Sept. 22, 1964 G. W. MORK 3,149,730

CONVERTIBLE CRANE

Filed June 8, 1962 2 Sheets-Sheet 1

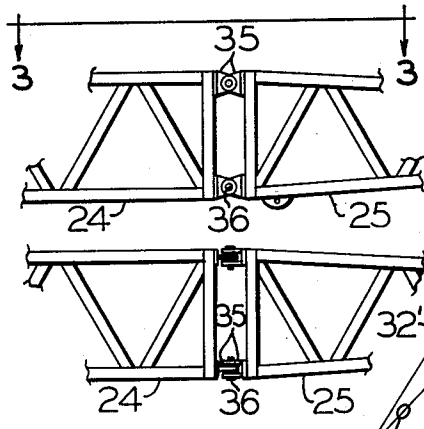


FIG. 3

FIG. 1

FIG. 2

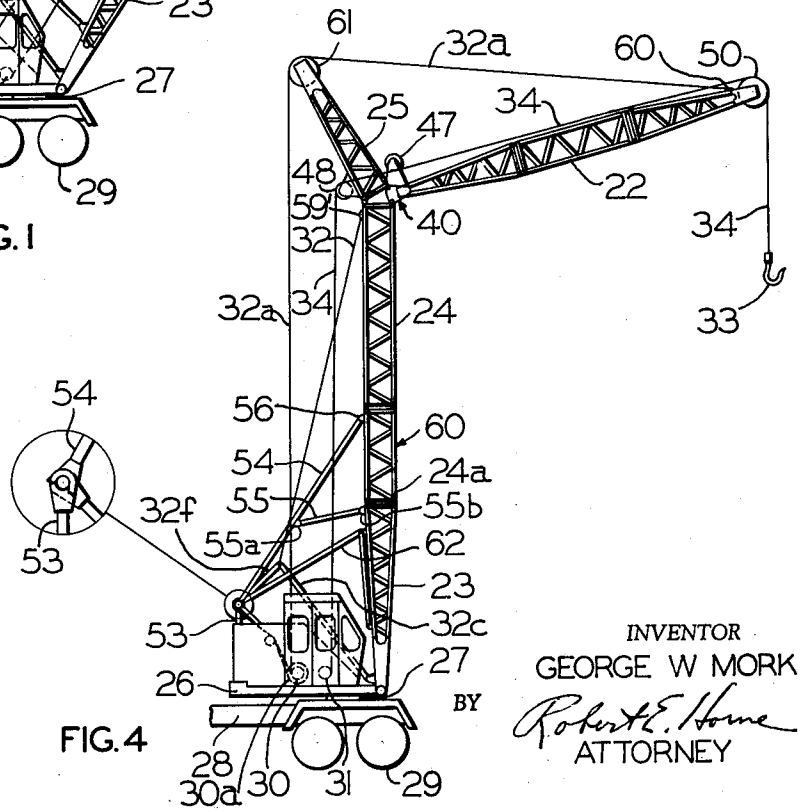


FIG. 4

INVENTOR
GEORGE W MORK
BY
Robert E. Home
ATTORNEY

Sept. 22, 1964 G. W. MORK 3,149,730

CONVERTIBLE CRANE

Filed June 8, 1962 2 Sheets-Sheet 2

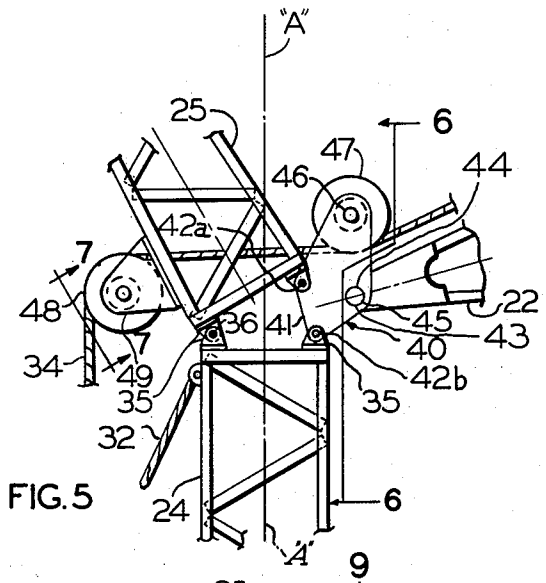


FIG. 5

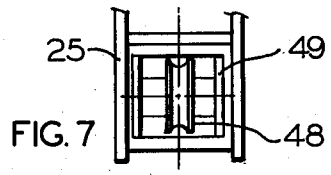


FIG. 7

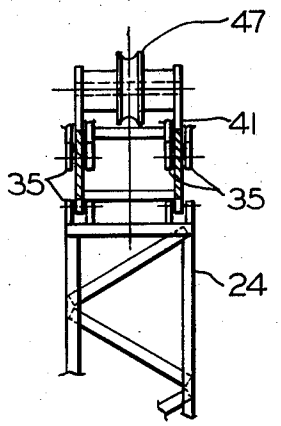


FIG. 6

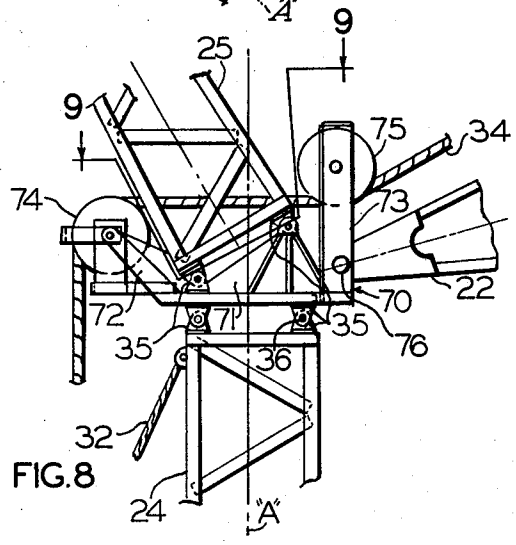


FIG. 8

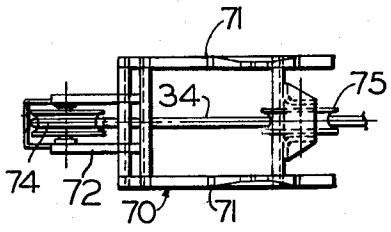


FIG. 9

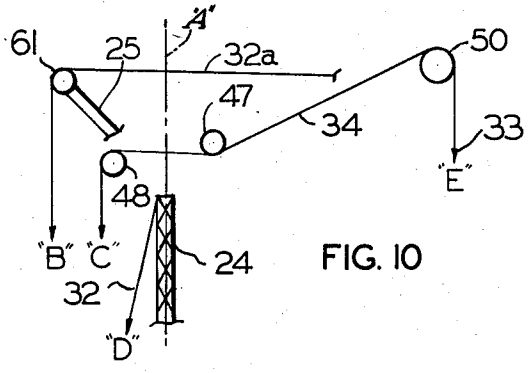


FIG. 10

INVENTOR,
GEORGE W MORK
BY
Robert E. Home
ATTORNEY

United States Patent Office 3,149,730 Patented Sept. 22, 1964

3,149,730

CONVERTIBLE CRANE

George W. Mork, South Milwaukee, Wis., assignor to Bucyrus-Erie Company, South Milwaukee, Wis., a corporation of Delaware

Filed June 8, 1962, Ser. No. 201,138
8 Claims. (Cl. 212—59)

This invention relates to a mobile crane having a boom and more particularly to a boom insert device for converting a mobile crane to a tower crane. Tower cranes are particularly adapted for hoisting steel and other materials to desired locations at a building site, and are designed to handle materials in narrow, confined places where the mobile crane does not ordinarily operate.

It is desirable to be able to convert a mobile crane to a tower crane as it allows a single crane to perform a variety of work functions in a variety of locations. For example, crane operation at a construction site may require lifting and placing loads which are ordinarly handled by mobile cranes, but it also may be necessary to perform material handling tasks that are more suitably handled by a tower crane. If a single crane can be converted readily from a mobile crane to a tower crane, the need of providing a second crane is eliminated. Such crane conversion should be accomplished in a facile manner and without the expenditure of an appreciable amount of time or extensive use of auxiliary tools and equipment.

For example, structure can be inserted in a crane boom to convert the boom of the crane to the tower of a tower crane. The insert when used with the components of mobile crane results in a tower crane having the requisite stability required for tower crane operation.

A characteristic of a tower crane resides in the vertical disposition of its tower, which in the instant invention is provided by the boom of the mobile crane raised to a vertical position after insertion of boom insert structure. With such insert structure attached to the crane boom, the uppermost portion of the boom may be canted rearwardly toward the mobile crane housing, and with appropriate reeving a jib may be attached to the tower.

It is therefore a principal object of the invention to provide a boom insert means for the boom of a conventional mobile crane, whereby a tower for a tower crane is provided.

It is another object of the invention to provide insert structure for readily converting the boom of a crane, upon insertion of said structure, to a tower of a tower crane to which a pivotal jib boom may be attached.

It is another object of the invention to provide a boom insert means for a sectionalized boom of a conventional mobile crane wherein insertion of said means converts said boom, when raised to a vertical position, to the tower of a tower crane.

It is another object of the invention to provide structure for converting a mobile crane having a jib boom to a tower crane.

It is another object of the invention to provide a means for converting a mobile crane to a tower crane wherein said tower crane has the requisite stability for handling loads suspended from a boom of said tower crane.

It is another object of the invention to provide a boom insert device for a crane boom for reducing bending stresses in said boom when raised to a substantially vertical position to function as a tower for a tower crane.

These and other objects of the invention will be apparent in the following specification and drawings, of which:

FIGURE 1 is a side elevation of a mobile crane having a pivotally mounted sectionalized boom and jib;

FIGURE 2 is an enlarged elevation of the outer boom

section connection of the sectionalized boom of FIGURE 1;

FIGURE 3 is a plan view along line 3—3 of the boom connection of FIGURE 2;

FIGURE 4 is a side elevation of the crane of FIGURE 1 converted to a tower crane showing the first embodiment of the invention;

FIGURE 5 is an enlarged side elevation of the boom insert means of FIGURE 4;

FIGURE 6 is an end view of the boom insert means taken along line 6—6 of FIGURE 5;

FIGURE 7 is an end view taken along line 7—7 of FIGURE 5;

FIGURE 8 is a side elevation of a second embodiment of the boom insert means;

FIGURE 9 is a plan view of the insert means taken along line 9—9 of FIGURE 8; and

FIGURE 10 is a force diagram of the loading on the tower crane of FIGURES 4 and 5.

Referring now to FIGURE 1, a mobile crane having main boom 21 and a jib 22 is shown to which the present invention is applied. Cranes having a main boom with a jib boom attached thereto are conventional in the art as disclosed in Forsythe et al. U.S. Patent No. 1,920,370, issued August 1, 1933.

The main boom 21 in FIGURE 1 is sectionalized, to include a boom-foot section 23, an intermediate section 24, and a boom-point section 25. Variations in over-all length of the boom 21 can be obtained by the addition of one or more boom sections 24*a* between the intermediate section and the boom-foot section and the boom-point section.

Boom 21 is pivotally attached to a conventional rotating platform 26 mounted on turntable 27 for rotation with respect to chassis 28 on wheels 29. Operating machinery is also mounted on platform 26, including a main load hoist means 30, a boom hoist means 30*a*, and a hoist means 31 which are driven by a power means (not shown). Boom 21 is raised and lowered by hoist means 30*a* through sectionalized pendant 32, cable reeving 32*a*. The pendant 32 is sectionalized as at turnbuckle 32*b* with a pendant section 32^1 connected to the outer end of boom 21 as at lug 59. A load attached to load hook 33 is raised and lowered by hoist means 30 through cable 32*a* reeved over sheave 50*b* and sheave 50 on jib 22. Jib 22 is maintained in angular relation to boom 21 by cable 22*a* connected to boom 21 at lug 22*b* and to jib 22 at lug 22*c* with mast 22*d* secured to boom 21 therebetween. A load may also be raised and lowered by load hook 33*a* connected to cable 34 reeved over sheave 50*a* on the boom point to hoist means 31.

The boom sections of boom 21 are joined by connecting means shown in FIGURES 2 and 3 wherein lugs 35 on boom sections 24 and 25 are interconnected by pins 36.

To convert the crane of FIGURE 1 to a tower crane, as, for example, the tower crane of FIGURE 4, a boom insert device or adapter 40 or 70 as disclosed in FIGURES 5 or 8 respectively is inserted between boom section 24 and boom-point section 25 of boom 21.

To convert the crane to a tower crane by means of the boom insert device or adapter of the first embodiment disclosed in FIGURES 4 and 5, it is necessary to remove only a pair of pins 36 from lugs 35 adjacent the outer or forward side and chords of the boom to allow boom-point 25 to be pivoted rearwardly about the rearward pins 36 interconnecting boom section 24 and boom-point section 25. The boom insert or adapter 40 is provided with a pair of main supporting plates 41 in which upper and lower vertically spaced openings 42*a* and 42*b* respectively are in alignment with the pin-connected to outer lugs 35 on boom-point section 25 and intermediate section

24 respectively to cant boom-point section 25 rearwardly in relation to boom section 24. Also provided in the main plates 41 are openings 43 aligned with opening 44 at the foot of jib 22 wherein pin 45 pivotally joints jib 22 to adapter 40. A cable sheave 47 is also mounted for rotation on a pin 46. A second cable sheave 48 is mounted on supporting means 49 preferably secured to boom-point section 25.

As the boom sections, including boom section 24, will be vertically disposed for tower crane operation as shown in FIGURE 4, bracing members 54 and 55 are added to the crane structure to afford additional stability. Member 54 is pin-connected at one end to lug 56 of the boom and engages A-frame 53 at the other end. Member 55 is pin-connected at each end to lugs 55*a* and 55*b* respectively on the brace 54 and boom section 23. Bracing members 54 and 55 are readily removed or added by reason of the pin-connections thus facilitating the conversion from crane to tower crane vice versa.

Reeving for the tower crane of FIGURE 4 differs in that pendant 32 is attached to lug 59^1 on boom section 23 instead of lug 59 of section 25, but the lower end of pendant 32 remains attached to mast 32*c* and reeving 32*a* connected to hoist means 30*a*. The section 32^1 of pendant 32 has been removed. Cable 34 connected to hoist means 31 is reeved over sheave 48 and under sheave 47 of adapter 40 to sheave 50 of jib 22 and load hook 33. Furthermore, jib 22 is raised and lowered by cable 32*a* connected to lug 60 at one end and to hoist means 30 at the other end, with the cable 32*a* running over sheave 61 on the rearwardly canted boom-point section 25.

A conventional folding boom stop means 62 is connected bewteen A-frame and boom-foot section 23 to limit the rearward (as viewed in drawings) positioning of boom 21 as it is moved to a vertical position by hoist means 30 and cable 32.

A second embodiment of the boom insert device or adapter is shown in FIGURE 8 and designated generally as 70. Basically, adapter 70 provides for the canting of boom-point section 25 in relation to boom section 24 when the adapter 70 is inserted in boom 21 between sections 24 and 25. The sections 24 and 25 are interconnected by pins 36 and lugs 35 as described in connection with FIGURES 1, 2, and 3. Adapter 70 is provided with lugs 35 on frame 71 located in a predetermined manner to match with lugs 35 on boom section 24 and boom-point section 25. The lugs 35 of adapter 70 matching with the lugs 35 on boom section 24 are secured as by pins 36. The forward lugs 35 on frame 71 are spaced vertically a greater extent than the reaward lugs on the frame so that the boom-point section is canted rearwardly.

Also mounted on frame 71 are sheaves supports 72 and 73 for sheaves 74 and 75 respectively. The foot of jib 22 is pivoted to support 73 as by pin 76.

Reeving for the tower crane having the adapter 70 is identical to the reeving described hereinabove in conjunction with adapter 40 and FIGURE 4.

In the embodiments of the invention of FIGURES 5 and 8, the sheaves 47, 48 of FIGURE 5 and 74, 75 of FIGURE 8, are located on opposite sides of the neutral vertical axis "A" of the tower crane. Referring to FIGURE 10, a moment diagram illustrates the forces balanced in relation to the boom insert device of FIGURE 5. The downward forces "B," "C," "D," and "E" represent the jib hoist line force at sheaves 61, the load hoist line force at sheave 48, the force at pendant 32, and the load at hook 33 respectively. As the force "E" is varied, and the inclination of jib 22 is changed, the force "D" on pendant 32 will vary and the pendant 32 as secured to boom section 24 and mast 32*c* must be of sufficient strength to stabilize the tower crane. The effect of the forces "B," "C," and "E" on pendant 32 is reduced by providing an adapter for canting the boom-point section rearwardly so that forces "B" and "C" act rearwardly of axis "A" of the tower crane and the force "E" acts forwardly of the axis "A."

The mobile crane of FIGURE 1 is thus readily converted with a minimum amount of structural changes to the tower crane of FIGURE 4 by the insertion of adapters 40 or 70 described hereinabove, the jib 22 of the crane 20 also serving as the jib 22 of the tower crane of FIGURE 4.

Having described two embodiments of boom insert devices or adapters for converting a conventional crane to a tower crane, the invention is not to be limited to the specific form or arrangement of parts herein described and shown, or specifically covered by the claims.

What is claimed is:

1. In a crane, the combination of: a main supporting frame; a sectionalized boom pivotally supported by said frame, said boom being adapted to be raised and lowered between forwardly inclined and vertical positions, and including: main-boom and boom-point sections, a first connecting means for detachably interconnecting said main-boom and boom-point sections and aligning said sections approximately on a common central longitudinal axis; a jib adapted to be pivotally supported in a forwardly inclined position between said main-boom and said boom-point sections; adapter means detachably interposed between said main and boom-point sections, and including: second connecting means for detachably connecting the adapter means to the first connecting means, differential spacer means for canting said boom-point section rearwardly relative to said main-boom section and longitudinal axis thereof when said axis is vertical, and third connecting means for detachably connecting said jib to said adapter means in a forwardly extended position relative to said main-boom section.

2. The combination of claim 1 wherein said adapter means is interposed intermediate the ends of said sectionalized boom forwardly of the central vertical axis of said boom.

3. The combination of claim 2 wherein said adapter means includes cable guide means for a jib load hoist cable.

4. The combination of claim 3 wherein the cable guide means of said adapter means includes a first cable guide means positioned forwardly of the central axis of said boom when it is vertical and a second cable guide means positioned rearwardly of said central vertical axis for a load cable.

5. In an adapter for a boom for converting a crane to a tower crane, the combination of: an adapter frame having connecting means for detachably connecting said adapter frame between the ends of said boom, said connecting means being forwardly and rearwardly of a central axis of the boom when said boom is vertical, said connecting means forwardly of said central axis being spaced a greater vertical extent than said connecting means rearwardly of said central axis for canting one end of said boom with respect to the longitudinal central axis of the boom; cable guide means mounted on said adapter frame forwardly and rearwardly of said central axis of the boom when the boom is vertical for guiding a hoist cable, and pivot means in said frame for pivotally supporting a jib on said adapter frame.

6. An adapter for a sectionalized boom of a crane for converting said crane to a tower crane, said adapter having spacer means for insertion intermediate the ends of said sectionalized boom, said spacer means canting an upper portion of said sectionalized boom with respect to the longitudinal central axis of the boom, a cable guide means mounted on said spacer means for guiding a hoist cable, and means for pivotally connecting a jib to said spacer means.

7. In a crane, the combination of: a main supporting frame; a boom pivotally carried by said frame, said boom being adapted to be raised and lowered between for-

wardly inclined and vertical positions, and including, main-boom and boom-point sections, a first connecting means for detachably interconnecting said main-boom and boom-point sections and aligning said sections approximately on a common central longitudinal axis; a jib adapted to be pivotally supported on said boom for pivotal movement in a vertical plane; adapter means detachably interposed between said main and boom-point sections, and including: second connecting means for detachably connecting the adapter means to the first connecting means, differential spacer means for canting said boom-point section relative to the longitudinal axis of said main-boom section when said axis is vertical, and third connecting means for detachably connecting said jib to said adapter means for pivotal movement of said jib in a vertical plane.

8. In an adapter for converting a crane to a tower crane, the combination of: an adapter frame having connecting means for insertion intermediate the ends of a sectionalized boom, said adapter frame having a spacer means for canting the upper portion of said boom relative to the remainder of said boom; guide means carried by said adapter for guiding a hoisting means; and pivot means carried by said adapter frame for pivotally supporting a jib swingable in a vertical plane.

References Cited in the file of this patent

UNITED STATES PATENTS

1,917,955	Dierks	July 11, 1933
1,920,370	Forsythe et al.	Aug. 1, 1933
2,031,549	Ruff	Feb. 18, 1936
2,833,423	Tucker	May 6, 1958