June 11, 1929. P. A. H. MOSSAY 1,716,732

MOTOR PROPELLED CRANE

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Fig. 1.

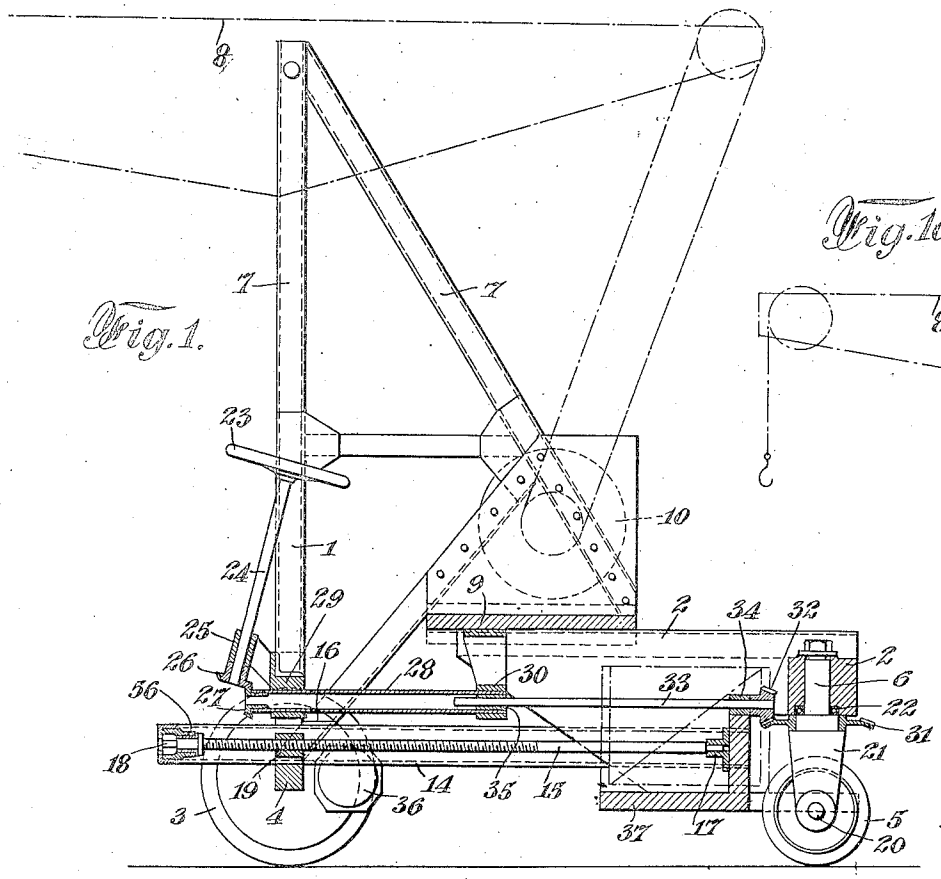
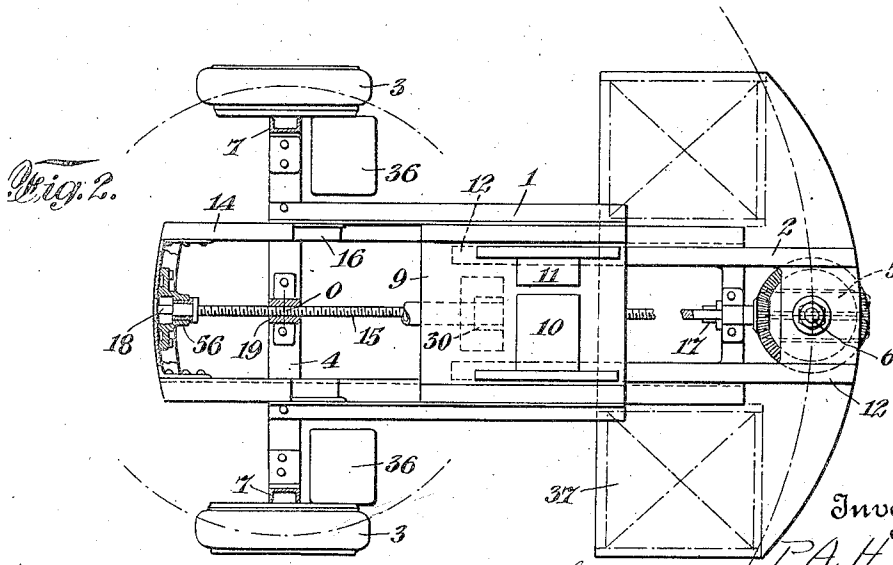


Fig. 1a.

Fig. 2.



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Fig. 3.

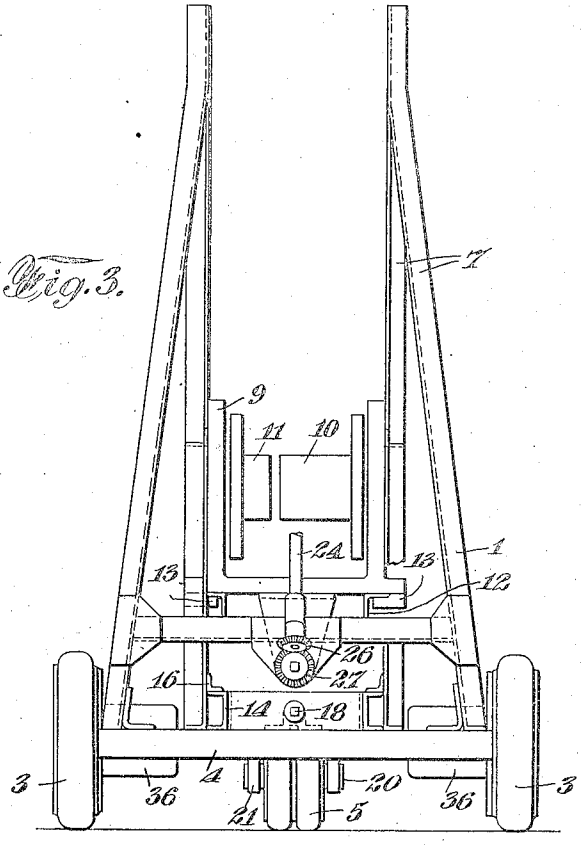
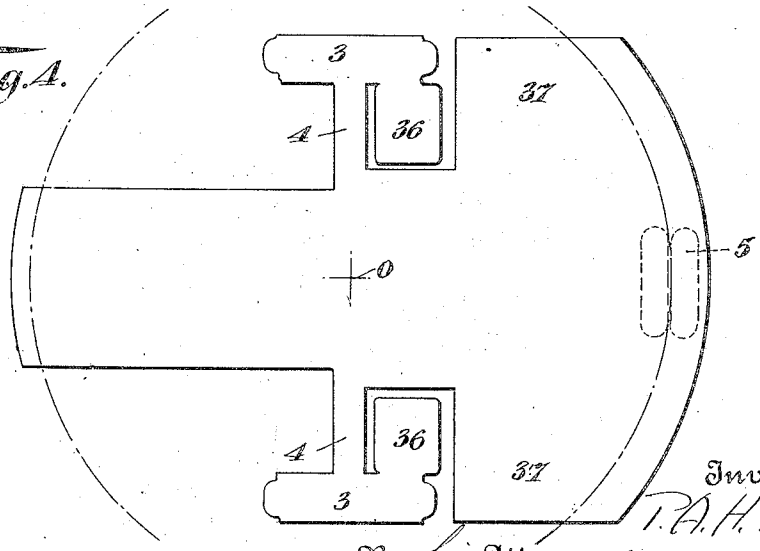


Fig. 4.



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Fig. 5a.

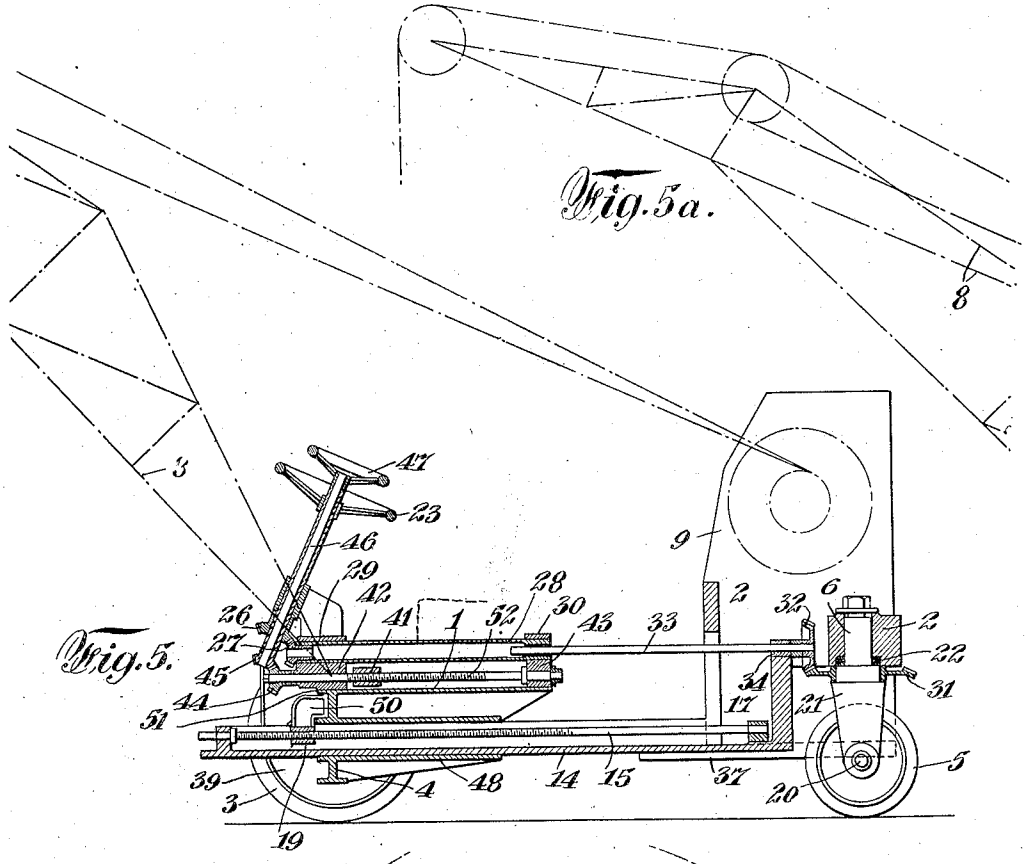


Fig. 5.

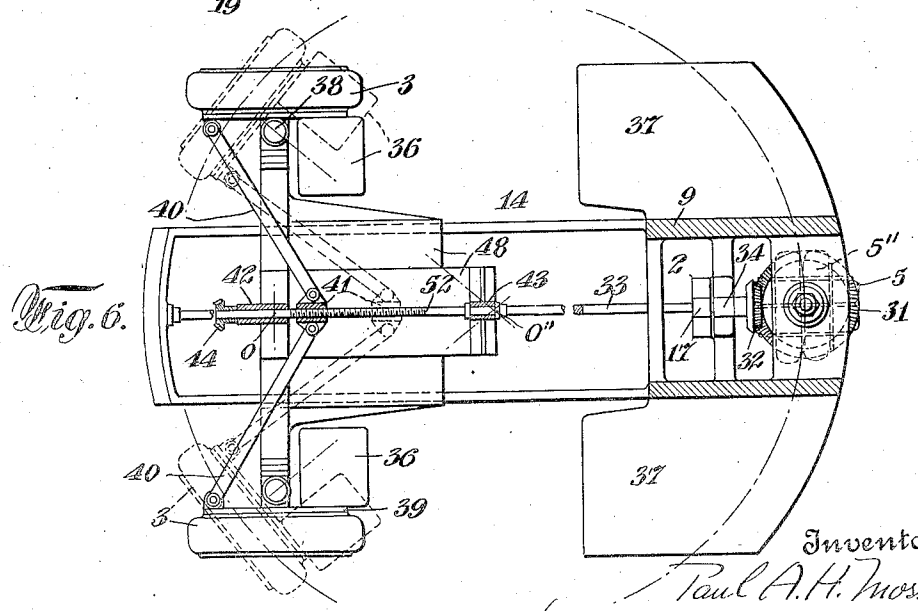


Fig. 6.

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MOTOR PROPELLED CRANE

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Fig. 7.

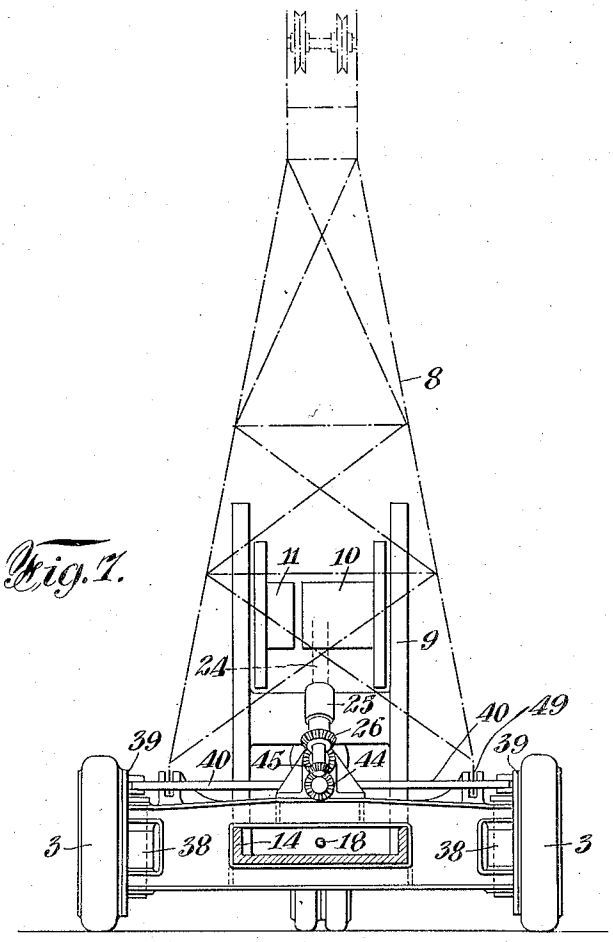
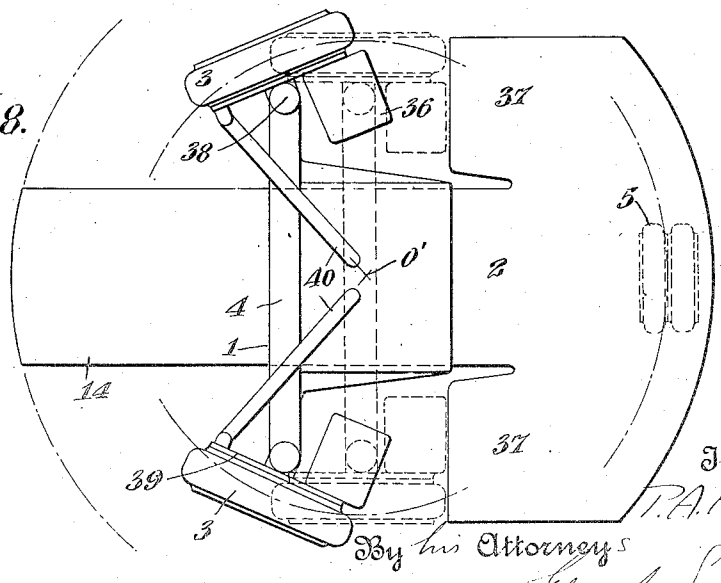


Fig. 8.



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UNITED STATES PATENT OFFICE.

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MOTOR-PROPELLED CRANE.

Application filed November 29, 1926, Serial No. 151,505, and in Great Britain December 14, 1925.

This invention relates to railless motor propelled cranes which are provided with ground wheels adapted to act both for translational movements and for slewing movements of the crane.

Cranes of this kind have hitherto been made with a wheel base of definite dimensions calculated in each case to give the required stability for the lifting capacity of the crane, it being desirable to keep the wheel base as small as possible in order to permit of rapid operation within a small turning or slewing radius and to enable the crane to pass through and to operate in narrow gangways or other confined spaces.

In arriving at the lifting capacity of a crane of the above type it is necessary to consider two opposing moments about the axis of the front wheel or wheels which acts as a fulcrum about which the crane might tilt.

One of these moments is that due to the rated maximum load to be lifted, and the distance at which this load acts in front of the tilting fulcrum when the jib is fully extended, while the other and opposing moment is that of the total weight of the crane concentrated at its centre of gravity and the distance of this centre of gravity from this tilting axis or fulcrum.

The second moment must exceed the first in order to counteract the tendency for the crane to tilt the ratio of the second moment to the first representing the coefficient of stability of the crane.

The object of the invention is to enable the lifting capacity of a crane of the type above mentioned to be increased without reducing the coefficient of stability of the crane, without necessitating alteration in the weight of the crane and also without requiring undue increase in the turning or slewing radius, or in other words, undue increase in the space within which the body of the crane can slew or rotate.

With the above object in view a crane according to the invention is provided with ground wheels, not only adapted to act both for translational movements and for slewing movements of the crane thereon, but also adapted to be adjusted so as to vary the counterbalancing effect of the weight of the crane by varying the position of the centre of gravity of the latter.

The invention may be applied to various forms of crane of the type above mentioned, for example it may be applied to one having non-swivelling front wheels, in which case the adjustment necessary to effect variation in the lifting capacity may result in some variation in the slewing radius, i. e., the radius of the circle swept out by the body of the crane when rotating or slewing; whereas it is also possible to apply it to a crane of the above type having swivelling front wheels so that practically a turning or slewing circle of constant small radius may be retained irrespective of the adjustment for lifting capacity, a smaller wheel base being assured when the crane is adjusted for a low lifting capacity thus also facilitating rapid turning or slewing operations, when dealing with light loads, when there is no necessity to swivel the front wheels.

In any case according to the present invention it is possible to adjust the crane to operate efficiently when dealing with light loads, not exceeding for instance half a ton, such as in warehouse work, when it is desirable to have a small wheel base facilitating mobility and rapidity of operation, and yet to adjust the crane to deal with heavier loads of say two tons when required, the increased lifting capacity being attained without any appreciable variation in the effective jib radius.

In the accompanying drawings;

Figure 1 is a side sectional elevation,

Figure 1ª is an outline side elevation showing the end of the overhanging jib structure omitted from Fig. 1,

Figure 2 is a plan partly in section, and

Figure 3 is a front elevation, illustrating one form of crane according to the invention, only those parts which are necessary to an understanding of the invention being shown.

Figure 4 is a diagram or outline plan corresponding to Figure 2 but after the wheels have been adjusted for a low lifting capacity, a short slewing radius and a minimum wheel base.

Figures 5 and 6 respectively are a sectional elevation and a sectional plan illustrating another form of the invention.

Figure 5ª is an outline side elevation showing the end of the overhanging jib structure omitted from Fig. 5.

Figure 7 is a front elevation partly in section of the modification illustrated in Figure 5.

Figure 8 is a diagrammatic plan view illustrating different adjustment of the units.

In the form illustrated by Figures 1 to 4, adjustment of the wheels to increase the lifting capacity results in some increase in the length of the turning or slewing radius.

The crane therein shown comprises two units 1 and 2. The unit 1 is provided with non-swivelling ground wheels 3, 3, rotating on a fixed axle 4, while the unit 2 has a steering ground wheel 5 adapted to be swivelled on a vertical axle 6 so that it can be set relatively to the wheels 3, 3 to suit steering and slewing operations as hereinafter explained. The two units 1 and 2 are relatively adjustable so that the distance between the point of contact of the wheel 5 with the ground and the line joining the points of contact of the wheels 3, 3, with the ground, can be varied.

The unit 1 comprises a derrick 7 conveniently built of steel channels for supporting the pivoted crane jib, indicated by dot and dash lines 8 and a structure 9 for supporting the hoisting and luffing winches 10, 11 which may be of any suitable kind.

The front channels of the derrick are supported on the fixed axle 4, while the structure 9 is supported and can slide on angle irons or rails 12 forming part of the rear unit 2. Retaining bars 13 on the structure 9 engage with the rails 12.

The unit 2 has a forward frame or extension 14 which at the front is supported by and can slide on the axle 4. Retaining bars such as angle irons 16 on the front channels of the derrick engage with the upper edges of the extension frame 14 to prevent vertical displacement, the sides of the extension frame engaging with the adjacent members of the unit 2 to prevent relative lateral displacement.

A screw threaded shaft 15 is mounted at its ends on the unit 2 in bearings 56 and 17, so that it can be rotated for example by a key or handle applied to its forward squared end 18, or, if desired, by a motor not shown.

The shaft 15 passes through a nut 19 which is fixed to the axle 4, so that when the shaft 15 is rotated in one direction or the other the unit 2 is caused to move relatively to the unit 1.

The steering ground wheel 5, for example, shown with twin tires, is fixed on an axle 20 which is free to rotate in a fork 21 having a vertical axle 6 mounted so as to rotate in a bearing 22 on the unit 2.

The ground steering wheel 5 is controlled by a steering hand wheel 23. The steering column 24 is mounted on a bracket 25 fixed on the unit 1. It has a bevel wheel 26 meshing with bevel wheel 27 fixed on a tubular shaft 28 carried in bearings 29 and 30 both fixed on the unit 1.

The fork 21 of the ground steering wheel 5 has a bevel wheel 31 fixed on it. A bevel wheel 32 meshes with the wheel 31 and is fixed on a shaft 33, one end of which is carried in a bearing 34 on the unit 2 while the other end slides in a socket 35 fixed in the end of the tubular shaft 28. The socket 35 has a square hole to receive the shaft 33 which for the greater part of its length is square. A driving but sliding connection is thus provided between the shafts 28 and 33, which together form a telescopic shaft, to insure operation of the steering ground wheel 5 from the hand wheel 23 whatever be the relative adjustment between the two units 1 and 2 effected by the screw threaded shaft 15.

In the above example the wheels 3, 3, are assumed to be driven by electric motors 36, 36, deriving current from accumulators which can be mounted on platforms (the accumulators and their supports being designated by the numerals 37, 37) on the unit 2, suitable controlling means being provided, for instance as described in my copending application Serial No. 491,099 by which the motors can be controlled to drive the wheels in the same or in opposite directions to effect translational or slewing movements of the crane and accordingly as the wheel 5 is set by the hand wheel 23 relatively to the wheels 3, 3. Since in the crane of Figures 1 to 4 the controls and motors 36 and accumulators 37 will be separated by a slidable connection the current supply to the controls and motors will be provided with a corresponding slidable or extensible connection.

When the wheel 5 is parallel to the wheels 3, 3, as indicated in Figures 1 and 2 and the wheels 3, 3, are driven in the same direction the crane can make rectilinear fore and aft movements.

When the wheel 5 is set at right angles to the wheels 3, 3, and the latter are rotated in opposite directions the crane rotates or slews on a circle the centre O of which is in the centre of the axis of the wheels 3, 3.

When the wheel 5 is set in intermediate positions the crane makes curvilinear translational movement. If the wheel 5 is in a position so that the planetary centre falls between the wheels 3, 3, these have to be rotated in opposite directions, whereas if it falls outside of these wheels they must rotate in the same direction.

When the two units 1 and 2 are adjusted as in Figures 1 to 3, the weight of the unit 2 and accessories carried by it, such as accumulators for example, is carried farther to the rear of the axis of the wheels 3, 3 so that the centre of gravity of the crane moves away from the said wheels 3, 3, and its moment acting to counterbalance the crane against the tilting effect of the lifted load is increased, so that the lifting capacity of the crane is increased. The turning or slewing radius of

the crane after this adjustment is greater than when the units are adjusted to reduce the lifting capacity, as indicated in Figure 4, in which case the turning or slewing radius is at its minimum and the size of the wheel base is also reduced.

If it be desired to maintain a minimum turning or slewing radius for the crane under all conditions or adjustment of lifting capacity, then the ground wheels 3, 3, can be adapted to be swivelled so that their axes can be set to a variable planetary centre, for example as in the form illustrated in Figures 5 to 8, wherein similar reference numerals indicate corresponding parts to those indicated in Figures 1 to 4.

In this form the ground wheels 3, 3, are mounted on stub axles in a similar manner to that usually adopted with the steering wheels of a motor car. The vertical pivot pins 38, 38, of the stub axles are mounted in the forked ends of the fixed axle 4. The motor plates 39, 39, are connected by links 40 to a nut 41 on a screw threaded shaft 52 carried in bearings 42, 43, on the front unit 1. The bevel wheel 44 on the end of the shaft 52 is in mesh with a bevel wheel 45 on the end of a steering column 46, which passes through the steering column 24 and is provided with a hand steering wheel 47.

By appropriate manipulation of the hand wheel 47 the wheels 3, 3, can be swivelled or adjusted about their vertical axles 38 into a number of positions within an angle of about 45° and by these adjustments in conjunction with adjustments of the wheel 5 by the hand wheel 23 it is possible to effect rectilinear fore and aft movements of the crane, and turning or slewing movements with a variety of turning or slewing radii.

When the units 1 and 2 are fully retracted for a minimum lifting capacity, the wheels 3, 3, are left parallel to one another as shown in dotted lines in Figure 8. The crane can then rotate or slew about the centre O′ with a minimum turning radius. Even when the units 1 and 2 are extended as shown in full lines in Figure 6 to insure a greater lifting capacity, the same minimum turning radius, i. e., space swept in swivelling can be maintained by setting the wheel 5 at right angles to the fore and aft axis of the crane as indicated in dotted lines at 5″ and setting the wheels 3, 3, into the positions indicated in dotted lines so that the planetary centre about which the crane slews is shifted from O to O″. The position of wheels 3, 3, shown in full lines in Figure 8 refers to an intermediate position of the two units when the rotation center is also in O′ which is the rotation center when the wheels 3, 3, are in the dotted position.

Any suitable means may be provided for locking either or both hand steering wheels after an operation.

The form of crane shown in Figures 5 to 8 differs somewhat in construction from that shown in Figures 1 to 4. The structure 9 supporting the hoisting and luffing winches 10, 11, is mounted on the unit 2. The axle 4 is provided with a hollow extension 48 to receive and to form a more extensive guide and support for the forward extension 14 of the unit 2, avoiding both lateral and vertical displacements between the two units. Moreover, the jib 8, instead of being mounted on a derrick, is directly mounted in pivotal brackets 49 on the axle 4 and the extension 48 supports the bearings 42, 43, 29, 30 for the shafts 52, 28.

In this construction the major portion of the total weight of the crane can be moved away from the axis of wheels 3, 3.

The nut 19 has a retaining piece 50 engaging within a channelled portion 51 in the axle 4.

It is to be understood that the invention is not confined to any particular number of wheels or means for driving them, for example, the rear wheel 5 in the examples described could be the driven wheel.

The propelling and hoisting and luffing may be effected in any desired manner as by electric motors or by internal combustion engines, petrol electric transmission or steam engines.

In both the crane of Figures 1 to 4 and that of Figures 5 to 8 the crane structure remains in a definite vertical plane, and for each adjustment of the units there is a fixed relation between the maximum overhang of the load and the wheel base in all positions of the crane. The operator, therefore, has simply to adjust the units to lift the desired load and once lifted no further manipulation of the crane will unbalance it, so that the ability of the crane to be adjusted to lift the load is the test of the ability to carry the load and deposit it. It is unnecessary to predetermine the weight of the parts to be transported. Whenever the load is too heavy this will be immediately shown during the attempt to lift it and the operator will know that the units must be adjusted for greater lifting power and that this adjustment when made will serve for all the subsequent movements of the crane with its load.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A railless motor propelled crane comprising a front unit having coaxial side wheels, motors for driving said wheels and a jib supported to overhang the front of the vehicle in a plane substantially perpendicular to the axis of said wheels, a rear unit adjustably connected to said front unit to slide in a direction parallel to said plane, and having a supporting and steering ground wheel, a

steering hand wheel on said front unit, means connecting said hand wheel and ground wheel during all relative adjustments of the units, and a power supply means carried by said rear unit for supplying power to the motors for driving the wheels of the first unit.

2. A railless motor propelled crane comprising a front portion having two wheels on opposite sides and a rear portion having a wheel on a line between said front wheels in generally triangular formation so as to provide a three point support, a crane supporting structure on said front portion adapted to support a lifting crane to overhang forwardly between said forward wheels, means for driving at least one of said wheels to propel said crane, means for steering said wheel and means for adjusting one portion with relation to the other to move said center of gravity backward.

3. A railless motor propelled crane comprising a front portion having two wheels on opposite sides and a rear portion having a wheel on a line between said front wheels in generally triangular formation so as to provide a three point support, a crane supporting structure on said front portion adapted to support a lifting crane to overhang forwardly between said forward wheels, means for driving at least one of said front wheels to propel said crane, means for steering said wheel and means for adjusting one portion with relation to the other to move said center of gravity backward.

4. A railless motor propelled crane comprising a front portion having two wheels on opposite sides and a rear portion having a wheel on a line between said front wheels in generally triangular formation so as to provide a three point support, a crane supporting structure on said front portion adapted to support a lifting crane to overhang forwardly between said forward wheels, means for driving at least one of said wheels to propel said crane, means for steering said rear wheel from said front portion and means for adjusting one portion with relation to the other to move the center of gravity backward.

5. A railless motor propelled crane comprising a front portion having two wheels on opposite sides and a rear portion having a wheel on a line with said front wheel in generally triangular formation so as to provide a three point support, means for adjusting the front and rear portions with relation to each other to move the center of gravity backward, steering means for said rear wheel and separate steering means for said forward wheels adapted to adjust said wheels in predetermined angular relation to each other, means for driving at least one of said wheels to propel said crane and means for supporting a crane structure on said wheels in position to overhang forwardly between said forward wheels.

6. A railless motor propelled crane comprising a front portion having two wheels on opposite sides and a rear portion having a wheel on a line with said front wheel in generally triangular formation so as to provide a three point support, means for adjusting the front and rear portions with relation to each other to move the center of gravity backward, means for steering said rear wheel from said front portion and separate steering means on said front portion adjacent said means for steering said rear wheel for said forward wheels adapted to adjust said wheels simultaneously in predetermined angular relation to each other, means for driving said front wheels to propel said crane and means for supporting a crane structure on said wheels in position to overhang forwardly between said forward wheels.

7. A crane, comprising in combination a mobile member, material-lifting devices thereon, three wheel elements for said member arranged in generally triangular formation to provide a three-point support, two of said wheel elements being arranged in a pair at opposite sides of said member and the third wheel element at one end of said member, means for variably setting the wheel pair independently of the third wheel element, means for variably setting said third element independently of said pair, and separate means for varying the bodily relationship of the wheel axes.

8. A motor propelled crane, comprising a unit having coaxial side wheels, motors for driving said wheels, a jib supported to overhang one end of said unit in a plane substantially perpendicular to the common axis of said wheels, a second unit, slidable connections between the two units affording relative movements in the plane of the jib, a third wheel supporting said second unit, hand steering means on the first recited unit, extensible connections between said steering means and said third wheel, and a power supply means on said second unit for supplying power to said motors.

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