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CRANE ASSEMBLY

Original Filed Sept. 26, 1956

3 Sheets-Sheet 1

FIG. 2

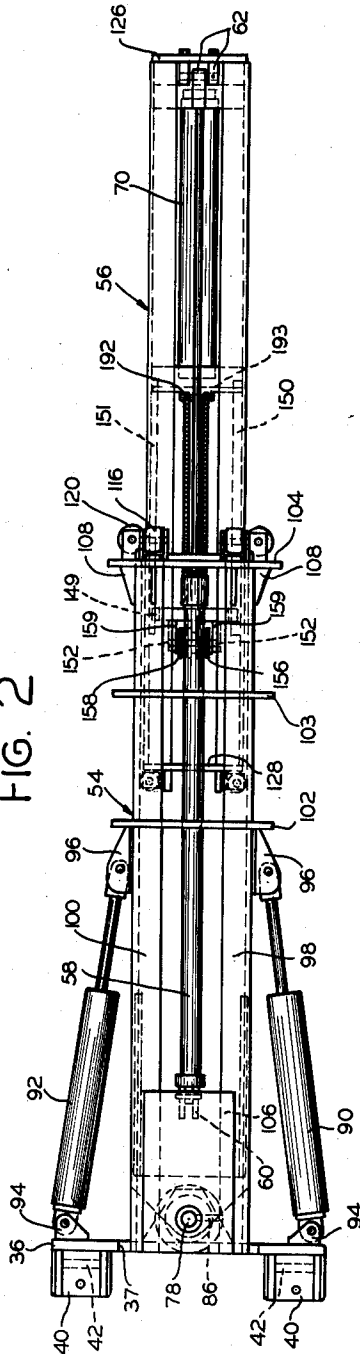
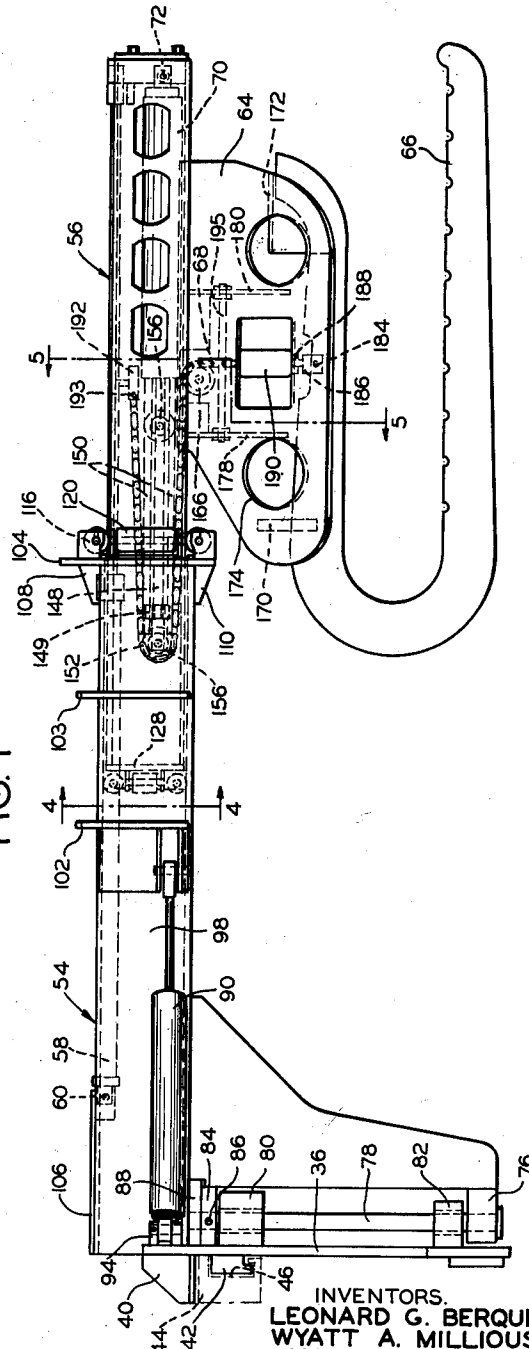


FIG. 1



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FIG. 4

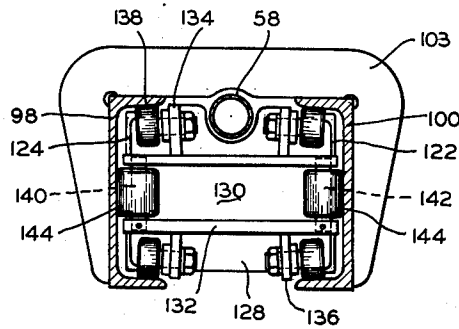
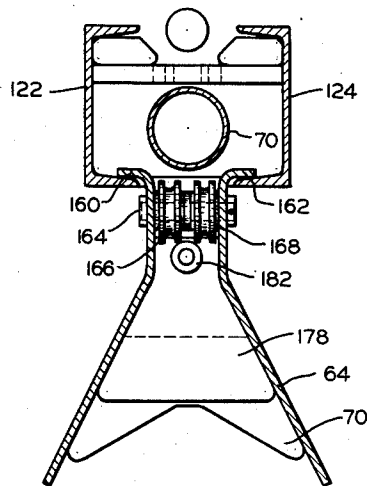


FIG. 5



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CRANE ASSEMBLY

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Original application Sept. 26, 1956, Ser. No. 612,322, now Patent No. 2,990,074, dated June 27, 1961. Divided and this application Oct. 10, 1960, Ser. No. 61,492
4 Claims. (Cl. 212--55)

The present invention relates generally to crane assemblies, and more particularly to a crane assembly having an improved extensible boom construction. This application comprises a division of application Serial No. 612,322, filed September 26, 1956, now Patent No. 2,990,074, granted June 27, 1961.

The main object of the present invention is to provide an improved extensible boom construction.

Another object of the invention is to provide in an extensible boom construction having boom elements nested in telescopic relation means for maintaining the boom elements in spaced and aligned relation.

In the disclosed embodiment of our present invention a crane support member is adapted to be detachably secured to a load supporting carriage of an industrial truck. The extensible boom construction is mounted for rotary movement about a vertical axis located adjacent the support member, and includes fixed and movable boom members, the movable boom member being telescoped within the fixed member and longitudinally actuable by means of hydraulic cylinder and piston means connected at its one end to the fixed member and at its opposite end to the movable member. Roller means are connected to one end of the fixed boom member and also to one end of the movable boom member, which roller means cooperate to maintain the boom members out of contact or frictional relation during telescoping movement and provide vertically and horizontally acting force couples which resist forces acting on the movable boom member which tend to misalign the boom members.

As disclosed herein, adjacent one end of the movable boom member is a suspended load engaging means which is actuatable in a vertical direction by means of an upper hydraulic cylinder and piston assembly associated with the movable boom member. A saddle means is provided to cooperate with the load engaging means when it is raised in relation to the boom members so that the load engaging means may be rigidly held in a fixed position.

Now, in order to acquaint those skilled in the art with the manner of constructing and using an extensible boom construction in accordance with the principles of our present invention, we shall describe in connection with the accompanying drawings a preferred embodiment of our present invention.

In the drawings:

FIGURE 1 is a side elevational view of a crane mechanism which embodies the extensible boom construction of the present invention;

FIGURE 2 is a plan view of the crane assembly shown in FIGURE 1;

FIGURE 3 is an enlarged front view of the mechanism shown in FIGURES 1 and 2;

FIGURE 4 is an enlarged sectional view taken on line 4--4 of FIGURE 1; and

FIGURE 5 is an enlarged sectional view taken on line 5--5 of FIGURE 1, but with the load engaging means not shown.

Referring now to the drawings in detail, there is indicated by the reference numeral 36 a crane support plate member 36 which is, for example, adapted to be mounted

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on an elevatable carriage of an industrial lift truck by means of a pair of laterally spaced and rearwardly extending bracket members 40 which are rigidly connected, as by welding, to upper opposite side portions of plate 36. A pair of similarly spaced brackets 42 are located just below brackets 40. An upper transverse member 44 of a lift truck carriage is constructed to provide an opening 46 which corresponds in shape to the outer boundary of brackets 42 (see broken line at numerals 44 and 46 in FIGURE 1) so that the crane assembly may be properly supported on such a carriage.

The crane assembly comprises generally a fixed boom assembly 54, a movable boom assembly 56 mounted in telescoping relation to assembly 54, a longitudinally extending hydraulic cylinder and piston assembly 58 fixedly mounted on boom member 54 at the rear end thereof by means of a pin and yoke connection 60 and at the forward end thereof to the boom member 56 by means of a pin and bracket means 62, an inverted Y-shaped or retaining saddle means 64 connected to the boom assembly 56, a hairpin-shaped hook or load engaging means 66 supported by tension means or chain 68 (which is suitably trained over boom mounted sheaves and connected to the boom member 56 at the upper end thereof), hydraulic cylinder and piston assembly 70 connected by bracket means 72 to the forward end of boom member 56 and to the chain and sheave means, and vertically disposed crane supporting plate means 74 rigidly connected to the under side of boom member 54 and having a rearwardly extending portion 76 which is adapted to receive a vertically extending pivot shaft 78. The crane assembly 52 is rotatably mounted on shaft 78 for rotative movement therewith. Support plate 36 defines an opening 79 in the upper portion thereof which permits the rear end of boom assembly 54 to rotate freely without interference.

The shaft 78 is mounted for rotation in a pair of vertically spaced and forwardly extending bearing members 80 and 82 which are rigidly connected to support plate 36. The lower portion of pivot shaft 78 extends through the bearing 82 and portion 76 of support plate means 74, and the upper portion thereof extends through bearing 80 and a collar 84 to which collar the shaft is attached by a pin 86, said collar being fixed to a transverse plate 88 of boom assembly 54.

A pair of hydraulic cylinder and piston assemblies 90 and 92 are disposed on opposite sides of the crane assembly and are connected to upper opposite sides of plate 36 by a pair of yoke and pin means 94 and to opposite sides of boom assembly 54 at the piston rod ends thereof by a pair of bracket and pin means 96.

The fixed boom assembly 54 comprises a pair of laterally spaced facing channel members 98 and 100 which are held in fixed and rigid relation to each other by a plurality of longitudinally spaced and generally downwardly facing C-shaped clamp members 102, 103 and 104. Additional rigidity may be afforded the boom assembly 54 by means of a connecting plate member, such as 106, between portions of the upper flanges of channel members 98 and 100.

The C-clamp 104 is mounted at the forward end of boom assembly 54 by means of pairs of vertically spaced and longitudinally extending bracket members 108 and 110. Attached to the forward surface of C-clamp 104 are a plurality of pairs of upper and lower laterally spaced and forwardly extending bracket members 112. Each pair of such bracket members is adapted to receive a stub shaft 114 on which is mounted a roller 116. The members of an additional pair of such brackets are located in vertically spaced relation on each of the opposite sides of the clamp 104 for receiving elongated shaft and roller members 118 and 120, respectively. A portion of the

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periphery of each roller 116 is located a predetermined distance inwardly of the inner surface of the channel member flange adjacent thereto, and a portion of the periphery of each roller 120 is located a predetermined distance inwardly of the inner surface of the channel member web adjacent thereto.

The movable boom assembly 56 comprises a pair of laterally spaced facing channel members 122 and 124 which are substantially smaller in cross section than channels 98 and 100 and which are adapted to be telescopically received within boom assembly 54 in inwardly spaced relation to the inner surfaces of channel members 98 and 100. The channel members 122 and 124 are maintained in fixed relation to each other by means of opposite end plate members 126 and 128. On the rear surface of connecting plate 128 (see FIG. 4) are mounted a pair of vertically spaced, horizontally extending, and rearwardly projecting bracket members 130 and 132 from which upwardly and downwardly project, respectively, pairs of laterally spaced off-vertical bracket means 134 and 136, respectively.

Mounted in each of the brackets 134 and 136 is a cocked off-vertical roller 138, each of which is adapted to roll on its periphery on the adjacent inner surface of the flanges of channel members 98 and 100. Mounted on vertically extending stub shafts 140 and 142, which are received by openings in bracket members 130 and 132, are roller members 144, which are adapted to roll on the respective inner surfaces of the webs of channel members 98 and 100. A semi-circular opening is formed in the upper portion of connecting plate 128 so that cylinder means 58 may extend therethrough. The rollers 138 are cocked in such a manner that each is adapted to roll in full surface engagement with the adjacent inner surface of the flange of channel members 98 and 100. The rollers 144 at the rear end of boom assembly 56 are mounted to cooperate with the rollers 120 which are located at the forward end of said boom assembly such that the webs of the channel members 122 and 124 of said boom assembly are laterally positioned and supported a predetermined distance inwardly of channel members 98 and 100. Each of the rearwardly mounted rollers 138 is adapted to cooperate with one of the forwardly mounted rollers 116 so as to support the flange sections of channel members 122 and 124 inwardly of the inner surfaces of the flange sections of channel members 98 and 100. It will be noted (FIGS. 3 and 4) that the rollers mounted on C-clamp 104 abut the outer surfaces of channel members 122 and 124, whereas the rollers mounted on the plate member 128 at the rear end of boom assembly 56 abut the inner surfaces of channel members 98 and 100.

By means of such construction it will be apparent that we have provided a telescoping crane which is adapted to operate with a high degree of stability and with a minimum amount of friction during relative movement of the boom assemblies 54 and 56. The boom assembly 56 at all times is maintained in substantially fixed axial alignment with the boom assembly 54 due to the fact that each of the rollers 116 cooperates with the nearest roller 138, and each of the rollers 120 cooperates with the nearest roller 144, to provide a plurality of force couples which resist in both horizontal and vertical planes any force which tends to misalign the movable and fixed boom assemblies.

The end of piston rod 148 of hydraulic cylinder and piston assembly 70 is threaded to engage a tapped opening in the center portion of a transversely extending sheave support member 149, the ends of which are of reduced cross-section and are mounted for sliding movement in inwardly opening track means which are formed by longitudinally extending pairs of bars 150 and 151. The pairs of bars 150 and 151 are suitably attached, as by welding, to opposite inner surfaces of the webs of channel members 122 and 124, respectively. The mem-

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bers comprising each pair of bars are vertically spaced to form longitudinally extending track means therebetween along which the sheave support member 149 is actuatable. Mounted on a shaft 152 is a pair of sheaves 156 and 158; the shaft 152 is supported at the opposite ends thereof by a pair of longitudinally extending brackets 159 which may be made integral with the support member 149. Whenever the cylinder assembly 70 is energized to extend piston rod 148, the sheaves 156, 158 and shaft 152 may be actuated longitudinally along the track formed by the said pairs of bars from a maximum forward position to the maximum rearward position thereof, as indicated in FIGURE 1.

The inverted Y-shaped saddle means 64 terminates at the upper end thereof in outwardly flared and longitudinally extending portions 160 and 162 (FIG. 5), which portions are suitably attached, as by welding, to the lower flanges of channel members 122 and 124. A transverse stub shaft 164 is mounted between vertical plate portions of the downwardly depending saddle 64 and carries thereon a pair of laterally spaced sheaves 166 and 168. Attached to and extending transversely of downwardly diverging portions of the saddle member 64 are a pair of longitudinally spaced V-shaped members 170 and 172. The legs of member 172 converge at a sharper angle than do the legs of member 170 so that the apex of member 172 is vertically above the apex of member 170. The downwardly diverging portions of the saddle member 64 are provided with a plurality of openings 174 to minimize the weight thereof. Downwardly depending structural strengthening members 178 and 180 extend transversely of saddle member 64 and are attached, as by welding, to opposite sides thereof.

The load engaging hairpin-shaped hook member 66 is pivotally suspended at the upper leg thereof from a pivot pin 184 which extends between the legs of an inverted U-shaped bracket 186. The bracket 186 is mounted to swivel in a horizontal plane on a pin 188 which depends from the underside of a sheave housing 190. Within housing 190 is suitably mounted a sheave, not shown, which is located in a plane transverse to the planes of the aforementioned double sheaves. An anchor block 192 extends transversely of the boom assembly 56 and is secured at its opposite ends to the webs of channel members 122 and 124. Secured to the anchor block 192 are laterally spaced ends of the chain 68 which extends rearwardly over sheave 156 from its one end connection, thence forwardly over the sheave 166, then downwardly under the sheave housed in member 190, and finally upwardly over sheaves 168 and 158 to its other end connection on anchor block 192. A longitudinally extending shaft or bolt 195 is supported at its opposite ends by members 178 and 180, and functions to guide spaced portions of chain 68 which are disposed on opposite sides of the shaft. The ends of chain 68 are anchored to block 192 by means of a transversely extending pin 193. It will be readily seen that the above described chain and sheave arrangement enables the hook means 66 to be raised or lowered at twice the rate of movement of piston rod 148; this results in a very compact construction in which the length of cylinder and piston assembly 70 tends to be minimized for any given desired vertical traverse of hook means 66.

In operation, an industrial truck or other vehicle with which the present invention may be associated may be maneuvered to the vicinity of a load to be transported from one location to another. Normally, the crane assembly is positioned axially of the supporting vehicle by cylinder and piston assemblies 90 and 92, the inner boom assembly 56 is held in a retracted position by cylinder and piston assembly 53, and the load hook 66 is held securely within the apex portions of inverted V-shaped members 170 and 172 of saddle 64. If it is found necessary to engage a load which is angularly displaced from the center line of the vehicle, cylinder and piston assem-

blies 90 and 92 may be energized by operator-control and pump means, not shown, to simultaneously extend one of the piston rods and retract the other, depending on the desired direction of rotation of the crane assembly. Simultaneously with the rotation of the crane movable boom assembly 56 may be extended by cylinder assembly 58. The piston rod of cylinder assembly 70 may be retracted to any selected position between full extension and full retraction thereof so as to slacken the chain 68 and permit the hook member 66 to drop vertically. When the hook is lowered to any position out of saddle 64 it may be pivoted in a vertical plane about pin 184 and may be swivelled a full 360° about pin 188.

Once having engaged a load, the hook may be actuated upwardly into the saddle 64 by extension of the piston rod 148 to the position shown in FIG. 1. It will be noted that the inverted V-shaped members 170 and 172 provide downwardly sloping sides which function as cam surfaces, whereby the ends of the upper leg of load hook 66 are automatically guided into the apex of the V-shaped stabilizing members during extension of piston rod 148.

From the above it will be now apparent that we have provided an extensible boom construction which is useful in numerous load handling operations and which provides a unique roller construction associated with the fixed and movable boom members for maintaining same in spaced relation to one another, whereby to minimize friction during telescopic movement between the boom members. The construction also provides vertically and horizontally acting force couples which resist other forces which act on the movable boom assembly and tend to misalign the desired coaxial relation of the fixed and movable boom assemblies.

Now, while we have shown and described what we believe to be a preferred embodiment of our present invention, it will be understood that various modifications and rearrangements may be made therein without departing from the spirit and scope of our present invention.

We claim:

1. A crane assembly comprising fixed boom means having a pair of elongated channel members disposed in parallel facing relation and a C-shaped member embracing the top and sides of said channel members for holding said channel members in fixed laterally spaced relation, a movable boom means telescopically disposed within the fixed boom means having a pair of elongated channel members disposed in parallel facing relation and brace means holding said latter channel members in fixed laterally spaced relation, a plurality of first rollers mounted adjacent the forward end of said fixed boom means for rotation about both substantially horizontal and vertical axes, a portion of the peripheries of such rollers extending into the space between said first channel members for abutting adjacent exterior surfaces of said movable boom means, a plurality of second rollers mounted adjacent the opposite end of said second boom means, a portion of the peripheries of said second rollers extending into the space between said first channel members for abutting adjacent interior surfaces of said fixed boom means, said first and second rollers cooperating to maintain said movable boom means in inward spaced relation to said fixed boom means and providing vertically and horizontally acting force couples

resisting forces acting on said movable boom means which tend to deflect said latter boom means relative to said fixed boom means, a double-acting fluid actuator connected between said fixed and movable boom means for moving said movable boom means between a retracted position and an extended position, and load engaging means depending from said movable boom means and located between and intermediate the ends of the channel members of said fixed boom means when said movable boom means is in retracted position.

2. A crane assembly as claimed in claim 1 wherein each of said channel members includes web and flange portions, said first rollers abutting the webs and flanges of said pair of movable channel members and said second rollers abutting the webs and flanges of said pair of fixed channel members.

3. A crane assembly as claimed in claim 1 wherein said first rollers include four rollers which are adapted to rotate about substantially horizontal axes, and said second rollers include four rollers which are adapted to rotate about axes biased relative to the horizontal, said first and second rollers also each including additional rollers adapted to rotate about substantially vertical axes.

4. A crane assembly comprising fixed boom means having a pair of elongated channel members disposed in parallel facing relation and first brace means embracing the top and sides of said channel members, said channel members forming an unobstructed longitudinal opening along at least a portion of the lower side thereof, a movable boom means telescopically disposed within the fixed boom means having a pair of elongated channel members disposed in parallel facing relation and brace means holding said latter channel members in fixed laterally spaced relation, a plurality of first rollers mounted adjacent the forward end of said fixed boom means, a portion of the peripheries of such rollers extending into the space between said first channel members for abutting adjacent exterior surfaces of said movable boom means, a plurality of second rollers mounted adjacent the opposite end of said second boom means, a portion of the peripheries of said second rollers extending into the space between said first channel members for abutting adjacent interior surfaces of said fixed boom means, said first and second rollers cooperating to maintain said movable boom means in inward spaced relation to said fixed boom means and providing vertically and horizontally acting force couples resisting forces acting on said movable boom means which tend to deflect said latter boom means relative to said fixed boom means, an actuator connected between said fixed and movable boom means for moving said movable boom means between a retracted position and an extended position, and load engaging means depending from said movable boom means and located in said longitudinal opening between said first channel members when said movable boom means is in a retracted position.

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