

Dec. 19, 1944.

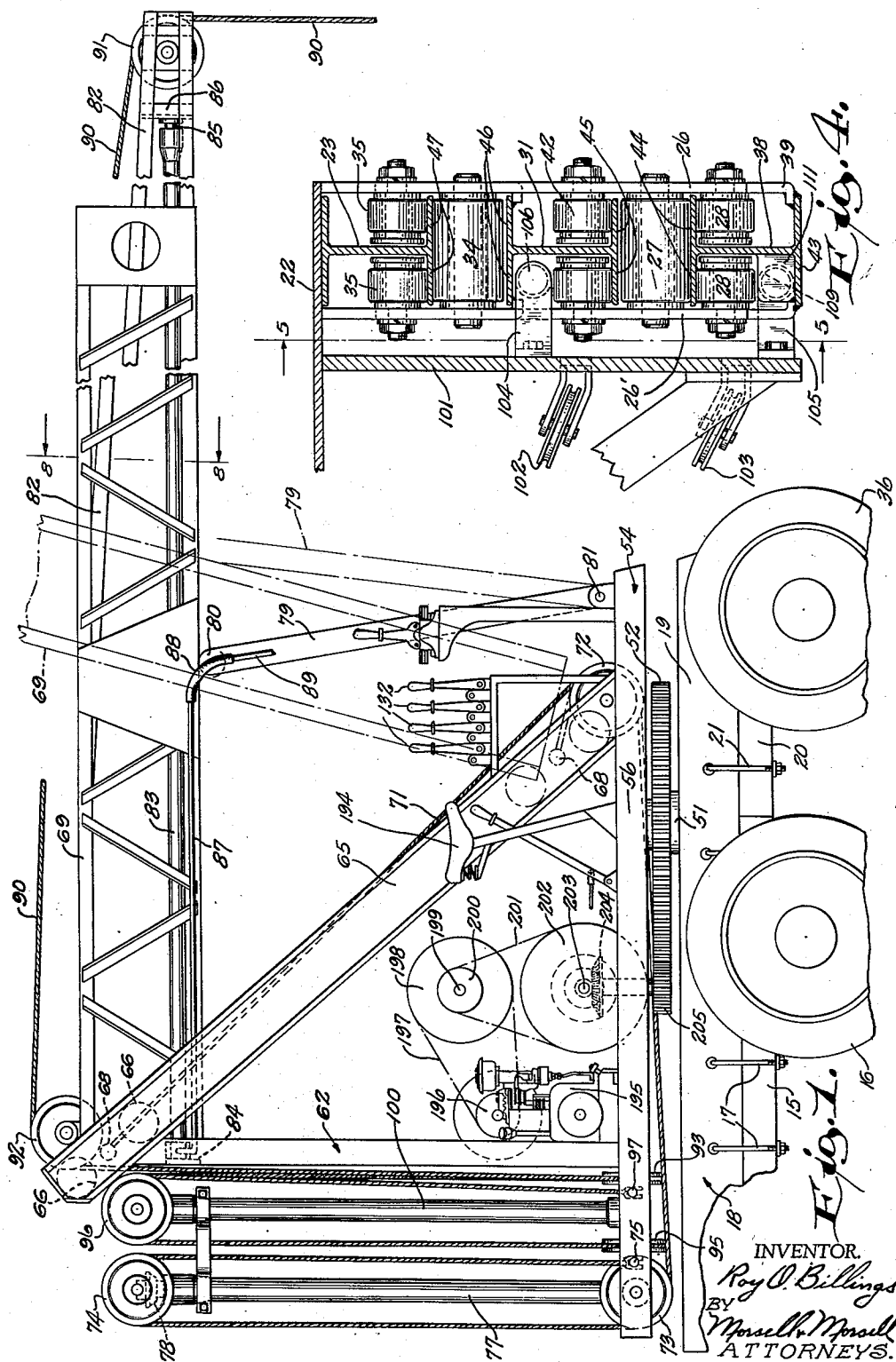
R. O. BILLINGS

2,365,167

TRUCK CRANE

Filed Sept. 2, 1942

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Dec. 19, 1944.

R. O. BILLINGS

2,365,167

TRUCK CRANE

Filed Sept. 2, 1942

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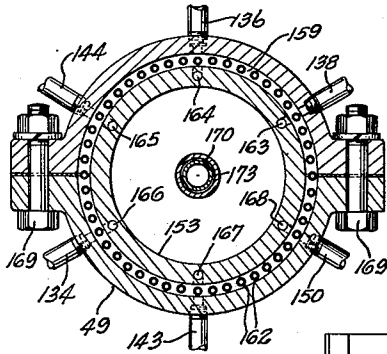


Fig. 12.

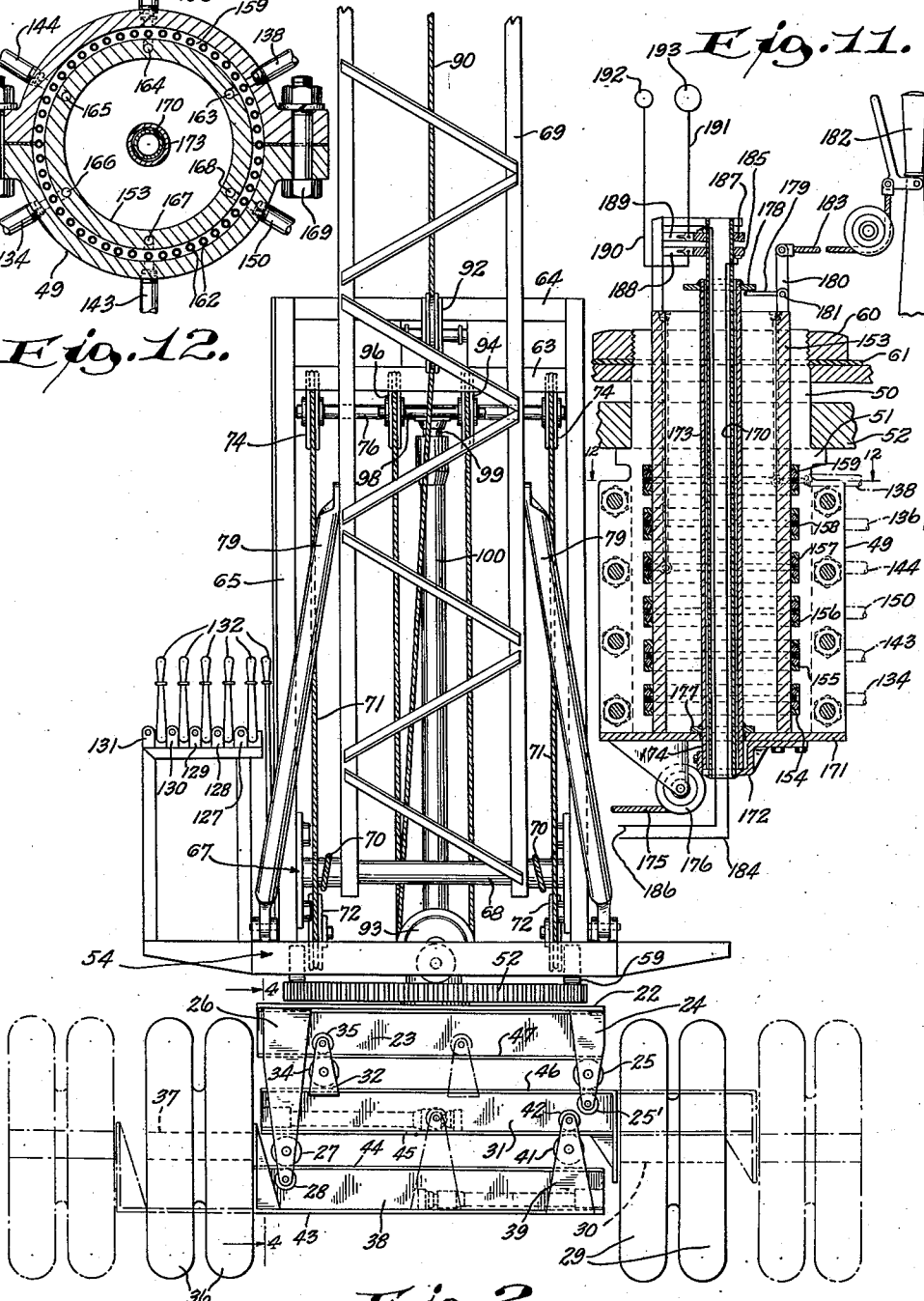


Fig. 2.

INVENTOR.

Roy O. Billings

BY

Morsell & Morsell
ATTORNEYS.

Dec. 19, 1944.

R. O. BILLINGS

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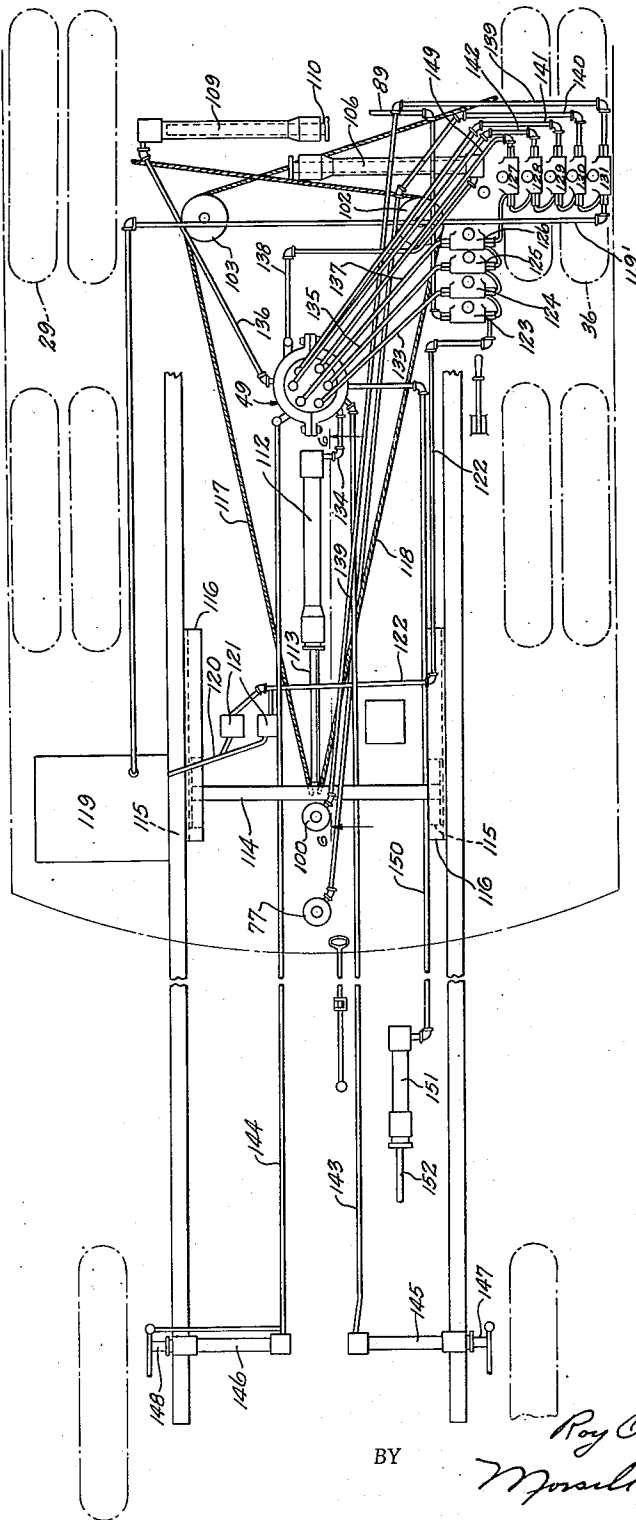


Fig. 3.

INVENTOR.

Roy O. Billings

BY

Morsella Morsella
ATTORNEYS.

Dec. 19, 1944.

R. O. BILLINGS

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Fig. 9.

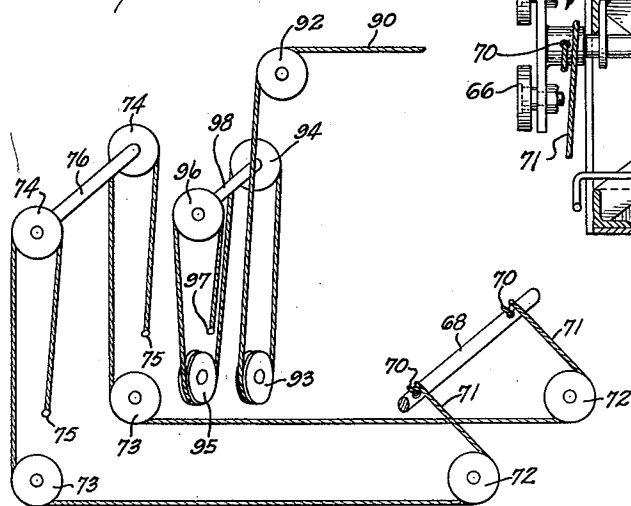


Fig. 7.

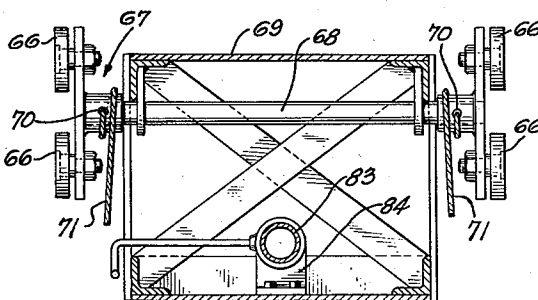


Fig. 5.

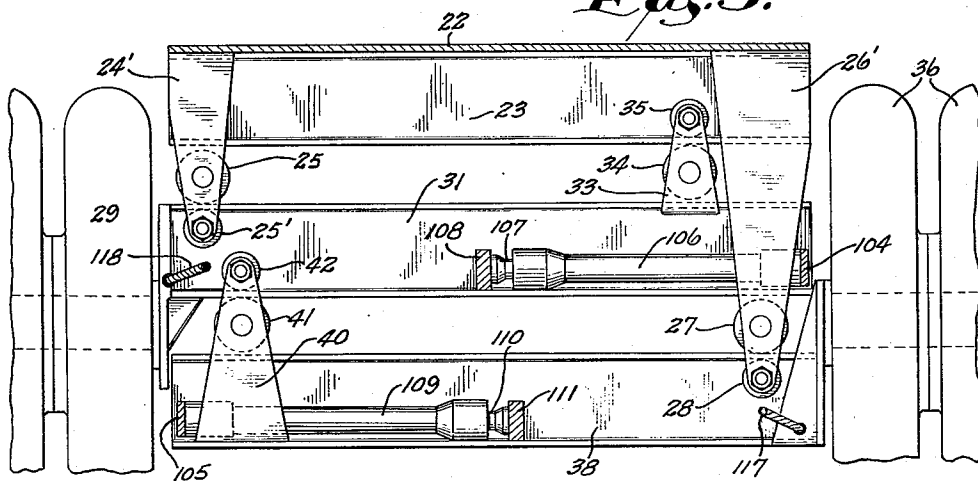
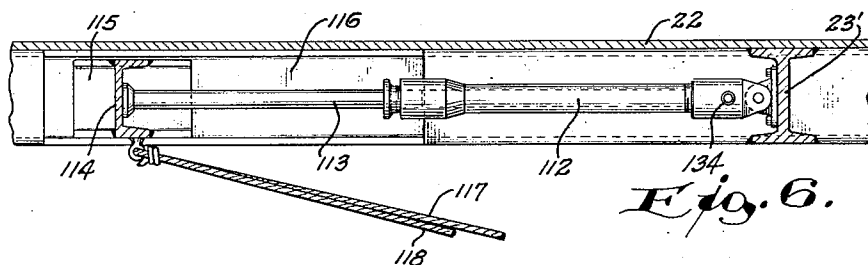


Fig. 6.



INVENTOR.

INVENTOR.
Ray O. Billings
Morsell & Morsell
ATTORNEYS

BY

Mossell & Mossell
ATTORNEYS

ATTORNEYS.

Dec. 19, 1944.

R. O. BILLINGS

2,365,167

TRUCK CRANE

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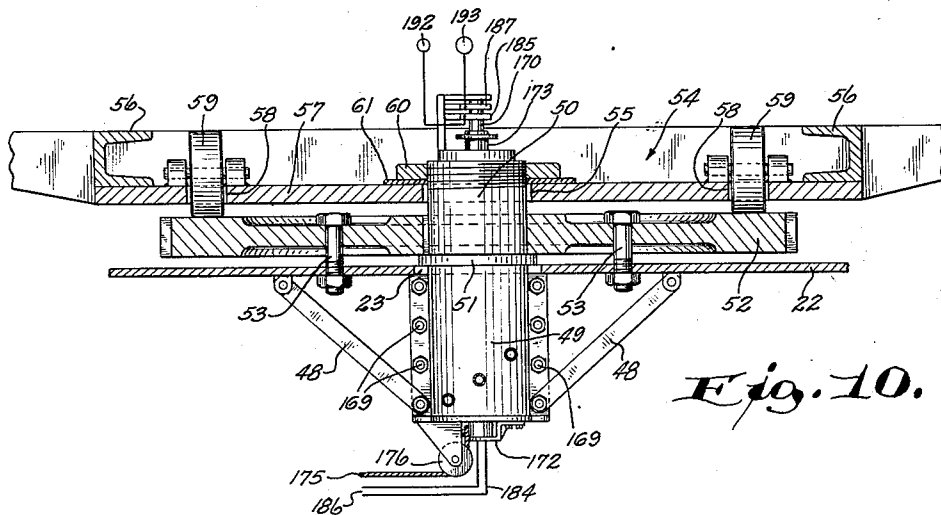


Fig. 10.

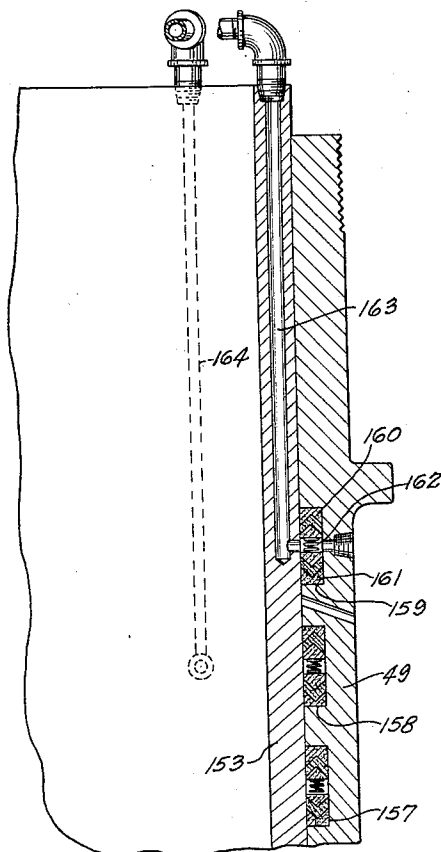


Fig. 13.

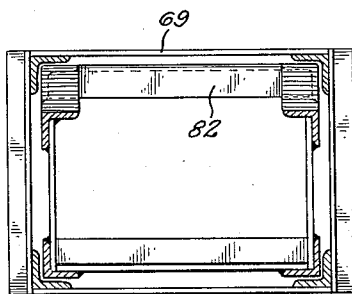


Fig. 8.

INVENTOR.
Roy O. Billings
BY
Mossell & Mossell
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,365,167

TRUCK CRANE

Roy O. Billings, Milwaukee, Wis.

Application September 2, 1942, Serial No. 457,052

27 Claims. (Cl. 212—55)

This invention relates to improvements in truck cranes.

Heretofore, in order to provide a truck crane it has been customary to mount the upper portion of a standard crane on a large-size truck, and because of the weight of the standard crane structure it has been considered necessary to use a seven-ton truck. The standard type of crane, however, has more power than can be utilized because when it is mounted on a truck there are definite limits as to the size of the load which can be safely handled. In practice, it has not been found practical to employ the crane for lifting more than six tons.

It is a general object of the present invention to provide an improved truck crane structure which can be designed to readily handle loads up to six tons, and to provide a structure wherein the crane is supported in a novel manner on a relatively small-size vehicle, such as a one-and-one-half ton tractor.

A further object of the invention is to make it possible to accomplish the above by the use of a crane structure wherein there is a ram operated telescoping boom and wherein a hydraulically operated cable and sheave means for controlling the boom load line and for controlling the angular raising and lowering of the boom is provided. Thus the structure eliminates the complicated drums, brakes, and clutches heretofore found necessary.

A further object of the invention is to provide a crane structure wherein the raising and lowering of the angular position of the boom may be accomplished with great rapidity, as distinguished from the slow manipulation resulting from the use of screw mechanism.

A further object of the invention is to provide a truck crane wherein the boom is mounted on a turntable and wherein novel means is employed for conducting hydraulic medium through a plurality of conduits extending through the axis of rotation for the turntable, without interfering with the rotating movement of the latter.

A further object of the invention is to provide a truck crane structure including longitudinally movable outrigger wheels and novel means for controlling the movement thereof.

With the above and other objects in view, the invention consists of the improved truck crane and all its parts and combinations as set forth in the claims, and all equivalents thereof.

In the accompanying drawings illustrating one complete embodiment of the preferred form of the invention, in which the same reference nu-

merals designate the same parts in all of the views,

Fig. 1 is a side elevational view of the improved truck crane, parts being broken away;

Fig. 2 is a rear elevational view of the truck crane, part of the boom being broken away and the dot-and-dash lines indicating an extended position for the outrigger wheels;

Fig. 3 is a partially diagrammatic top view of the truck crane showing more particularly the hydraulic connections and the outrigger wheel operating mechanism, the turntable and wheels being designated by dot-and-dash lines so as not to obstruct the showing of the other features;

Fig. 4 is an enlarged sectional view taken approximately on the line 4—4 of Fig. 2;

Fig. 5 is a sectional view taken approximately on the line 5—5 of Fig. 4;

Fig. 6 is a fragmentary longitudinal sectional view taken approximately at the location indicated by the line 6—6 in Fig. 3;

Fig. 7 is a transverse sectional view through the boom, looking at the inner end thereof and illustrating the supporting carriage attached to said end;

Fig. 8 is a transverse sectional view on an enlarged scale taken approximately on the line 8—8 of Fig. 1 and illustrating the telescoping arrangement for the boom extension;

Fig. 9 is a diagrammatic perspective view illustrating the cable and sheave arrangement for operating the boom and for operating the boom load line;

Fig. 10 is a transverse sectional view through the turntable structure, parts being broken away;

Fig. 11 is a vertical sectional view taken through the center pin, illustrating associated structure;

Fig. 12 is an enlarged sectional view taken approximately on the line 12—12 of Fig. 11; and

Fig. 13 is a fragmentary vertical sectional view through a portion of the center pin structure.

Referring more particularly to the drawings, the numeral 15 designates a rear portion of the chassis of a relatively small size tractor, such as a one-and-one-half ton tractor. The standard rear wheels 16 of the tractor are also indicated.

The auxiliary frame and outrigger

Mounted on top of the portions 15, and connected by means of bolts 17 or other suitable means, is an auxiliary frame 18. The auxiliary frame has a portion 19 which projects beyond the rear wheels 16 of the tractor and which sup-

ports an outrigger assemblage 20, the latter being connected by bolts such as those indicated at 21.

The auxiliary frame 18 as well as the rear extension 19 thereof may be provided with a top plate 22 (see Fig. 2) and there are also a plurality of transversely extending I-beams 23 for strengthening the top plate 22.

Referring to Figs. 2 and 4, there is a short arm 24 extending downwardly from the top plate 22 on the rear side of the rearwardmost I-beam 23 and a similar short arm 24' extending downwardly on the other side of the I-beam 23 (see Fig. 5). These arms 24 and 24' support a roller 25 and a smaller roller 25'.

Near the other end of the rearwardmost I-beam 23 is a longer downwardly extending arm 26 on one side of the I-beam and 26' on the other side of the I-beam (see Fig. 5). The arms 26 and 26' support near their lower ends rollers 27 and 28.

Wheels 29 on one side of the outrigger are supported on an axle 30, and said axle projects from a slide 31. The slide 31 has arms 32 and 33 rigidly secured thereto and projecting upwardly therefrom. These arms support rollers 34 and 35 therebetween. The wheels 36 on the other side of the outrigger are mounted on an axle 37, and said axle projects from a lower slide 38. The slide 38 has rigidly connected thereto upwardly projecting arms 39 and 40 carrying rollers 41 and 42 therebetween. The slide 38 is preferably of I-beam construction, as shown in Fig. 4, and includes bottom flanges 43, and top flanges 44 forming a rail. The slide 31 is also of I-beam construction and includes bottom flanges 45 and top flanges 46, both of which serve as rails. In addition, the bottom flanges 47 of the I-beam 23 serve as a rail. Referring to Figs. 2, 4, and 5, the bottom flanges 47 of the I-beam 23 slide between the rollers 34 and 35, and the top flanges 46 of the slide 31 slide between the rollers 25 and 25'. Thus through these two sets of rollers the slide 31 is supported for lateral sliding movement from the full-line position of Fig. 2 to the dot-and-dash line position therein to extend the outrigger wheels 29.

The bottom slide 38 has its top flanges 44 slidable between the rollers 27 and 28 carried by the arms 26 and 26' so that the slide 38 is supported from the top plate 22 and I-beam 23. In addition the bottom flanges 45 of the slide 31 slide between the rollers 41 and 42 carried by the arms 40. Thus the slide 38 may be moved laterally from the full line position of Fig. 2 to the dot-and-dash line position therein to extend the wheels 36.

The turntable

Secured to the bottom side of the top plate 22 of the auxiliary frame 18 by arms 48 is a hollow cylindrical center pin 49 (see Fig. 10). The center pin has an upper portion 50 which projects through and above the plate 22, there being an opening 23 in said plate. Just above the upper surface of the plate 22 there is an annular collar 51 on the center pin separating the portions 49 and 50 thereof. Connected to the portion 50 of the center pin is a ring gear 52, and said ring gear rests on the annular collar 51 and is additionally bolted as at 53 to the plate 22.

A turntable 54 forming a supporting frame for the crane structure has an opening 55 therein through which the portion 50 of the center pin projects, and the turntable is therefore rotatable around the center pin. The turntable includes side channels 56 and a bottom plate 57 having

openings 58 therein. Rollers 59 suitably supported on the plate 57 of the turntable project through the openings 58 to engage the top face of the ring gear 52. There are preferably four of such rollers utilized to furnish proper rolling support for the turntable. A nut 60 threaded on the upper end of the projecting portion 50 of the center pin presses a friction washer 61 loosely against the top side of the bottom plate 57 of the turntable. Thus as the turntable rotates it will rub on the bottom face of the washer 61.

The movable boom

Projecting upwardly from the turntable is a frame comprising spaced side members 62, (see Fig. 1), connected by a pair of transverse members 63 and 64 at the top (see Fig. 2). Angular guides 65, one on each side of the turntable, have their lower ends rigidly connected to the turntable and their upper ends rigidly connected to the upper portions of the vertical frame member 62. These guides have their inner faces channel-shaped to form tracks for the wheels 66 of a carriage 67 (see Fig. 7). The carriage includes a transverse rod 68 which extends rotatably through the inner end of the boom 69, as shown in Fig. 7, so that as the carriage moves from the dotted line position of Fig. 1 to the dot-and-dash line position therein the boom is moved from the substantially horizontal full-line position of Fig. 1 to the dot-and-dash line position therein.

Cables 71 connected to the boom carriage 67 as at 70 extend downwardly around sheaves 72 near the lower ends of the guides 65, and then forwardly to the bottom of sheaves 73 (see Figs. 1 and 9). The cables 71 then extend upwardly around sheaves 74 and then downwardly where the ends are dead-ended to the turntable frame as at 75.

The sheaves 74 are mounted on a common shaft 76. A hydraulic cylinder 77 has its lower end connected to the turntable frame and within said cylinder is a slidable ram 78, which has its upper end engaging the sheave-connecting shaft 76. When fluid is forced into the lower end of the cylinder 77 the ram 78 is pushed upwardly from the position of Fig. 1 to an elevated position, resulting in a pull upon the cables 71 and causing the boom to be pulled from the full line position of Fig. 1 to the dot-and-dash line position therein. Due to the fact that the boom when in the dot-and-dash line position of Fig. 1 is still inclined somewhat, the boom will tend to return by gravity to the full line position of Fig. 1. Thus when hydraulic pressure is released in the cylinder 77 the gravity actuated movement of the boom will return the ram 78 to the position shown in Fig. 1.

The boom portion 69 is additionally connected to the turntable by links 79 which are pivoted to the boom as at 80 and to the turntable as at 81.

For convenience in transportation the boom is formed in two telescoping parts; that is, there is a boom extension 82 which telescopes within the boom portion 69, the fully telescoped position being illustrated in Fig. 1. In order to bring about extension of the boom, there is a hydraulic cylinder 83 connected at its inner end as at 84 to the main boom portion 69. An extensible ram 85 engages the extensible section 82 of the boom through the bracket 86 so that when fluid is pumped under pressure into the cylinder 83 the ram 85 will be forced outwardly to cause an approximate doubling in the effective length of the boom. Hydraulic fluid may flow to the cylinder 83 through a conduit 87, and said conduit

may be connected by a flexible hose 88 near the pivot 80 with another conduit portion 89 leading to the hydraulic system.

The extended boom portion 82 may be retracted by gravity when the boom is in the dot-and-dash line position to force the ram 85 back into the cylinder and to force the hydraulic fluid out of the cylinder back through the lines 87, 88, and 89.

The boom load line

The boom load line comprises a cable 90 which may have its lower end connected to block and tackle, to a hook, or any other suitable lifting device. The load line extends over a pulley 91 on the outer end of the boom extension 82, around a pulley 92 supported on the frame 62 near the inner end of the boom portion 69, and then downwardly. The downwardly extending portion of the cable 90 extends around a bottom sheave 93 (see Fig. 9), upwardly around a sheave 94, downwardly again around a sheave 95, upwardly around a sheave 96, and then downwardly where its end is dead-ended to the frame as at 97.

The sheaves 94 and 96 are mounted on a common shaft 98, and the shaft 98 is engaged by the ram portion 99 of a hydraulic cylinder 100 (see Fig. 2). The lower end of the cylinder 100 is connected to the turntable. Thus when fluid under pressure is pumped into the cylinder 100 the ram 99 is elevated, raising the sheaves 94 and 96 and causing a pull on the load line cable 90. Due to the cable and sheave arrangement of Fig. 9, the effective pull on the cable 90 is multiplied several times. Thus the load line may be raised hydraulically by cable and sheave means without employing the usual drum. The weight of the load on the load line will tend to return the ram 99 to its position of Fig. 1 within the cylinder 100 when hydraulic pressure is released.

The outrigger wheel moving mechanism

Referring to Figs. 3, 4, 5, and 6, a transverse plate 101, which extends below the plate 22 (see Fig. 4) carries sheaves 102 and 103. This plate also carries brackets 104 and 105 which project into the I-beam slides 31 and 38. The bracket 104 supports the inner end of a hydraulic cylinder 106, and this cylinder has a movable ram 107 which engages a bracket 108 secured to the slide 31. As a result when hydraulic fluid is pumped into the cylinder 106 it causes the ram 107 to be extended to push the slide 31 from the full line position of Fig. 2 to the dot-and-dash line position therein.

The other bracket 105 similarly supports the inner end of a hydraulic cylinder 109 within the slide 38. This cylinder has a movable ram portion 110 which bears against a bracket 111 connected to the slide 38. When hydraulic fluid is pumped into the cylinder 109, the ram 110 is pushed outwardly, moving the slide 38 and wheels 36 from the full line position of Fig. 2 to the dot-and-dash line position therein.

Another hydraulic cylinder 112 extending longitudinally of the tractor, as shown in Fig. 3, has its inner end suitably connected to the plate 22 through one of the transverse bracing I-beams 23', as shown in Fig. 6. The hydraulic cylinder 112 has a movable ram portion 113 which presses against the transverse portion of a slide 114. The slide 114 extends transversely of the tractor, as indicated in Fig. 3, and has its ends fitted with sliding plates 115, which slide in guiding chan-

nels 116. A cable 117, which is connected to the slide 114, extends around the pulley 103, as shown in Fig. 3, and has its other end connected to the outrigger slide 38. Another cable 118, also connected to the slide 114 of Fig. 6, extends around the pulley 102 and has its other end connected to the outrigger slide 31.

Thus after the outrigger wheels have been extended to the dot-and-dash line position of Fig. 2, they may be returned to normal position by creating hydraulic pressure in the cylinder 112 to cause the ram 113 and slide 114 to be moved to the positions of Figs. 3 and 6. This causes a pull on the cables 117 and 118 and returns the wheels to the full line position of Fig. 2. During this operation it is of course necessary for hydraulic pressure to be released in the hydraulic cylinders 106 and 109.

Referring to Fig. 3, there is supported on one of the side wings of the turntable an oil reservoir 119. Oil from the reservoir is conducted by a conduit 120 through suitable fluid pumps 121 into a line 122. The line 122 connects with the first valve 123 of a series of valves. The series of valves includes valves 123 to 131 inclusive. These valves are operated by individual manual control levers 132, as shown in Fig. 2. When the lever for the valve 123 is moved to a position to open said valve, liquid under pressure flows from the valve through line 89 into line 87 leading to the hydraulic cylinder 83 of the boom. Thus the valve 123 controls the telescoping of the boom extension 82.

If the valve 124 is opened, oil under pressure flows through the line 133, through the turntable center pin conduits, and out below the turntable into line 134 leading to the hydraulic cylinder 112. Thus the valve 124 controls the operation of the outrigger wheel return ram 113. When the valve 125 is opened, hydraulic fluid under pressure flows through the line 135, through the turntable center pin conduits, and out beneath the turntable through conduit 136 to the outrigger wheel cylinder 109. To cause operation of the outrigger slide 38, the valve 126 when open allows hydraulic fluid under pressure to flow through the line 137, down through the center pin conduits, and out beneath the turntable through conduit 138 leading to the hydraulic cylinder 106 for the outrigger slide 31.

When the valve 131 is opened, hydraulic fluid under pressure can flow through the line 139 which extends above the turntable, directly to the cylinder 100, which operates the ram for the boom load line through movement of the sheaves 94 and 96. Similarly, when the valve 130 is opened, oil can flow through the line 140 which leads directly to the cylinder 77 for operating the sheaves 74. The valves 129 and 128 are connected by lines 141 and 142 with center pin conduits, and these conduits connect with lines 143 and 144 respectively beneath the turntable which lead to hydraulic cylinders 145 and 146. These cylinders have rams 147 and 148 which are suitably connected with the front wheel steering gear to steer the vehicle. The valve 127 controls the flow of hydraulic fluid through a line 149. This line leads down through the center pin conduits to a line 150 which connects with a hydraulic cylinder 151. The latter cylinder operates a ram 152 which may control the clutch of the tractor engine. When the valves 123 to 131 are all closed and the hydraulic pumps are operating, fluid may

be by-passed back to the reservoir 119 through by-pass line 119'.

All of the hydraulic cylinders described herein may be built according to the principles described and shown in pending application Serial No. 450,974, filed July 15, 1942.

When hydraulic fluid is forced by the pumps 120 and 121 into a particular cylinder to extend the ram therein, the valve 123 to 131 being used is in open position. These are standard three-way valves and also have a neutral position which serves to lock the fluid in the cylinder to prevent retraction of the ram. The third valve position is the ram return position, and a particular valve is shifted to this position just prior to causing return of the ram. When in this position the oil in the particular cylinder is forced out of the cylinder, back through the valve and into the line 119' leading back to the oil reservoir 119. The pumps 120 and 121 may be continuously operating so that when none of the valves are open fluid is merely returned back through the line 119' to the reservoir.

The center pin conduits

Referring to Figs. 10 to 13 inclusive, there is rotatably mounted within the center pin 49 an oil directing cylinder 153. The inner surface of the center pin 49 is formed with a plurality of vertically spaced annular grooves 154 to 159 inclusive. Within each annular groove are two sets, 160 and 161, of packing. This packing comprises a plurality of layers, each approximately V-shaped in cross-section, as shown in Fig. 13, and a plurality of coiled expansion springs 152 maintain the sets of packing 160 and 161 spaced apart. Thus in each of the grooves 154 to 159 is an annular space containing springs through which oil may flow. The springs not only serve to maintain these annular oil spaces but also cause the packing rings to bear more tightly against the side of the cylinder 153.

The top of the inner cylinder 153 has a plurality of downwardly extending oil ducts 163, 164, 165, 166, 167, and 168 therein. The duct 163 has its lower end communicating with the oil space of the groove 159, the duct 164 has its lower end in communication with the oil space of the annular groove 158, the duct 165 has its lower end in communication with the oil space of the groove 157, the duct 166 has its lower end in communication with the oil space of the groove 156, the duct 167 has its lower end in communication with the oil space of the groove 155, and the duct 168 has its lower end in communication with the oil space of the groove 154. Inasmuch as these oil spaces and grooves are circular, the vertical ducts are in communication with their respective grooves in any position of rotation of the cylinder 153 within the center pin 49.

As illustrated in Fig. 12, the center pin also has a radial bore communicating with each of the annular oil grooves 154 to 159 inclusive, and to these radial bores are connected the conduits 136, 144, 134, 143, 150, and 138 leading to the various hydraulic cylinders beneath the turntable. The center pin 49 is preferably formed in two half shell sections bolted together as at 169.

Referring to Fig. 11, there is disposed axially within the oil conducting cylinder 153 a tube 170. This tube has its lower end extending through an opening in a bottom plate 171 and secured to a bracket 172. Slidable on the tube 170 is a sleeve 173, which has a portion projecting slidably through the opening in the bottom plate 171. The

lower end of this extension is connected to a cable 175 guided around an idler pulley 176. The cable 175 may extend to the throttle on the carburetor of the tractor. There is also a stop collar 177 welded to the sleeve 173, which limits downward movement of the latter. At the upper end of the sleeve is another welded collar 178. This collar is adapted to be engaged by a part 179 of a bell crank 180. The bell crank in turn is pivotally connected as at 181 to the top of the cylinder 153. A hand lever 182 suitably connected by a cable 183 with the bell crank 180 serves to impart vertical movement to the sleeve 173 for the purpose of controlling the throttle from on top of the turntable. In addition to the above, an electric wire 184 extending from the self starter for the tractor extends upwardly through the tube 170 and is electrically connected to a fixed contact ring 185 surrounding the upper end of the tube 170. Another electric wire 186 extends upwardly through the tube 170 and is electrically connected to another contact ring 187. The rings 185 and 187 engage brushes 188 and 189 respectively which rotate with the cylinder 153 and with the turntable. Wires 190 and 191 leading from these brushes extend to a starter button 192 and to an ignition switch 193 which are conveniently mounted on the turntable. Thus the starting of the tractor, and the hydraulic steering thereof through the steering cylinders 145 and 146 may be controlled by an operator seated on the seat 194 of the turntable. In addition this operator may hydraulically control the clutch of the tractor engine through the hydraulic lines leading to the engine clutch cylinder.

Referring to Fig. 1, there is a gasoline engine 195 mounted on the turntable having a driving connection through sprocket 196, endless chain 197, and sprocket 198 with a shaft 199. The shaft 199 in turn drives a smaller sprocket 200 which is connected by an endless chain 201 with a sprocket 202 mounted on a shaft 203. The shaft 203 has a bevel gear thereon driving a bevel gear 204 which is rigidly connected to a vertical shaft driving a pinion 205. The pinion 205 engages the stationary ring gear 52 so that when the pinion is rotated the turntable rotates around the ring gear. The gasoline engine 195 may also be employed for driving the hydraulic pumps 120 and 121.

The operation

In use of the improved tractor crane, the crane may of course be transported to a desired location by running the tractor in the usual manner. When actually working on a location, the operator seats himself on the turntable seat 194 where he can both operate and steer the tractor and operate the crane.

The first operation is to open the valves 125 and 126. This causes the rams in the cylinders 106 and 109 to be extended to push the outrigger wheels from the full line position of Fig. 2 to the dot-and-dash line position therein. This extension of the outrigger wheels is best accomplished while the tractor is moving along slowly. With the outrigger wheels extended, a much firmer support is afforded for the operation of the crane. Next the operator opens the valve 123 to cause the boom section 82 to be extended. The valve 123 is then placed in neutral or holding position. Following this the valve 130 may be opened to cause flow of hydraulic fluid into the cylinder 77, and extension of the sheaves 74. This causes a pull on the cable 71 and an elevat-

ing of the boom to a desired angular position, such as the dot-and-dash line position of Fig. 1. When the desired angular position has been obtained, then the valve 130 is placed in neutral or holding position. Next the valve 131 may be opened to cause a flow of hydraulic fluid into the cylinder 100 and raising of the sheaves 94 and 96 to bring the block and tackle or hook on the suspended portion of the cable 90 to the desired working position. By fully extending the ram in the cylinder 100, the load may be raised to a maximum elevation. If it is then desired to again lower the load line 90, the valve 131 may be placed in reverse position and the weight of the load will cause a lowering of the sheaves 94 and 96 and will force fluid from the cylinder 100 back into the reservoir. In case the weight of the load is insufficient, the shaft 98 connecting the sheaves 94 and 96 may be weighted. During these operations the clutch connected with the engine 195 may be operated to swing the turntable to a desired position of rotation.

When the work is finished and it is desired to return the boom to telescoped position, this is best accomplished by having the boom in the dot-and-dash line position of Fig. 1. Then, with the valve 123 shifted to reverse position, the weight of the boom section 82 will push the ram 85 back into the cylinder 83 and the hydraulic fluid from the cylinder will flow back to the fluid reservoir 119. After the boom has been telescoped, then the valve 130 may be placed in reverse position and gravity will cause the boom to swing from the dot-and-dash line position of Fig. 1 to the full line position therein. This of course causes the ram 78 of the cylinder 77 to be pushed back to the position of Fig. 1, and the fluid from the cylinder 77 flows back into the oil reservoir 119.

To return the outrigger wheels to normal driving position, the valves 125 and 126 are first shifted to reverse position and then the valve 124 is opened to cause a flow of oil under pressure to enter the outrigger return cylinder 112. This acts through the slide carriage 114 to exert a pull on the cables 117 and 118, which cables in turn pull the outrigger slides 31 and 38 back to the full line position of Fig. 2. During this operation the oil from the cylinders 106 and 109 is returned to the reservoir 119.

It is obvious, therefore, that a light weight but efficient crane structure has been provided which can be mounted on a relatively small tractor and which can be operated by one man. It is also obvious that due to the hydraulic arrangement for controlling the angular position of the boom, a fast acting boom is made possible. Heretofore the angular position of a boom has been commonly changed through the use of a slow acting screw. The novel hydraulic operation for the load line is also fast acting and is more powerful and efficient than the drum arrangement commonly employed. Due to the novel center pin arrangement including the cylinder 153 for the hydraulic conduits which is rotatable within the center pin 49, the hydraulic operation is made possible in a turntable mounted crane, and it is possible to conduct hydraulic fluid both to locations above or below the turntable without interfering with the rotation of the latter and even while the turntable is rotating.

Although only one form of the invention has been shown and described, it is obvious that various changes and modifications may be made without departing from the spirit of the inven-

tion, and all of such changes are contemplated as may come within the scope of the claims.

What I claim is:

1. In a crane or the like having a frame, a boom mounted on said frame for pivotal movement in a vertical plane, a guiding sheave at the outer end of said boom movable with the boom, a guiding sheave mounted on the frame near the inner end of the boom, a load line cable having an anchored end and having a load lifting portion guided over the guiding sheaves, spaced sheaves, at least one of which is movable, carried by the frame cooperable with a portion of the cable between the anchored end and the guiding sheaves to exert a pull on the load lifting portion of the cable when the movable sheave is moved away from the other of said spaced sheaves on the frame, and means on the frame for causing movement of said movable sheave.

2. In a crane or the like having a supporting frame, a boom mounted on said frame for pivotal movement in a vertical plane, a pair of sheaves supported on said frame, a hydraulic ram having one end connected to said frame and having a movable portion, a pair of sheaves supported on said movable portion of the hydraulic ram in spaced relation from the first pair of sheaves, and a load line cable having a load lifting end and having its opposite end fixed relative to said supporting frame and then extending upwardly to one of the sheaves on the movable portion of the ram, downwardly to one of the sheaves supported on the frame, upwardly to the other sheave on the movable portion of the ram, and downwardly to the other sheave on the frame whereby operation of the ram will cause a pull of multiple length on the cable to lift objects, a guiding sheave supported at an elevation above the frame, and a guiding sheave on the outer end of the boom, the load lifting end of the cable being guided over said guiding sheaves.

3. In a crane or the like having a frame, a boom mounted on said frame for pivotal movement on an intermediate fulcrum to change the boom angle in a vertical plane, a cable having one end secured to the inner swingable end portion of the boom and having its other end anchored, sheaves, at least one of which is movable, carried by the frame and positioned to be cooperable with a portion of the cable between the anchored end and the boom secured end to exert a downward pull on the latter portion of the cable and cause downward movement of the inner end of the boom when the movable sheave is moved away from the other sheave, and means for causing movement of said movable sheave.

4. In a crane or the like having a frame, a boom mounted on said frame for pivotal movement to change the boom angle, a cable having one end secured to a swingable portion of the boom and having its other end anchored, sheaves, at least one of which is movable, carried by the frame and cooperable with a portion of the cable between the anchored end and the boom secured end to exert a pull on the latter portion of the cable when the movable sheave is moved away from the other sheave, and a hydraulic ram for causing movement of said movable sheave.

5. In a crane or the like having a frame, a boom, means projecting upwardly from the frame and permanently pivotally connected to the boom outwardly of its inner end to provide for angular swinging movement of the boom in a vertical plane, a track extending angularly upwardly from the frame, means on the inner end of the boom

engageable with said track to move longitudinally thereof, and means including a cable and sheaves for exerting a downward pull on said track engaging means to cause angular movement of the boom.

6. In a crane or the like having a frame, a boom, means projecting upwardly from the frame and pivotally connected to the boom outwardly of its inner end to provide for angular swinging movement of the boom in a vertical plane, a track extending angularly upwardly from the frame, a carriage on the inner end of the boom cooperable with said track, and hydraulically operated means including a cable and sheaves for exerting a pull on said carriage to cause angular movement of the boom.

7. In a vehicle having lifting mechanism thereon, wheels for said vehicle including a set positioned below the portion of the lifting mechanism where greatest tilting strains occur, hydraulic rams for laterally spreading the wheels of said set, and cable means for returning said wheels and rams to normal position, and means for exerting a pull on said cable means.

8. In a vehicle, a turntable mounted on said vehicle, lifting mechanism on said turntable, manual controls on the turntable for said lifting mechanism, wheels for said vehicle including a set positioned below the portion of the lifting mechanism where greatest tilting strains occur, means controlled from the turntable for spreading the wheels of said set, and means controlled from the turntable for returning said wheels to normal position.

9. In a vehicle having a frame portion, a turntable mounted on said frame portion, hydraulically operated members on the vehicle frame, hydraulically operated lifting mechanism on the turntable, hydraulic control valves on the turntable, means for conducting hydraulic fluid under pressure from said control valves to the hydraulically operated lifting mechanism on the turntable, a hollow cylindrical center pin projecting upwardly from the vehicle frame around which said turntable rotates, an inner cylindrical member rotatable with the turntable and within said center pin, and means including registering ducts in said inner cylindrical member and center pin for conducting hydraulic fluid from said control valves on the turntable to said hydraulically operated members on the vehicle frame.

10. In a device including hydraulically operated units and having a frame, a turntable mounted on said frame, a hollow cylindrical center pin projecting upwardly from the frame around which said turntable rotates, an inner cylindrical member rotatable with the turntable and within said center pin, and means including registering ducts in said inner cylindrical member and center pin for conducting hydraulic fluid to said hydraulically operated units, the ducts in the inner cylindrical member having longitudinally spaced radially extending ports, and the ducts in the center pin including spaced annular grooves on the inner wall surface of the center pin, each groove registering with one of said radial ports of the inner cylindrical member.

11. In a device including hydraulically operated units and having a frame, a turntable mounted on said frame, a hollow cylindrical center pin projecting upwardly from the frame around which said turntable rotates, an inner cylindrical member rotatable with the turntable and within said center pin, and means including registering ducts in said inner cylindrical member and center pin

for conducting hydraulic fluid to said hydraulically operated units, the ducts in the inner cylindrical member having longitudinally spaced radially extending ports, and the ducts in the center pin including spaced annular grooves on the inner wall surface of the center pin, each groove registering with one of said radial ports on the inner cylindrical member, there also being two sets of packing rings in each annular groove, and means for maintaining a space for hydraulic fluid between said sets of packing rings.

12. In a device including hydraulically operated units and having a frame, a turntable mounted on said frame, a hollow cylindrical center pin projecting upwardly from the frame around which said turntable rotates, an inner cylindrical member rotatable with the turntable and within said center pin, and means including registering ducts in said inner cylindrical member and center pin for conducting hydraulic fluid to said hydraulically operated units, the ducts in the inner cylindrical member having longitudinally spaced radially extending ports, and the ducts in the center pin including spaced annular grooves on the inner wall surface of the center pin, each groove registering with one of said radial ports of the inner cylindrical member, there also being two sets of packing rings in each annular groove, and a plurality of expansion springs between the sets of packing rings in each groove for maintaining a space for hydraulic fluid and for urging the packing rings into an effective oil sealing position.

13. In a crane or the like having a frame, a boom mounted on said frame for pivotal movement in a vertical plane, a guiding sheave at the outer end of said boom movable with the boom, a guiding sheave mounted on the frame near the inner end of the boom, a load line cable having a load lifting portion guided over the guiding sheaves, spaced sheaves, at least one of which is movable, carried by the frame and cooperable with a portion of the cable to exert a pull on the load lifting portion of the cable when the movable sheave is moved away from the other of said spaced sheaves on the frame, and an hydraulic ram on the frame for causing movement of said movable sheave.

14. In a crane or the like having a boom supporting frame, means upstanding from the frame and pivotally connected to the boom at a distance outwardly from the inner end of the boom to support the boom for pivotal movement in a vertical plane, a cable guiding sheave on the outer end of the boom movable with the boom, a cable guiding sheave supported at an elevation from the frame near the inner end of the boom when said inner end is in raised position, a load line cable having an outer load lifting portion guided by the sheave on the boom, said load line cable extending longitudinally of the boom to the sheave which is supported at an elevation from the frame near the inner end of the boom, and means including additional sheaves and an hydraulic ram mounted on the boom supporting frame and cooperable with the inner end portion of the cable for exerting a pull on the load lifting portion of the cable in any position of adjustment of the inner end of the boom.

15. In a crane or the like having a frame, a boom mounted on said frame for pivotal movement in a vertical plane to change the boom angle, a cable having one end secured to a swingable portion of the boom, and means including an hydraulic ram on the frame for exerting a pull

on said cable to cause pivotal movement of the boom in a vertical plane.

16. In a crane or the like having a frame, a boom mounted on said frame for pivotal movement in a vertical plane to change the boom angle, a cable having one end secured to a swingable portion of the boom, and means including sheaves and an hydraulic ram on the frame for exerting a pull of multiplied length on said cable to cause pivotal movement of the boom in a vertical plane.

17. In a crane or the like having a frame, a boom, means projecting upwardly from the frame and permanently pivotally connected to the boom outwardly of its inner end to provide for angular swinging movement of the boom in a vertical plane, a track extending upwardly from the frame, means on the inner end of the boom engageable with said track to move longitudinally thereof, and hydraulically operated means including a cable and sheaves for exerting a downward pull on said track engaging means to cause angular movement of the boom.

18. In a crane or the like having a frame, a boom, means pivotally connected at its lower end to the frame and at its upper end to the boom outwardly of the inner end of the boom to provide for angular swinging movement of the boom in a vertical plane, a track extending upwardly from the frame at an oblique angle, means on the inner end of the boom engageable with said track, and hydraulically operated means including a cable and sheaves for exerting a pull on said track engaging means to cause angular movement of the boom.

19. In a vehicle having a lifting mechanism thereon, wheels for said vehicle including a set positioned below the portion of the lifting mechanism where greatest tilting strains occur, hydraulic rams for laterally spreading the wheels of said set, cable means for returning said wheels and rams to normal position, and an additional hydraulic ram for exerting a pull on said cable means.

20. In a vehicle having a lifting mechanism thereon, wheels for said vehicle including a set positioned below the portion of the lifting mechanism where greatest lifting strains occur, a transverse wheel supporting slide for the wheels on each side of said set, means on the vehicle supporting said slides for transverse movement, and transversely extending hydraulically operated means on the vehicle positioned adjacent said slides and co-acting therewith to move the slides outwardly.

21. In a vehicle having a lifting mechanism thereon, wheels for said vehicle including a set positioned below the portion of the lifting mechanism where greatest lifting strains occur, a transverse wheel supporting slide for the wheels on each side of said set, said slides being positioned one below the other, means for slidably suspending said slides from the vehicle for transverse movement, the lowermost slide being additionally slidably suspended from the slide thereabove, and means for causing outward and inward movement of said slides.

22. In a vehicle having a frame portion, a turntable mounted on said frame portion, hydraulically operated members on the vehicle

frame, hydraulically operated lifting mechanism on the turntable, hydraulic control valves on the turntable, means for conducting hydraulic fluid under pressure from said control valves to the hydraulically operated lifting mechanism on the turntable, a pair of cylindrical center pin members rotatable one around the other, one of said members being rotatable with the turntable and one of said members projecting upwardly from the vehicle frame, and means including registering ducts in said center pin members for conducting hydraulic fluid from said control valves on the turntable to said hydraulically operated members on the vehicle frame.

23. In a device including hydraulically operated units and having a frame, a turntable mounted on said frame, a pair of cylindrical center pin members rotatable one around the other, one of said center pin members being connected to the turntable and the other of said members projecting upwardly from the frame, and means including registering ducts in said cylindrical center pin members for conducting hydraulic fluid to said hydraulically operated units, the ducts in one of said members having longitudinally spaced radially extending ports, and the ducts in the other center pin member including spaced annular grooves, each groove registering with one of said radial ports.

24. In a vehicle having lifting mechanism thereon, outrigger means movably positioned below the portion of the lifting mechanism where greatest tilting strains occur, hydraulic rams for laterally moving said outrigger means, cable means for returning said outrigger means and rams to normal position, and means for exerting a pull on said cable means.

25. In a vehicle, a turntable mounted on said vehicle, lifting mechanism on said turntable, manual controls on the turntable for said lifting mechanism, outrigger means for said vehicle positioned below the portion of the lifting mechanism where greatest tilting strains occur, means controlled from the turntable for laterally moving said outrigger means, and means controlled from the turntable for returning said outrigger means to normal position.

26. In a vehicle having lifting mechanism thereon, outrigger means for the vehicle movably positioned below the portion of the lifting mechanism where greatest tilting strains occur, an hydraulic ram for laterally moving said outrigger means, cable means for returning said outrigger means to normal position, and an additional hydraulic ram for exerting a pull on said cable means.

27. In a vehicle having lifting mechanism thereon, outrigger means for said vehicle positioned below the portion of the lifting mechanism where greatest strains occur, said outrigger means including a transverse supporting slide and means on the vehicle supporting said slide for transverse movement, and transversely extending hydraulically operated means on the vehicle co-acting with said slide to move the latter outwardly.

ROY O. BILLINGS.