April 17, 1951 A. E. ORMSBY 2,549,120

CRANE

Filed June 2, 1947 4 Sheets-Sheet 1

Fig-1

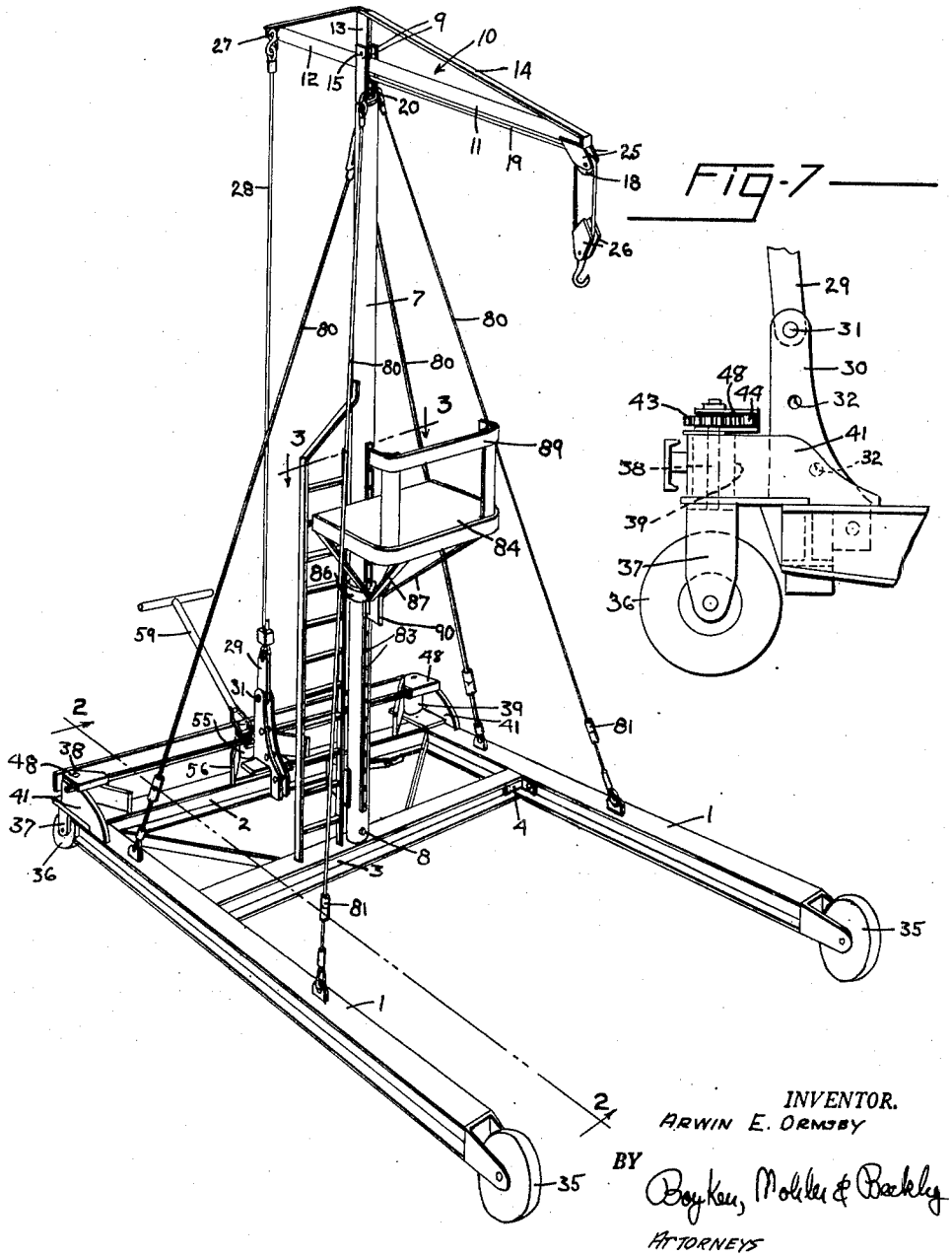


Fig-7

INVENTOR.
ARWIN E. ORMSBY

BY Boykin, Mobley & Barkley

ATTORNEYS

April 17, 1951 A. E. ORMSBY 2,549,120

CRANE

Filed June 2, 1947 4 Sheets-Sheet 2

Fig-6

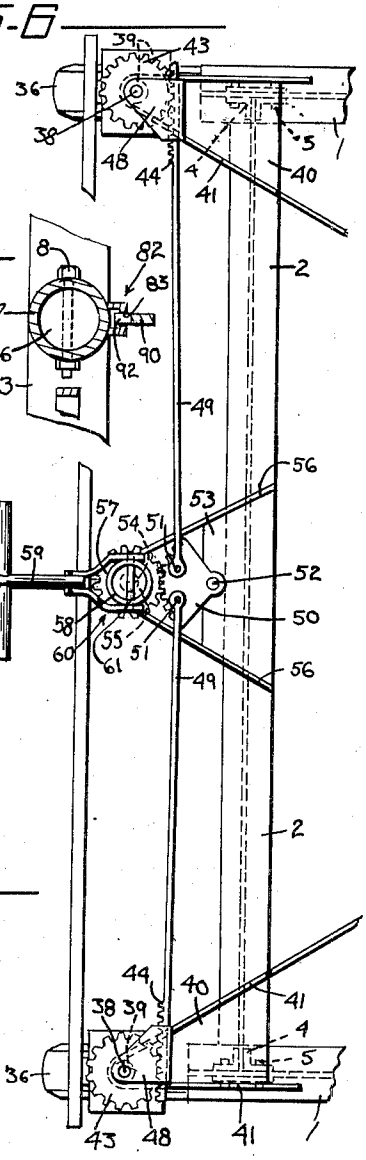


Fig-3

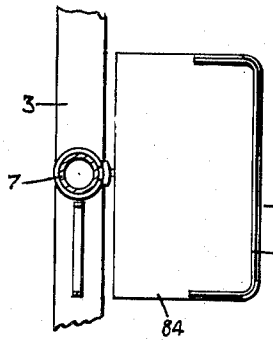


Fig-5

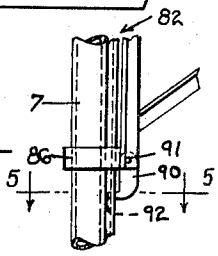


Fig-4

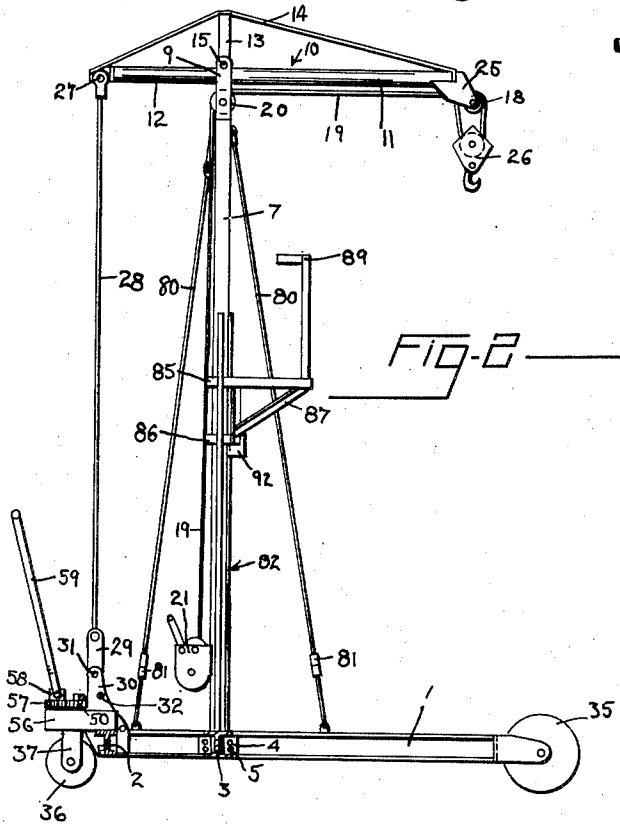


Fig-2

INVENTOR.
ARWIN E ORMSBY

BY Boyken, Mohler & Beckley

ATTORNEYS

April 17, 1951 A. E. ORMSBY 2,549,120

CRANE

Filed June 2, 1947 4 Sheets-Sheet 3

Fig-8

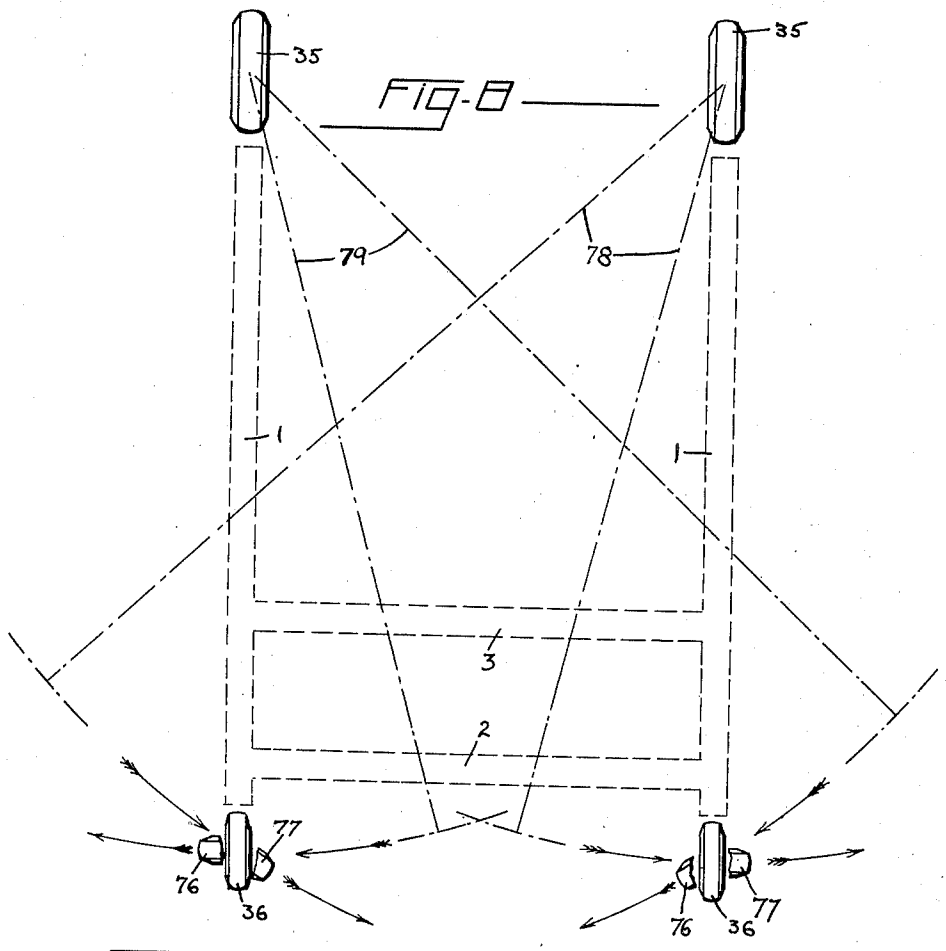


Fig-9

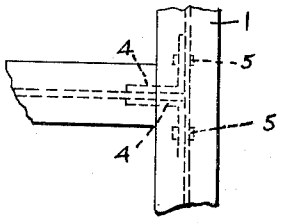
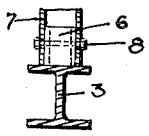


Fig-10



INVENTOR.
ARWIN E. ORMSBY

BY Boykin, Mahler & Beckley

ATTORNEYS

April 17, 1951 A. E. ORMSBY 2,549,120

CRANE

Filed June 2, 1947 4 Sheets-Sheet 4

Fig-11

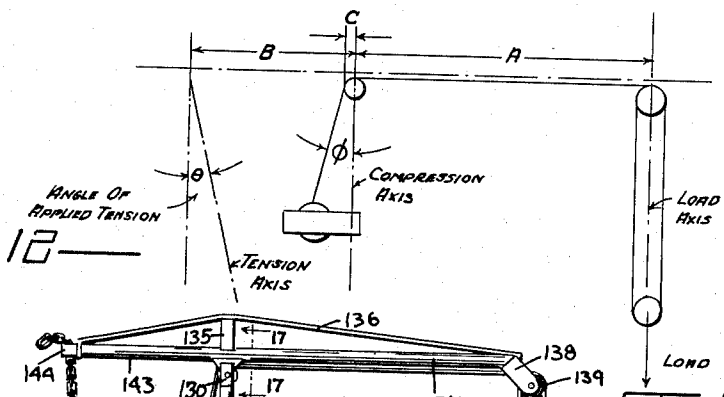


Fig-12

Fig-14

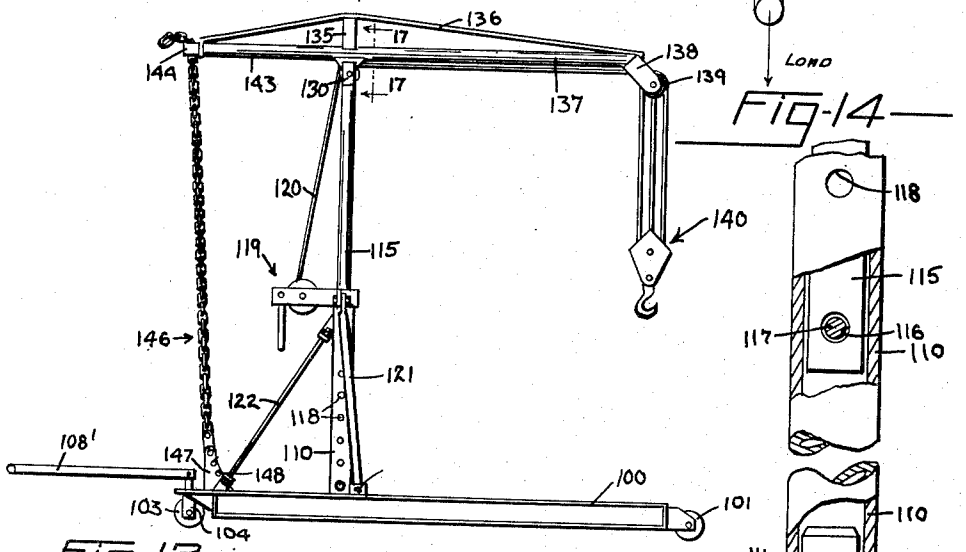


Fig-13

Fig-16

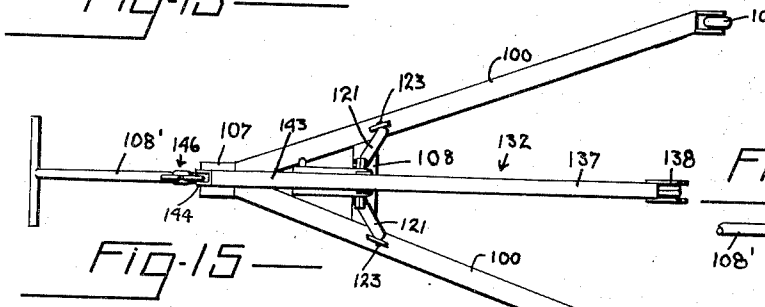


Fig-15

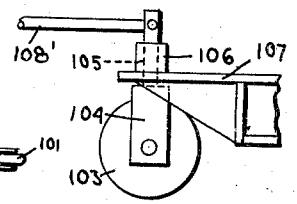
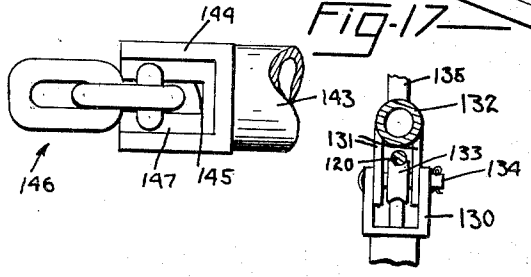


Fig-17



INVENTOR.
ARWIN E. ORMSBY
BY
Boykin, Mahler & Beckley
ATTORNEYS

Patented Apr. 17, 1951

2,549,120

UNITED STATES PATENT OFFICE

2,549,120

CRANE

Arwin E. Ormsby, Oakland, Calif., assignor to Lucienne M. Ormsby, Oakland, Calif.

Application June 2, 1947, Serial No. 751,796

3 Claims. (Cl. 254—139.1)

1

This invention relates to cranes and has for one of its objects the provision of a crane of simple structure having a much higher load lifting capacity for its weight than heretofore.

Another object of the invention is the provision of a simple, efficient portable crane provided with improved steering means for easily moving the crane in any direction and without detrimental wear on the ground wheels.

A still further object of the invention is the provision of lightweight portable crane having a vertically adjustable platform on its post for the operator and which crane has its jib and load lifting line arranged so as not to interfere with an operator on the platform.

An additional object is the provision of a crane having a post and a vertically swingable jib thereon that carries the load lifting tackle, and which jib is adapted to be secured in adjusted position so that the post is under compression during load lifting operations free from detrimental bending strains, thus making the crane safe for heavy loads without the employment of weighty braces, struts, stays, etc.

Other objects and advantages will appear in the specification and in the drawings.

In the drawings:

Fig. 1 is a perspective view of one form of the invention that is widely used for lifting airplane engines and for supporting the same while doing work thereon.

Fig. 2 is a reduced size side sectional view of the crane of Fig. 1 taken along line 2—2 of Fig. 1.

Fig. 3 is a sectional view taken along line 3—3 of Fig. 1.

Fig. 4 is a fragmentary side elevational view showing the means for holding the platform on the post at the desired elevation.

Fig. 5 is an enlarged sectional view taken along line 5—5 of Fig. 4.

Fig. 6 is an enlarged plan view of the steering end of the crane showing the steering mechanism.

Fig. 7 is an enlarged fragmentary side elevational view of one of the steering ground wheels.

Fig. 8 is a diagrammatic view showing the steering system in so far as the degree and positions of the ground steering wheels are concerned when the tongue is swung to one side or the other.

Fig. 9 is an enlarged fragmentary plan view showing the means for detachably securing the ends of the post carrying cross piece to the side frame members of the base.

Fig. 10 is a fragmentary sectional view through the bottom of the post and its supporting cross

2

piece showing the means for detachably securing the post to the cross piece.

Fig. 11 is a schematic view showing the formula whereby the post of the crane is under compression during the time the load is on the jib and is substantially free from bending strain.

Fig. 12 is a side elevational view of another form of the invention used generally for lifting automobile engines from their mountings and for handling similar loads.

Fig. 13 is a plan view of the crane of Fig. 12.

Fig. 14 is an enlarged part sectional part elevational fragmentary view of the post of the crane of Fig. 11 showing the adjustment for the post.

Fig. 15 is an enlarged elevational view of the chain lock for holding the jib in the desired position.

Fig. 16 is an enlarged fragmentary elevational view of the steering wheel of the crane of Fig. 12.

Fig. 17 is an enlarged sectional view taken along line 17—17 of Fig. 12.

In detail, the device of Figs. 1 to 10 has a base comprising a pair of horizontally extending and horizontally spaced parallel base members 1 that are preferably I beams. These beams are connected at one of their corresponding ends by a cross piece 2 and adjacent said cross piece 2 is a second cross piece 3 parallel therewith. The cross piece 3 is nearer the cross piece 2 than it is to the opposite ends of members 1 and both are preferably of I beam structure.

These I beams 2, 3 are respectively removably secured to the webs of members 1 by angle pieces 4 that are bolted to said webs by bolts 5 (Figs. 6, 8). Thus the base frame may readily be disassembled for shipment.

Intermediate the ends of cross piece 3 is an upwardly extending cylindrical projection 6 (Fig. 10) that may be secured to said cross piece in any suitable manner, such as welding.

A tubular post 7 is supported at its lower end on cross piece 3 with the projection 6 extending into said lower end. Said projection and the lower end of post 7 are removably secured together by a bolt 8.

Post 7 is forked at its upper end 9 and a horizontally extending beam 10 is positioned between said fork. The beam 10 is positioned between said fork 9 at a point about one-third of the distance between the ends of the beam, the longer end of the beam at one side of said point, thus providing a jib 11 which is double the length of the extension 12 projecting from the other side of said point.

Secured to beam 10 at the point where it passes between the fork 9 is an upwardly projecting strut 13. A tie bar 14 is secured at its ends to opposite ends of the beam 10 and extends over strut 13, thus the beam, tie bar and strut provide a strong trussed structure.

A horizontal pivot 15 extends through the arms of fork 9 and strut 13 at a point directly above and adjacent the beam 10.

At the outer end of jib 11 is a pulley 18 over which a load line 19 passes. Line 19 extends below jib 11 and parallel therewith to the post 7 and between the arms of fork 9 and over a roller 20 that is carried by said arms. From roller 20 the line 19 extends downwardly alongside the post 7 to a winch 21 that is carried by said post at its lower end. It is desirable that the axis of roller 20 and the pivot 15 be on the axis of post 7, the reason for which will later on be explained more fully.

The pulley 18 at the outer end of the jib 11 is supported on a bracket member 25 that is rigidly secured to jib 11 and the line 19, as shown, carries an ordinary tackle block 26 in the portion depending from pulley 18, the terminating end of said line being secured to said bracket in the usual manner for deadening such line.

The outer end of the extension 12 of jib 11 has a horizontal pivot 27 (Fig. 4) to which is connected the upper end of a stay 28, the latter preferably being a cable or the like. The lower end of stay 28 is pivotally connected to one end of a short link 29, the other end of which is pivotally connected to a cable anchor 30 by a horizontal pivot 31.

This anchor 30 is in the form of a pair of spaced opposed vertically extending plates between which the lower end of link 29 is adapted to extend. Said plates are formed with a curved row of spaced openings 32 and when beam 10 is horizontal, the pivot 31 may be in the top hole of the row, said row extending generally upwardly and in an arc that corresponds with the curve defined by pivot 27 when the jib is swung upwardly from horizontal. In this manner the stay 28 will remain in the same position relative to vertical when the pivot 31 is shifted to any of the holes below the uppermost one for swinging the jib upwardly. The anchor for the stay may, of course, be longer with more holes so that some may be above as well as below the top hole indicated in the drawing. However, the structure shown is adequate to meet substantially all conditions.

Secured to the ends of the base members 1 that are most remote from cross piece 3 is a pair of coaxial ground wheels 35. These are fixed against rotation about vertical axes.

At the opposite ends of members 1 from the ground wheels 35 are ground steering wheels 36 rotatably carried on caster yokes 37. The vertical shafts 38 an which the yokes 37 are vertically pivoted are directly over the wheel axles and said shafts rotatably extend through fixed bearings 39. These bearings 39 are each in turn secured on a plate 40 and within the bend of a generally U-shaped strap 41 that is positioned on its side with its lower edges welded to plate 40.

A gear 43 is rigidly secured to the upper end of each caster shaft 38. Thus upon rotating gears 43 the wheels 36 will be turned. The means for turning gears 43 comprise horizontally extending racks 44 that extend alongside each gear 43 with its teeth in mesh with the gear teeth and held in mesh by a keeper 48. The racks 44 have extensions 49 extending longitudinally of the racks toward each other, and these links or extensions 49 are pivoted at their adjacent ends to a horizontally disposed gear segment 50 by pivots 51 that are spaced from each other in alignment with the links 49. The segment 50 is midway between the steering wheels 36 and is in turn pivoted by means of a vertical pivot 52 to a plate 53 that is rigid with cross piece 2. Pivot 52 is offset toward the end of the crane that carries wheels 35, and the rear edge of the segment is arcuate with gear teeth formed therein, said teeth extending generally between pivots 51.

In using the word front or forwardly relative to the crane, it is to be understood that the wheels 35 are at said front end while wheels 36 are at the rear end. This identification is made purely for clarity and is arbitrary inasmuch as it has no relation to which way the crane may be moved.

A vertical pin 54 is rotatable in a vertically disposed bearing 55 that in turn is secured in the bend of a generally V-shaped metal strap 56. The apex of strap 56 is rearwardly of segment 50 and the ends of said strap are secured to cross piece 2.

Carried rigidly on the upper end of pin 54 coaxial therewith is a horizontally disposed gear 57. Above gear 57 and welded thereto is a short tubular member 58.

A draw bar or tongue 59 is provided with spaced arms 60 at one end and the said tubular member 58 is positioned between said arms and is pivoted thereto by a horizontal pivot 61.

Upon swinging tongue 59 to the right, the segment 50 will be rotated to the left, which in turn moves the racks 44 to the left rotating gears 43 on wheels 36 to the right for moving the steering wheels in the same direction. The steering wheels 36 will be pivoted to the left upon swinging the tongue to the left.

Looking at the steering assembly from the tongue side of Fig. 6, it will be seen that the pivot 51 of the left-hand link 49 will move a lesser distance laterally between wheels 36 when the tongue 59 is swung to the right than the right-hand pivot 51, thus the left-hand wheel will not be rotated on its axis as much as the right-hand wheel.

The position of wheels 36 when in neutral position or straight ahead is indicated at 36 in Fig. 8. When the tongue is swung its maximum distance to the left (as seen in Fig. 8) the wheels 36 take the position designated 76, and when the tongue is swung to the right the maximum distance, the wheels 36 take the position 77. It will be seen that in swivelling to position 77 the radii of the wheels is generally indicated at 78, which is substantially at the right-hand front wheel 35 for all practical purposes. The wheels 36 swivel about radii 79 that extend from the left front wheel 35 when the tongue is swung to the left. In this manner the crane base can be turned easily when the wheels 36 are swivelled to positions almost at right angles to neutral. In fact one of the two wheels may be so swivelled. This feature prevents excessive wear on the tires as well as facilitating the turning of the crane.

Fixed stays 80 extend from the upper end of post 7 to the base members 1, two of said stays extending forwardly and two rearwardly of the post. These are tension stays as distinguished from compression members, and are preferably cables or the like, thus being relatively light. Their function is to hold the post upright and

each may include a conventional turnbuckle 81 for tightening the same for securing post 7 vertical.

Along the front side of post 7 is a channel member 82 having the free edges of its sides welded to post 7. The bottom of this member 82 faces forwardly and is formed with a vertical row of holes 83.

A platform 84 having vertically spaced sleeves 85, 86 secured thereto respectively slidably embrace said post. The lower sleeve 86 of said pair has braces 87 that extend divergently upwardly to platform 84, and the upper sleeve 85 is secured to the rear edge of said platform. The latter preferably carries a guard rail 89 along its forward edge.

Lower sleeve 86 also carries a latch 90 (Fig. 4) that is pivotally secured to said sleeve by a pivot 91. The latch depends from said pivot and has a tooth 92 that is adapted to swing into any one of the holes 83 in channel member 82. The tooth 92 will normally swing into one of said holes by itself and must be withdrawn manually for lowering the platform, although upon elevating said platform it will be automatically withdrawn.

By the above means an operator may readily change the elevation of the platform for working at different levels.

As has already been mentioned, the holes 32 in plates 30 are in an arcuate row so that the relationship between stay 28 and vertical will be substantially constant when the jib 11 is swung upwardly or downwardly by securing the lower end of stay 28 in different holes 32. Also it is pertinent to note that the stay 28 inclines slightly from the upper end toward the lower end of the post 7.

The mechanical advantage of pulley 18, the ratio between extension 12 and jib 11, the angle between stay 28 and vertical, the angle between the length of line 19 that is between roller 20 and the winch and the vertical axis of the post 7 are extremely important features of this invention inasmuch as the crane is adapted to handle loads that would normally require a crane of at least double its weight. The reason for this is that by the design herein disclosed, the post 7 is not under any detrimental bending forces during the handling of a load by the tackle, irrespective of the degree of tilt of the jib.

Referring to Fig. 11, let it be considered that—

a=length of jib 11 from the post axis
b=length of extension 12 from the post axis
c=radius of roller 20
θ=angle between stay 28 and a vertical line extending through pivot 27
ϕ=angle between the downwardly extending length of line 19 and the axis of post 7
K=mechanical advantage of the load tackle
n=distance between lower end of line 19 at winch and axis of post
q=horizontal distance between the lower end of stay 28 and a vertical line extending through the point of connection of said stay with the extension 12
W=load on the tackle
R=tension in line 19
Q=tension in stay 28.

Taking moments about the pivot point of the beam:

$$Wa=Rc+Qb\cos\theta$$

For a condition of no bending in the post:

$$R\sin\phi=Q\sin\theta$$

Letting

$$R=\frac{W}{k}$$

and combining the above formulas:

$$\tan\theta=\frac{\sin\theta}{\cos\theta}=\frac{b\sin\phi}{Ka-c}$$

Thus the angle at which the stay 28 should be adjusted is readily determinable from the known quantities above enumerated. This formula,

$$\tan\theta=\frac{b\sin\phi}{Ka-c}$$

is employed for all cases including the embodiment illustrated in Figs. 12, 13 which will subsequently be described.

If the winch 21 in the embodiment illustrated in Figs. 1 and 2 is positioned so that the load line 19 engages the drum approximately in the same horizontal plane as the connection of stay 28 to the anchor 30, then:

$$\frac{q}{\tan\theta}=\frac{n}{\tan\phi}$$

and

$$q=\frac{nb\cos\phi}{Ka-c}$$

Since the angle ϕ is relatively small then cos ϕ may be assumed equal to unity for all practical purposes and the following formula may be employed:

$$q=\frac{nb}{Ka-c}$$

Inasmuch as the post when collapsed is relatively short and free from danger due to bending forces, it is not so important that the post be practically wholly under compression except when the post is extended.

Referring to Figs. 12, 13, the crane in this instance has a base that comprises a pair of divergently extending I beams 100 that are connected at their convergent ends forming a V-shaped base. Ground wheels 101 are secured to the divergent ends of said beams 100 and a single ground wheel 103 is secured to the connected convergent ends of said beams. The wheel 103 is supported between the sides of a caster support 104 that has a pivot 105 rotatably extending through a bearing 106 that is secured to said beams by a bracket plate 107 (Fig. 16) to which the bearing is preferably welded. The pivot 105 is vertically over the axis of the wheel 103 and projects from the bearing 106. Tongue 108′ is pivotally secured to the projecting end of said bearing.

A cross piece 108 (Fig. 13) connects the beams 100 at a point fairly close to the juncture between said beams, which cross piece is preferably of I beam structure.

A boss or upward cylindrical projection 109 (Fig. 14) is integrally secured to cross piece 108 centrally between the ends of the latter, which projection corresponds with the projection 6 (Fig. 10) and is for the same purpose.

A lower vertical tubular post section 110 is secured at its lower end to projection 109, the latter extending into said post and being removably secured thereto by a bolt 111.

This lower post section 110 telescopically receives therein an upper post section 115 that

projects from the upper end thereof and that is vertically slidable in section 110. The lower end of said section 115 is apertured at 116 for a bolt 117 (Fig. 14), the latter extending through one of the pairs of registering holes 118 in the lower section 110 whereby the post, as a whole, may be extended by sliding the upper section to any desired degree of extension.

Rigidly secured to the upper end of the lower section 110 is a winch 119 for winding the lifting cable 120.

The lower post section is held vertical by laterally and downwardly extending rigid stays 121 and by a rearwardly extending rigid stay 122. All of these stays are connected at their upper ends with the lower post section 110 at points adjacent the upper end of the latter. Stays 121 extend to the beams 100 with which they are removably secured by bolts 123 while stay 122 is removably connected with plate 107 at the apex of the beams 100. The upper ends of said posts are secured by bolts so as to also be removable to facilitate collapse of the crane for shipment.

The upper end of the upper post section 115 carries an upwardly opening clevis 130 (Fig. 17) that is rigid therewith. Between the arms of said clevis is a horizontal pin 134 supporting plates 131 that are welded to a horizontally extending cross beam 132 at a point about a third of the way along said beam. A pulley 133 is rotatably supported on a horizontal pin 134 that also pivotally connects plates 131 with the sides of clevis 130. The load line 120 extends over this pulley.

A strut 135 directly over the pulley 133 and beam 132 extends between said beam and a tie bar 136 that correspond with the strut 13 and tie bar 14 of Fig. 2, the tie bar 136 being secured at its ends to the ends of beam 132.

The longer portion of the beam 132 provides jib 137 of the crane and this jib has a bracket 138 at its outer end rotatably supporting load pulleys 139 over which line 120 extends to a tackle block 140, the free end of line 120 being secured in the conventional manner to the block 140. The jib 137 extends over the space between the free ends of the beams 100 for lifting a load such, for instance, as an automobile engine, inasmuch as the forward ends of beams 100 at wheels 101 are adapted to be moved under the forward end of an automobile between its front wheels. The fact that stay bars 121 are practically coplanar with post 110 makes it possible to move the beams 110 a sufficient distance under the front end of an automobile to practically bring the front bumpers of the automobile into engagement with the post 110. This is a very desirable feature of this invention.

The shorter portion of beam 132 forms an extension 143 of jib 137 and said extension carries a clevis member 144 at its outer end (Fig. 15) having a rearwardly opening horizontal slot 145 therein for receiving one of the lengths of a stay chain 146 that is connected at its lower end with anchor plates 147 that are substantially identical in structure and function with the anchor plates 30 of the crane of Fig. 1.

The slot 145 will permit insertion and removal of a link of the chain 146 flatwise therein so that the adjacent link 147 (Fig. 15) will be held by the sides of the slot. This provides for quick and easy adjustment of the tilt of the jib 137.

The anchor plates 147 are rigidly secured to the plate 107 and has an upwardly extending arcuate row of openings 148 therein for adjustably securing the lower end of the stay 146 to said anchor plate according to the degree of tilt of the jib.

I claim:

1. In a crane having a vertical post supported on a portable base and a generally horizontally extending beam horizontally pivoted to the upper end of said post at a point intermediate opposite ends of said beam but closer to one end than the other whereby said beam provides a relatively short projection and a jib respectively at opposite sides of said post, a stay extending slantingly downwardly from the outer end of said projection in direction toward the foot of said post connecting said outer end with said base, a load pulley on the outer end of said jib, a roller on the axis of said post adjacent said beam and secured to said post, a winch below said projection spaced a substantial distance therefrom, a flexible load line extending over said pulley and roller and then downwardly to said winch, the horizontal distance between the lower end of said stay and a vertical line extending through the point of connection between said stay and said projection being substantially equal to the distance between said point and the pivot supporting said beam times the horizontal distance between the lower end of said load line and said post divided by the mechanical advantage of said pulley times the distance between said pulley and said pivot less the radius of said roller.

2. In a crane having a vertical post supported on a portable base and a generally horizontally extending beam horizontally pivoted to the upper end of said post at a point intermediate opposite ends of said beam but closer to one end than the other whereby said beam provides a relatively short projection and a jib respectively at opposite sides of said post, a stay extending slantingly downwardly from the outer end of said projection in direction toward the foot of said post connecting said outer end with said base, a load pulley on the outer end of said jib, a roller on the axis of said post adjacent said beam and secured to said post, a winch below said projection spaced a substantial distance therefrom, a flexible load line extending over said pulley and roller and then downwardly to said winch; the tangent of the angle between said stay and a vertical line extending through its point of connection with said pivot being substantially equal to the distance between said point and the beam pivot times the sine of the angle between the portion of said load line that extends between said roller and said winch and the axis of said post divided by the mechanical advantage of said pulley times the distance between said pulley, and said axis less the radius of said roller.

3. A crane of the character described having a base comprising a pair of parallel, horizontally extending horizontally spaced frame members and a piece adjacent one of the corresponding ends of said frame members secured to said frame members at opposite ends of said cross piece, a vertical post secured on said cross piece at a point intermediate the ends of the latter, a jib on the upper end of said post pivotally secured thereto on the axis of said post, said jib extending to one side of said post and a continuation thereof extending past said pivot and to the opposite side of said post, a stay connected at one end with the outer end of said continuation and extending to a point adjacent said base, a bracket member secured to said base provided with an arcuately and upwardly extending row of holes along a curved

line substantially corresponding with an arc defined by a point on said continuation upon pivoting said jib, means for connecting the lower end of said stay with said bracket at any one of said holes corresponding with the position of said point on said continuation during such pivoting of said jib, the lower hole of said row being the closest hole in said row to said post and said bracket being in a vertical plane extending through said post and substantially bisecting the space between said frame members.

ARWIN E. ORMSBY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
690,965	Jones	Jan. 14, 1902
738,080	Sorensen	Sept. 1, 1903
934,646	Alexander	Sept. 21, 1909
1,331,938	McConnell et al.	Feb. 24, 1920
1,786,060	Greaves et al.	Dec. 23, 1930
2,023,790	Ormsby et al.	Dec. 10, 1935