side (the left side) of boom B. However, jib J can be stored alongside and above, below or on the other (right) side of boom B, if suitable provisions are made therefor in the construction and arrangement of various components, and such arrangements are within the scope of the present invention.

Also, when jib J is axially moved clear of its support roller 36, it may be swung 180° into and out of position either manually or by means of attachment of one of the hoist lines thereto and use of power from one of the winches.

Furthermore, although jib J is shown in FIG. 3 in axial alignment with boom B, jib J can be attached so as to be disposed at an angle with respect to boom B by appropriate setting or adjustment of the attachment means 60, i.e., by use of appropriately sized offset links. Similarly, jib fly section J III can be angled with respect to jib J after extension thereof by appropriate setting or adjustment of the attachment means 47 by appropriately sized offset links.

Resume

A mobile crane comprises a multisection telescopic boom B and an optionally usable multisection tele-

scopic lattice type jib J (having a base section JI and axially movable intermediate and fly sections J II and J III, respectively,) which when no in use is telescoped and stored on a support roller 36 in parallel reverse disposition alongside the boom B. Each jib section comprises four hollow tubular longitudinal members 46 (each of rectangular cross section) arranged in parallel spaced apart relationship with a plurality of angularly disposed tubular cross braces 56 connected between each pair of members 46 to define a jib section of rectangular cross section. Each longitudinal member 46 is rotated 45° on its axis to present opposite inwardly and outwardly facing flat bearing surfaces 45 and also to present two other opposite flat surfaces 57 to which the ends of the cross braces 56 are welded. Bearing means are provided to facilitate relative sliding motion and to transmit thrust forces between adjacent relatively movable jib sections. The bearing means comprises inwardly facing slide pads 58 mounted at the lower front ends of the base and intermediate jib sections J I and J II, respectively, and outwardly facing slide pads 58 mounted at the upper and lower rear ends of the intermediate and fly jib sections J II and J III, respectively; each slide pad 58 being mounted on a suitably braced slide pad support 59 secured within the hollow end of a tubular longitudinal member 46 and engaged with an appropriate bearing surface 45 on an adjacent jib section. To unstore the jib J and set it up for use, the foot end of the jib is releasably connected by pivot pin means P1 to the point end of the boom B and the boom is partially extended to axially move the jib forward clear of its support 36. At this stage the unextended jib J may be swung 180° about the pivot pin means P1 into axial alignment with the boom B and rigidly secured thereto by suitable attachment means including pin means P3. Or, the jib J may be partially or fully extended prior to being swung 180° by connecting either the jib intermediate section J II or the jib fly section J III, respectively, by releasable rear pin means P2 to the boom base section BI and by then further extending the boom, either partially or fully, respectively. In all cases, prior to swinging the jib J, a guy wire jib mast M pivotally attached to the boom point and folded back alongside the boom B is swung into upright position. The jib J is designed so that it can be rigidly connected at an angle to the boom axis by adjustment of attachment means 60 and so that the jib fly section J III can be rigidly connected at an angle to the jib axis by adjustment of attachment means 47.

I claim:

1. In a mobile crane: a telescopic boom having a stored position and comprising a boom base section and at least one other boom section telescopically movable with respect to said base section; means for telescopically moving said other boom section; a jib comprising at least one jib section; support means including roller means for supporting said jib in stored position parallel to said boom when the latter is in stored position; said jib being reversely disposed with respect to said boom when both are in stored position; first means pivotally connecting the jib foot to the boom point, said first means enabling axial movement of said other boom section to effect axial movement of said jib onto and off of said roller means of said support means, said first means also enabling pivotal movement of said jib between one position wherein said jib is parallel to and reversely disposed with respect to said boom and an-

other position wherein said jib is aligned with said boom, provided said jib is off of said roller means of said support means; and connecting means for releasably connecting said jib to said boom when said jib is pivoted into alignment with said boom.

2. A crane according to claim 1 wherein said first means comprises at least one pin removably engageable with a pin hole on said jib and a pin hole on said boom.

3. A crane according to claim 2 wherein said pin is vertically disposed when said boom and jib are in stored position and wherein said jib is swingable horizontally about said pin when said jib is off of said support means.

4. A crane according to claim 3 wherein said connecting means comprises at least one pin removably engageable with a pin hole on said boom and a pin hole on said jib.

5. A crane according to claim 4 including a jib mast pivotably mounted on said other boom section and pivotable between a stored position alongside said boom and an upright position.

6. In a mobile crane: a telescopic boom having a stored position and comprising a boom base section and at least one other boom section telescopically movable with respect to said boom base section; means for telescopically moving said other boom section; a telescopic jib comprising a jib base section and at least one other jib section telescopically movable with respect to said jib base section; support means including roller means for supporting said jib while telescoped in stored position parallel to said boom when the latter is in stored position; said jib being reversely disposed with respect to said boom when both are in stored position; first means for pivotally connecting the jib foot end of said jib base section to the boom point end of said other boom section, said first means enabling axial movement of said other boom section to effect axial movement of said jib onto and off of said roller means of said support means, said first means also enabling pivotal movement of said jib between one position wherein said jib is parallel to and reversely disposed with respect to said boom and another position wherein said jib is aligned with said boom, provided said jib is off of said roller means of said support means; second means for releasably connecting said other jib section to a point on said crane which is fixed with respect to said other boom section, said second means enabling axial movement of said other boom section to effect axial telescopic movement of said jib base section with respect to said other jib section; and connecting means for releasably connecting said jib to said boom when said jib is pivoted into alignment with said boom.

7. A crane according to claim 6 wherein said first means comprises at least one pin removably engageable with a pin hole on said boom and a pin hole on said jib.

8. A crane according to claim 7 wherein said pin is vertically disposed when said boom and jib are in stored position and wherein said jib is swingable horizontally about said pin when said jib is off of said support means.

9. A crane according to claim 8 wherein said second means comprises at least one pin releasably engageable with a pin hole on said boom and a pin hole on said jib.

10. A crane according to claim 9 wherein said connecting means comprises at least one pin removably engageable with a pin hole on said boom and a pin hole on said jib.

11. A crane according to claim 10 including a jib mast pivotably mounted on said other boom section and pivotable between a stored position alongside said boom and an upright position.

12. In a mobile crane: a telescopic boom having a stored position and comprising a boom base section and a plurality of other boom sections telescopically movable with respect to said boom base section; means for telescopically moving said other boom sections; a telescopic jib comprising a jib base section and a plurality of other jib sections telescopically movable with respect to said jib base section; support means including roller means for supporting said jib while telescoped in stored position parallel to said boom when the latter is in stored position; said jib being reversely disposed with respect to said boom when both are in stored position; first means for pivotally connecting the jib foot end of said jib base section to the boom point end of one of said other boom sections, said first means enabling axial movement of said one other boom section to effect axial movement of said jib onto and off of said roller means of said support means, said first means also enabling pivotal movement of said jib between one position wherein said jib is parallel to and reversely disposed with respect to said boom and another position wherein said jib is aligned with said boom, provided said jib is off of said roller means of said support means; second means for releasably connecting one of said other jib sections to a point on said crane which is fixed with respect to said other boom section, said second means enabling axial movement of at least one of said other boom sections to effect axial telescopic movement of said jib base section with respect to said one other jib section; and connecting means for releasably connecting said jib to said boom when said jib is pivoted into alignment with said boom.

13. A crane according to claim 12 wherein said point on said crane which is fixed with respect to said one other boom section is located on said boom base section.

14. A crane according to claim 13 wherein said first means comprises at least one pin removably engageable with a pin hole on said boom and a pin hole on said jib.

15. A crane according to claim 14 wherein said pin is vertically disposed when said boom and jib are in stored position and wherein said jib is swingable horizontally about said pin when said jib is off of said support means.

16. A crane according to claim 15 wherein said second means comprises at least one pin releasably engageable with a pin hole on said boom and a pin hole on said jib.

17. A crane according to claim 16 wherein said connecting means comprises at least one pin removably engageable with a pin hole on said boom and a pin hole on said jib.

18. A crane according to claim 17 including a jib mast pivotably mounted on said other boom section and pivotable between a stored position alongside said boom and an upright position.

19. A method of employing a telescopic crane boom to handle a jib storable parallel to and in reverse dispo-

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sition with respect to the boom on support means, comprising the steps of: releasably and pivotally connecting the foot end of said jib to the point of said boom; telescopically moving said boom to effect axial movement of said jib with respect to said support means; and pivoting said jib with respect to said boom while said jib is clear of said support means.

20. A method of employing a telescopic crane boom to handle a telescopic jib storable parallel to and in reverse disposition with respect to the boom on support means, comprising the steps of: releasably and pivotally connecting the foot end of said jib to the point of said boom; telescopically moving said boom to effect axial movement of said jib with respect to said support means; releasably securing another portion of said jib to a relatively fixed point; telescopically moving said boom to effect axial telescoping of said jib; unsecuring said other portion of said jib from said relatively fixed point; and pivoting said jib with respect to said boom while said jib is clear of said support means.

21. A method of connecting a jib to the boom point of a telescopic crane boom where said jib is stored alongside of and in reverse disposition with respect to

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said boom on support means, comprising the steps of: releasably and pivotally connecting the foot end of said jib to the point of said boom; extending said boom to axially move said jib clear of said support means; pivoting said jib into end-to-end relationship with said boom; and releasably securing said jib to said boom in end-to-end relationship.

22. A method of extending and connecting a telescopic jib to the boom point of a telescopic crane boom where said jib is stored alongside of and in reverse disposition with respect to said boom on support means, comprising the steps of: releasably and pivotally connecting the foot end of said jib to the point of said boom; extending said boom to axially move said jib clear of said support means; releasably securing another portion of said jib to a relatively fixed point; extending said boom to effect axial extension of said jib; unsecuring said other portion of said jib from said relatively fixed point; pivoting said jib into end-to-end relationship with said boom; and releasably securing said jib to said boom in end-to-end relationship.

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